

Title 36 WAC

LICENSING, DEPARTMENT OF (PROFESSIONAL ATHLETICS)

Chapters

36-12 Professional boxing.

Chapter 36-12 WAC PROFESSIONAL BOXING

WAC

36-12-195
36-12-196

License fees, renewals and requirements.
Organizations approved by the department to certify
experience, skill and training of officials.

WAC 36-12-195 License fees, renewals and requirements. (1) The license year is one year from date of issue. License fees are paid annually. Fees shall be as follows:

Manager	-	\$40.00
Referee	-	\$15.00
Boxer	-	\$15.00
Matchmaker	-	\$40.00
Second	-	\$15.00
Inspector	-	\$40.00
Judge	-	\$40.00
Timekeeper	-	\$40.00
Announcer	-	\$40.00
Event physician	-	\$40.00
Promoter	-	\$50.00

(2) All renewal fees shall be the same fee as each original license fee.

(3) Licensing requirements:

(a) Completed application on form approved by the department.

(b) Completed physical within one year (boxer and referee only).

(c) Federal identification card (boxer only).

(d) One small current photograph, not more than two years old (boxer only).

(e) Payment of license fee.

(f) Certification from an organization approved by the department under RCW 67.08.100(3) and WAC 36-12-196.

(4) Applicants may not participate until all licensing requirements are received and approved by the department of licensing.

[Statutory Authority: RCW 67.08.017(1). 01-22-029, § 36-12-195, filed 10/29/01, effective 11/29/01; 00-02-054, § 36-12-195, filed 12/31/99, effective 1/31/00. Statutory Authority: Chapter 67.08 RCW. 97-01-035, § 36-12-195, filed 12/10/96, effective 1/10/97; 91-11-038, § 36-12-195, filed 5/10/91, effective 6/10/91.]

WAC 36-12-196 Organizations approved by the department to certify experience, skill and training of officials. Any organization wishing to be approved by or

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maintain their approval by the department to certify adequate experience, skill and training of officials, pursuant to RCW 67.08.100(3), shall submit the following information to the department annually:

(1) Description of training courses required;

(2) List of all persons seeking licensing from Washington state who have received training given by the organization within the past year;

(3) Dates training was given; and

(4) Assessment of the skill and experience of the person.

[Statutory Authority: RCW 67.08.017(1). 01-22-029, § 36-12-196, filed 10/29/01, effective 11/29/01.]

Title 51 WAC

COMMUNITY, TRADE, AND ECONOMIC DEVELOPMENT, DEPARTMENT OF (BUILDING CODE COUNCIL)

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51-13	Ventilation and indoor air quality.
51-40	State Building Code adoption and amendment of the 1997 edition of the Uniform Building Code.
51-42	State Building Code adoption and amendment of the 1997 edition of the Uniform Mechanical Code.
51-44	State Building Code adoption and amendment of the 1997 edition of the Uniform Fire Code.
51-46	State Building Code adoption and amendment of the 1997 edition of the Uniform Plumbing Code.
51-47	State Building Code adoption of Appendix I of the 1997 edition of the Uniform Plumbing Code.
51-56	State Building Code adoption and amendment of the 2000 edition of the Uniform Plumbing Code.
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Chapter 51-04 WAC

POLICIES AND PROCEDURES FOR CONSIDERATION OF STATEWIDE AND LOCAL AMENDMENTS TO THE STATE BUILDING CODE

WAC

51-04-040 Reconsideration.

WAC 51-04-040 Reconsideration. Any party proposing a statewide or local government amendment to the building code may, upon denial of the amendment by the council, file a petition for reconsideration.

Within ten days of a building code council vote to deny a statewide or local government amendment, any party may file a petition for reconsideration, stating the specific justification for rule adoption or local amendment. The petition shall be filed with the State Building Code Council, P.O. Box 48300, Olympia, Washington 98504.

The council is deemed to have denied the petition for reconsideration if, within sixty days from the date the petition is filed, the council does not either:

(1) Dispose of the petition; or

(2) Serve the parties with a written notice specifying the date by which it will act on the petition.

Unless the petition is deemed denied, the petition shall be disposed of by the council with recommendations from the same committee or committees that considered the proposed rule or local amendment. The disposition shall be in the form of a written notice denying the petition, granting the petition and refiling the rule-making order or approving the local amendment, or granting the petition and setting the matter for further hearings.

[Statutory Authority: RCW 19.27.035 and chapters 19.27 and 34.05 RCW. 02-01-113, § 51-04-040, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapters 19.27 and 34.05 RCW and 1989 c 348. 90-02-108, § 51-04-040, filed 1/3/90, effective 2/3/90.]

Chapter 51-11 WAC

WASHINGTON STATE ENERGY CODE

WAC

51-11-0101	Section 101. Scope and general requirements.
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51-11-1513	Lighting controls.
51-11-1521	Prescriptive interior lighting requirements.
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51-11-2002	Repealed.
51-11-2003	Repealed.
51-11-2004	Repealed.
51-11-2005	Repealed.
51-11-2006	Repealed.
51-11-2007	Repealed.
51-11-2008	Repealed.
51-11-2009	Repealed.
51-11-99902	Section 2—General principles and requirements.
51-11-99903	Section 3—Specific modeling assumptions.
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DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

51-11-1201	Scope. [Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1201, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
51-11-1210	Application of terms. [Statutory Authority: RCW 19.27A.025 and 19.27A.045. 98-03-003, § 51-11-1210, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27.074, 19.27A.020 and 19.27A.025. 97-03-017, § 51-11-1210, filed 1/7/97, effective 7/1/97. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1210, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
51-11-1701	Scope. [Statutory Authority: RCW 19.27A.025 and 19.27A.045. 98-03-003, § 51-11-1701, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1701, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
51-11-2000	Default heat-loss coefficients. [Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-2000, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.

- 51-11-2001 General. [Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2001, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2002 Below grade walls and slabs. [Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2002, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2003 On-grade slab floors. [Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2003, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2004 Floors over unconditioned space. [Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2004, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2005 Above grade walls. [Statutory Authority: RCW 19.27A.025 and 19.27A.045, 98-03-003, § 51-11-2005, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2005, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2006 Default U-factors for glazing and doors. [Statutory Authority: RCW 19.27A.025 and 19.27A.045, 98-03-003, § 51-11-2006, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2006, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2007 Ceilings. [Statutory Authority: RCW 19.27A.025 and 19.27A.045, 98-03-003, § 51-11-2007, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2007, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2008 Reserved. [Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2008, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.
- 51-11-2009 Mass. [Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-2009, filed 10/18/93, effective 4/1/94.] Repealed by 01-03-010, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 19.27A.045.

WAC 51-11-0101 Section 101. Scope and general requirements.

101.1 Title: Chapters 1 through 10 of this Code shall be known as the "Washington State Residential Energy Code" and may be cited as such; and will be referred to herein as "this Code."

101.2 Purpose and Intent: The purpose of this Code is to provide minimum standards for new or altered buildings and structures or portions thereof to achieve efficient use and conservation of energy.

The purpose of this Code is 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.

It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve efficient use and conservation of energy. These provisions are structured to permit compliance with the intent of this Code by any one of the following three paths of design:

1. A systems analysis approach for the entire building and its energy-using sub-systems which may utilize renewable energy sources, Chapter 4.

2. A component performance approach for various building elements and mechanical systems and components, Chapter 5.

3. A prescriptive requirements approach, Chapter 6.

Compliance with any one of these approaches meets the intent of this Code. This Code is not intended to abridge any safety or health requirements required under any other applicable codes or ordinances.

The provisions of this Code do not consider the efficiency of various energy forms as they are delivered to the building envelope. A determination of delivered energy efficiencies in conjunction with this Code will provide the most efficient use of available energy in new building construction.

101.3 Scope: This Code sets forth minimum requirements for the design of new buildings and structures that provide facilities or shelter for residential occupancies by regulating their exterior envelopes and the selection of their HVAC, service water heating systems and equipment for efficient use and conservation of energy.

Buildings shall be designed to comply with the requirements of either Chapter 4, 5, or 6 of this Code.

101.3.1 Exempt Buildings: Buildings and structures or portions thereof meeting any of the following criteria shall be exempt from the building envelope requirements of sections 502 and 602, but shall comply with all other requirements for building mechanical systems, and service water heating.

101.3.1.1: Buildings and structures or portions thereof whose peak design rate of energy usage is less than three and four tenths (3.4) Btu/h per square foot or one point zero (1.0) watt per square foot of floor area for space conditioning requirements.

101.3.1.2: Buildings and structures or portions thereof which are neither heated according to the definition of heated space in Chapter 2, nor cooled by a nonrenewable energy source, provided that the nonrenewable energy use for space conditioning complies with requirements of section 101.3.1.1.

101.3.1.3: Greenhouses isolated from any conditioned space and not intended for occupancy.

101.3.1.4: The provisions of this code do not apply to the construction, alteration, or repair of temporary worker housing except as provided by rule adopted under chapter 70.114A RCW or chapter 37, Laws of 1998 (SB 6168). "Temporary worker housing" means a place, area, or piece of land where sleeping places or housing sites are provided by an employer for his or her employees or by another person, including a temporary worker housing operator, who is providing such accommodations for employees, for temporary, seasonal occupancy, and includes "labor camps" under RCW 70.54.110.

101.3.2 Application to Existing Buildings: Additions, historic buildings, changes of occupancy or use, and alter-

ations or repairs shall comply with the requirements in the subsections below.

- EXCEPTION:** The building official may approve designs of alterations or repairs which do not fully conform with all of the requirements of this Code where in the opinion of the building official full compliance is physically impossible and/or economically impractical and:
1. The alteration or repair improves the energy efficiency of the building; or
 2. The alteration or repair is energy efficient and is necessary for the health, safety, and welfare of the general public.

In no case, shall building envelope requirements or mechanical system requirements be less than those requirements in effect at the time of the initial construction of the building.

101.3.2.1 Additions to Existing Buildings: Additions to existing buildings or structures may be made to such buildings or structures without making the entire building or structure comply, provided that the new additions shall conform to the provisions of this Code.

- EXCEPTION:** New additions which do not fully comply with the requirements of this Code and which have a floor area which is less than seven hundred fifty square feet shall be approved provided that improvements are made to the existing occupancy to compensate for any deficiencies in the new addition. Compliance shall be demonstrated by either systems analysis or component performance calculations. The nonconforming addition and upgraded, existing occupancy shall have an energy budget or Target UA which is less than or equal to the unimproved existing building (minus any elements which are no longer part of the building envelope once the addition is added), with the addition designed to comply with this Code.

101.3.2.2 Historic Buildings: The building official may modify the specific requirements of this Code for historic buildings and require in lieu thereof alternate requirements which will result in a reasonable degree of energy efficiency. This modification may be allowed for those buildings which have been specifically designated as historically significant by the state or local governing body, or listed in The National Register of Historic Places or which have been determined to be eligible for listing.

101.3.2.3 Change of Occupancy or Use:

Any Other than Group R Occupancy which is converted to Group R Occupancy shall be brought into full compliance with this Code.

101.3.2.4 Alterations and Repairs: All alterations and repairs to buildings or portions thereof originally constructed subject to the requirements of this Code shall conform to the provisions of this Code without exception. For all other existing buildings, initial tenant alterations shall comply with the new construction requirements of this Code. Other alterations and repairs may be made to existing buildings and moved buildings without making the entire building comply with all of the requirements of this Code for new buildings, provided the following requirements are met:

101.3.2.5 Building Envelope: The result of the alterations or repairs both:

1. Improves the energy efficiency of the building, and

2. Complies with the overall average thermal transmittance values of the elements of the exterior building envelope in Table 5-1 of Chapter 5 or the nominal R-values and glazing requirements of the reference case in Tables 6-1 to 6-6.

- EXCEPTIONS:**
1. Untested storm windows may be installed over existing glazing for an assumed U-factor of 0.90, however, where glass and sash are being replaced in Group R Occupancy, glazing shall comply with the appropriate reference case in Table 6-1 through Table 6-6.
 2. Where the structural elements of the altered portions of roof/ceiling, wall or floor are not being replaced, these elements shall be deemed to comply with this Code if all existing framing cavities which are exposed during construction are filled to the full depth with batt insulation or insulation having an equivalent nominal R-value while, for roof/ceilings, maintaining the required space for ventilation. Existing walls and floors without framing cavities need not be insulated. Existing roofs shall be insulated to the requirements of this Code if
 - a. The roof is uninsulated or insulation is removed to the level of the sheathing, or
 - b. All insulation in the roof/ceiling was previously installed exterior to the sheathing or nonexistent.

101.3.2.6 Building Mechanical Systems: Those parts of systems which are altered or replaced shall comply with section 503 of this Code.

101.3.2.7 Service Water Heating: Those parts of systems which are altered or replaced shall comply with section 504.

101.3.2.8 Lighting: Alterations shall comply with section 1132.3.

- EXCEPTION:** Group R-3 Occupancy and the dwelling unit portions of Group R-1 Occupancy.

101.3.3 Mixed Occupancy: When a building houses more than one occupancy, each portion of the building shall conform to the requirements for the occupancy housed therein. Where approved by the building official, where minor accessory uses do not occupy more than ten percent of the area of any floor of a building, the major use may be considered the building occupancy.

101.4 Amendments by Local Government: Except as provided in RCW 19.27A.020(7), this Code shall be the maximum and minimum energy code for Group R Occupancy in each town, city and county, no later than July 1, 1991.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-0101, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27.031 and 19.27.074. 98-24-078, § 51-11-0101, filed 12/1/98, effective 7/1/99. Statutory Authority: RCW 19.27A.025 and 19.27A.045. 98-03-003, § 51-11-0101, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-0101, filed 10/18/93, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0101, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0201 Scope. The following definitions shall apply to chapters 1 through 20.

201.1 Application of Terms: For the purposes of this Code, certain abbreviations, terms, phrases, words and their derivatives, shall be as set forth in this chapter. Where terms are not defined, they shall have their ordinary accepted meanings within the context with which they are used. In the event there is a question about the definition of a term, the definitions for terms in the codes enumerated in RCW 19.27.031

and the edition of Webster's dictionary referenced therein shall be considered as the sources for providing ordinarily accepted meanings.

Addition: See the Washington State Building Code.

Advanced framed ceiling: Advanced framing assumes full and even depth of insulation extending to the outside edge of exterior walls. (See Standard Framing and Section 1007.2 of this Code.)

Advanced framed walls: Studs framed on twenty-four inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2X material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall. (See Standard Framing and Section 1005.2 of this Code.)

AFUE. Annual fuel utilization efficiency: Unlike steady state conditions, this rating is based on average usage including on and off cycling as set out in the standardized Department of Energy Test Procedures.

Air conditioning, comfort: The process of treating air to control simultaneously its temperature, humidity, cleanliness and distribution to meet requirements of the conditioned space.

ARI: Air-Conditioning and Refrigeration Institute.

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

ASTM: American Society for Testing and Materials

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**.)

Below grade walls: Walls or the portion of walls which are entirely below the finish grade or which extend two feet or less above the finish grade.

Boiler capacity: The rate of heat output in Btu/h measured at the boiler outlet, at the design inlet and outlet conditions and rated fuel/energy input.

Building envelope: For Group R Occupancy, the elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior or to or from spaces exempted by the provisions of Section 101.3.1. For other than Group R Occupancy, the elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior, or to or from unconditioned spaces, or to or from semi-heated spaces, or to or from spaces exempted by the provisions of Section 1301.

Building, existing: See the Washington State Building Code.

Building official: The official authorized to act in behalf of a jurisdiction code enforcement agency or its authorized representative.

Building project: A building or group of buildings, including on-site energy conversion or electric-generating facilities, which utilize a single submittal for a construction permit or are within the boundary of a contiguous area under one ownership.

Conditioned floor area: (See Gross conditioned floor area.)

Conditioned space: A cooled space, heated space (fully heated), heated space (semi-heated) or indirectly conditioned space.

Cooled space: An enclosed space within a building that is cooled by a cooling system whose sensible capacity

a. exceeds 5 Btu/(h • ft²), or

b. is capable of maintaining space dry bulb temperature of 90°F or less at design cooling conditions.

COP - Coefficient of performance: The ratio of the rate of net heat output (heating mode) or heat removal (cooling mode) to the rate of total on-site energy input to the heat pump, expressed in consistent units and under designated rating conditions. (See Net Heat Output, Net Heat Removal, Total On-Site Energy Input.)

Daylighted zone:

a. Under overhead glazing: the area under overhead glazing whose horizontal dimension, in each direction, is equal to the overhead glazing dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent overhead or vertical glazing, whichever is least.

b. At vertical glazing: the area adjacent to vertical glazing which receives daylighting from the glazing. For purposes of this definition and unless more detailed daylighting analysis is provided, the daylighting zone depth is assumed to extend into the space a distance of 15 feet or to the nearest ceiling height opaque partition, whichever is less. The daylighting zone width is assumed to be the width of the window plus either two feet on each side (the distance to an opaque partition) or one-half the distance to adjacent overhead or vertical glazing, whichever is least.

Daylight sensing control (DS): A device that automatically regulates the power input to electric lighting near the glazing to maintain the desired workplace illumination, thus taking advantage of direct or indirect sunlight.

Deadband: The temperature range in which no heating or cooling is used.

Design cooling conditions: The cooling outdoor design temperature from the 0.5% column for summer from the Puget Sound Chapter of ASHRAE publication "Recommended Outdoor Design Temperatures, Washington State, ASHRAE."

Design heating conditions: The heating outdoor design temperature from the 0.6% column for winter from the Puget Sound Chapter of ASHRAE publication "Recommended Outdoor Design Temperatures, Washington State, ASHRAE."

Door: All operable opening areas, which are not glazing, in the building envelope including swinging and roll-up doors, fire doors, smoke vents and access hatches.

Door area: Total area of door measured using the rough opening and including the door and frame.

Dwelling unit: See the Washington State Building Code.

EER. Energy efficiency ratio: The ratio of net equipment cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions.

Economizer, air: A ducting arrangement and automatic control system that allows a cooling supply fan system to supply outside air to reduce or eliminate the need for mechanical refrigeration during mild or cold weather.

Economizer, water: A system by which the supply air of a cooling system is cooled directly, indirectly or both, by evaporation of water or by other appropriate fluid in order to reduce or eliminate the need for mechanical refrigeration.

Efficiency, HVAC system: The ratio of useful energy (at the point of use) to the energy input for a designated time period, expressed in percent.

Emissivity: The ability to absorb infrared radiation. A low emissivity implies a higher reflectance of infrared radiation.

Energy: The capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (work), electrical and chemical; in customary units, measured in kilowatt-hours (kWh) or British thermal units (Btu). (See **New energy**.)

Energy, recovered: (See **Recovered energy**.)

Exterior envelope: (See **Building envelope**.)

Facade area: Vertical projected area including nonhorizontal roof area, overhangs, cornices, etc. measured in elevation in a vertical plane parallel to the plane of the building face.

Floor over unconditioned space: A floor which separates a conditioned space from an unconditioned space which is buffered from exterior ambient conditions including vented crawl spaces and unconditioned basements or other similar spaces, or exposed to exterior ambient conditions including open parking garages and enclosed garages which are mechanically ventilated.

F-Factor: The perimeter heat loss factor expressed in Btu/hr • ft • °F.

F-Value: (See **F-Factor**.)

Garden window: A multi-sided glazing product that projects beyond the plane of the wall.

Glazed wall system: A category of site assembled fenestration products used in the NFRC 100 and NFRC 200 rating procedures that include curtainwalls.

Glazing: All areas, including the frames, in the shell of a conditioned space that let in natural light including windows, clerestories, skylights, sliding or swinging glass doors and glass block walls.

Glazing area: Total area of the glazing measured using the rough opening, and including the glazing, sash, and frame. For doors where the daylight opening area is less than 50% of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the door area.

Gross conditioned floor area: The horizontal projection of that portion of interior space which is contained within exterior walls and which is conditioned directly or indirectly by an energy-using system, and which has an average height of five feet or greater, measured from the exterior faces.

Gross exterior wall area: The normal projection of the building envelope wall area bounding interior space which is conditioned by an energy-using system and which separates conditioned space from: Unconditioned space, or semi-

heated space, or exterior ambient conditions or earth; includes opaque wall, vertical glazing and door areas. The gross area of walls consists of all opaque wall areas, including foundation walls, between floor spandrels, peripheral edges of floors, vertical glazing areas and door areas, where such surfaces are exposed to exterior ambient conditions and enclose a conditioned space including interstitial areas between two such spaces. (See **Below grade wall**.)

Gross floor area: The sum of the areas of the several floors of the building, including basements, cellars, mezzanine and intermediate floored tiers and penthouses of headroom height, measured from the exterior faces of exterior walls or from the center line of walls separating buildings, but excluding: Covered walkways, open roofed-over areas, porches and similar spaces. Pipe trenches, exterior terraces or steps, chimneys, roof overhangs and similar features.

Gross roof/ceiling area: A roof/ceiling assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed to exterior ambient conditions and encloses a conditioned space. The assembly does not include those components that are separated from a heated and/or cooled space by a vented airspace. The gross area of a roof/ceiling assembly consists of the total interior surface of such assembly, including overhead glazing.

Guest room: See the Washington State Building Code.

Heat: The form of energy that is transferred by virtue of a temperature difference.

Heat storage capacity: The physical property of materials (mass) located inside the building envelope to absorb, store, and release heat.

Heated space (Fully heated): An enclosed space within a building, including adjacent connected spaces separated by an uninsulated component (e.g., basements, utility rooms, garages, corridors), which is heated by a heating system whose output capacity is

a. Capable of maintaining a space dry-bulb temperature of 45°F or greater at design heating conditions; or

b. 8 Btu/(h • ft²) or greater in Climate Zone 1 and 12 Btu/(h • ft²) or greater in Climate Zone 2.

Heated space (Semi-heated): An enclosed space within a building, including adjacent connected spaces separated by an uninsulated component (e.g., basements, utility rooms, garages, corridors), which is heated by a heating system

a. whose output capacity is 3 Btu/(h • ft²) or greater in Climate Zone 1 and 5 Btu/(h • ft²) or greater in Climate Zone 2; and

b. is not a Heated Space (Fully Heated).

HSPF, Heating season performance factor: The total heating output (in Btu) of a heat pump during its normal annual usage period for heating divided by the total (watt hour) electric power input during the same period, as determined by test procedures consistent with the U.S. Department of Energy "Test Procedure for Central Air Conditioners, Including Heat Pumps" published in Standard RS-30. When specified in Btu per watt hour an HSPF of 6.826 is equivalent to a COP of 2.0.

Humidistat: A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.

HVAC: Heating, ventilating and air conditioning.

HVAC system components: HVAC system components provide, in one or more factory-assembled packages, means for chilling and/or heating water with controlled temperature for delivery to terminal units serving the conditioned spaces of the buildings. Types of HVAC system components include, but are not limited to, water chiller packages, reciprocating condensing units and water source (hydronic) heat pumps. (See **HVAC system equipment**.)

HVAC system efficiency: (See **Efficiency, HVAC system**.)

HVAC system equipment: HVAC system equipment provides, in one (single package) or more (split system) factory-assembled packages, means for air circulation, air cleaning, air cooling with controlled temperature and dehumidification; and optionally, either alone or in combination with a heating plant, the functions of heating and humidifying. The cooling function may be either electrically or heat operated and the refrigerant condenser may be air, water or evaporatively cooled. Where the equipment is provided in more than one package, the separate packages shall be designed by the manufacturer to be used together. The equipment may provide the heating function as a heat pump or by the use of electric elements. (The word "equipment" used without modifying adjective may, in accordance with common industry usage, apply either to HVAC system equipment or HVAC system components.)

Indirectly conditioned space: An enclosed space within a building that is not a heated or cooled space, whose area weighted heat transfer coefficient to heated or cooled spaces exceeds that to the outdoors or to unconditioned spaces; or through which air from heated or cooled spaces is transferred at a rate exceeding three air changes per hour. Enclosed corridors between conditioned spaces shall be considered as indirectly conditioned space. (See **Heated Space, Cooled Space** and **Unconditioned Space**.)

Infiltration: The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind and/or the effect of differences in the indoor and outdoor air density.

Insulation baffle: A rigid material, resistant to wind driven moisture, the purpose of which is to allow air to flow freely into the attic or crawl space and to prevent insulation from blocking the ventilation of these spaces, or the loss of insulation. Example materials for this purpose are sheet metal, or wax impregnated cardboard.

Insulation position:

a. **Exterior Insulation Position:** a wall having all or nearly all of its mass exposed to the room air with the insulation on the exterior of the mass.

b. **Integral Insulation Position:** a wall having mass exposed to both room and outside air, with substantially equal amounts of mass on the inside and outside of the insulation layer.

c. **Interior Insulation Position:** a wall not meeting either of the above definitions; particularly a wall having most of its mass external to the insulation layer.

IPLV—Integrated part-load value: A single number figure of merit based on part-load EER or COP expressing part-load efficiency for air conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment as specified in the Air-Conditioning and Refrigeration Institute (ARI) and Cooling Tower Institute (CTI) procedures.

Luminaire: A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the electric power supply.

Manual: Capable of being operated by personal intervention. (See **Automatic**.)

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.

NFPA: National Fire Protection Association.

NFRC: National Fenestration Rating Council.

Net heat output: The change in the total heat content of the air entering and leaving the equipment (not including supplementary heat and heat from boilers).

Net heat removal: The total difference in heat content of the air entering and leaving the equipment (without heat) or the difference in total heat content of the water or refrigerant entering and leaving the component.

New energy: Energy, other than recovered energy, utilized for the purpose of heating or cooling. (See **energy**.)

Nominal R-value: The thermal resistance of insulation as specified by the manufacturer according to recognized trade and engineering standards.

Nonrenewable energy sources: All energy sources that are not renewable energy sources including natural gas, oil, coal, wood, liquified petroleum gas, steam, and any utility-supplied electricity.

Nonresidential: All buildings and spaces in the Uniform Building Code (UBC) occupancies other than Group R. **Occupancy:** See the Washington State Building Code.

Occupancy sensor: A device that detects occupants within an area, causing any combination of lighting, equipment or appliances to be turned on or shut off.

Opaque envelope areas: All exposed areas of a building envelope which enclose conditioned space, except openings for doors, glazing and building service systems.

Open blown: Loose fill insulation pneumatically installed in an unconfined attic space.

Outdoor air (outside air): Air taken from the outdoors and, therefore, not previously circulated through a building.

Overhead glazing: A glazing surface that has a slope of less than 60° from the horizontal plane.

Packaged terminal air conditioner: A factory-selected combination of heating and cooling components, assemblies

or sections intended to serve a room or zone. (For the complete technical definition, see Standard RS-10.)

Permeance (perm): The ability of a material of specified thickness to transmit moisture in terms of amount of moisture transmitted per unit time for a specified area and differential pressure (grains per hour • ft² • inches of HG). Permeance may be measured using ASTM E-96-72 or other approved dry cup method as specified in RS-27.

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.

Pool cover: A vapor-retardant cover which lies on or at the surface of the pool.

Power: In connection with machines, the time rate of doing work. In connection with the transmission of energy of all types, the rate at which energy is transmitted; in customary units, it is measured in watts (W) or British Thermal Units per hour (Btu/h).

Process energy: Energy consumed in support of a manufacturing, industrial, or commercial process other than the maintenance of building comfort or amenities for building occupants.

Radiant slab floor: A slab floor assembly on grade or below, containing heated pipes, ducts, or electric heating cables that constitute a floor or portion thereof for complete or partial heating of the structure.

Readily accessible: See the Washington State Mechanical Code.

Recooling: The removal of heat by sensible cooling of the supply air (directly or indirectly) that has been previously heated above the temperature to which the air is to be supplied to the conditioned space for proper control of the temperature of that space.

Recovered energy: Energy utilized which would otherwise be wasted (i.e. not contribute to a desired end use) from an energy utilization system.

Reheat: The application of sensible heat to supply air that has been previously cooled below the temperature of the conditioned space by either mechanical refrigeration or the introduction of outdoor air to provide cooling.

Renewable energy sources: Renewable energy sources of energy (excluding minerals) are derived from: (1) incoming solar radiation, including but not limited to, natural daylighting and photosynthetic processes; (2) energy sources resulting from wind, waves and tides, lake or pond thermal differences; and (3) energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

Reset: Adjustment of the set point of a control instrument to a higher or lower value automatically or manually to conserve energy.

Roof/ceiling assembly: (See Gross roof/ceiling area.)

SEER - Seasonal Energy Efficiency Ratio: The total cooling output of an air conditioner during its normal annual usage period, in Btu's, divided by the total electric energy

input in watt-hours, during the same period, as determined by 10 CFR, Part 430.

Semi-heated space: Sub-category of **Heated Space**. (See **Heated Space**.)

Sequence: A consecutive series of operations.

Service systems: All energy-using systems in a building that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering or similar functions.

Service water heating: Supply of hot water for domestic or commercial purposes other than comfort heating.

Shaded: Glazed area which is externally protected from direct solar radiation by use of devices permanently affixed to the structure or by an adjacent building, topographical feature, or vegetation.

Shading coefficient: The ratio of solar heat gain occurring through nonopaque portions of the glazing, with or without integral shading devices, to the solar heat gain occurring through an equivalent area of unshaded, 1/8 inch thick, clear, double-strength glass.

Note: Heat gains to be compared under the same conditions. See Chapter 28 of Standard RS-27, listed in Chapter 7 of this Code.

Shall: Denotes a mandatory code requirement.

Single family: One and two family residential dwelling units with no more than two units in a single building.

Skylight: (See Overhead glazing.)

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, exterior: Any portion of a slab floor in contact with the ground which is less than or equal to twenty-four inches below the final elevation of the nearest exterior grade.

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, or which has a million dollars or less per year in gross sales, of window products.

Solar energy source: Source of natural daylighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

Solar heat gain coefficient (SHGC): The ratio of the solar heat gain entering the space through the glazing product 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.

Split system: Any heat pump or air conditioning unit which is provided in more than one assembly requiring refrigeration piping installed in the field.

Standard framing: All framing practices not defined as "intermediate" or "advanced" shall be considered standard. (See Advanced framed ceiling, Advanced framed walls, Intermediate framed wall and Section 1005.2 of this Code.)

Substantial contact: A condition where adjacent building materials are placed in a manner that proximal surfaces are contiguous, being installed and supported as to eliminate voids between materials, without compressing or degrading the thermal performance of either product.

System: A combination of central or terminal equipment or components and/or controls, accessories, interconnecting means, and terminal devices by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.

Tapering: Installation of a reduced level of ceiling insulation at the eaves, due to reduced clearance.

Thermal by-pass: An area where the envelope surrounding the conditioned space is breached, or where an ineffective application compromises the performance of a thermal or infiltration barrier, increasing the structure's energy consumption by exposing finished surfaces to ambient conditions and additional heat transfer.

Thermal conductance (C): Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions ($\text{Btu/hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

Thermal resistance (R): The reciprocal of thermal conductance ($\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$).

Thermal transmittance (U): The coefficient of heat transmission (air to air). It is the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($\text{Btu/hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

Thermal transmittance, overall (U_o): The overall (average) heat transmission of a gross area of the exterior building envelope ($\text{Btu/hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$). The U_o -factor applies to the combined effect of the time rate of heat flows through the various parallel paths, such as glazing, doors and opaque construction areas, comprising the gross area of one or more exterior building components, such as walls, floors or roof/ceiling.

Thermostat: An automatic control device actuated by temperature and designed to be responsive to temperature.

Total on-site energy input: The combination of all the energy inputs to all elements and accessories as included in the equipment components, including but not limited to, compressor(s), compressor sump heater(s), circulating pump(s), purge devices, fan(s), and the HVAC system component control circuit.

Transmission coefficient: The ratio of the solar heat gain through a glazing system to that of an unshaded single pane of double strength window glass under the same set of conditions.

U-factor: (See thermal transmittance.)

U-Value: (See U-factor.)

Uniform Building Code (UBC): (See Washington State Building Code.)

Uniform Mechanical Code (UMC): (See Washington State Mechanical Code.)

Uniform Plumbing Code (UPC): (See Washington State Plumbing Code.)

Unitary cooling and heating equipment: One or more factory-made assemblies which include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well. Where such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Unitary heat pump: One or more factory-made assemblies which include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. When such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Vapor retarder: A layer of low moisture transmissivity material (not more than 1.0 perm dry cup) placed over the warm side (in winter) of insulation, over the exterior of below grade walls, and under floors as ground cover to limit the transport of water and water vapor through exterior walls, ceilings, and floors. Vapor retarding paint, listed for this application, also meets this definition.

Vaulted ceilings: All ceilings where enclosed joist or rafter space is formed by ceilings applied directly to the underside of roof joists or rafters.

Ventilation: The process of supplying or removing air by natural or mechanical means to or from any space. Such air may or may not have been conditioned.

Ventilation air: That portion of supply air which comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

Vertical glazing: A glazing surface that has a slope of 60° or greater from the horizontal plane.

Walls (exterior): Any member or group of members which defines the exterior boundaries or courts of a building and which have a slope of sixty degrees or greater with the horizontal plane, and separates conditioned from unconditioned space. Band joists between floors are to be considered a part of exterior walls.

Washington State Building Code: The building code as modified by the Washington State Building Code Council.

Washington State Mechanical Code: The mechanical code as modified by the Washington State Building Code Council.

Washington State Plumbing Code: The plumbing code as modified by the Washington State Building Code Council.

Zone: A space or group of spaces within a building with heating and/or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device. Each dwelling unit in residential buildings shall be considered a single zone.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-0201, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0201, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0201, filed 2/10/94, effective 4/1/94. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-0201, filed 10/18/93, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2, 91-01-112, § 51-11-0201, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0502 Building envelope requirements.**502.1 General:**

502.1.1: The stated U- or F-factor of any component assembly, listed in Table 5-1 or 5-2, such as roof/ceiling, opaque wall or opaque floor may be increased and the U-factor for other components decreased, provided that the total heat gain or loss for the entire building envelope does not exceed the total resulting from compliance to the U-factors specified in this Section.

The U-factors for typical construction assemblies are included in Chapter 10. These values shall be used for all calculations. Where proposed construction assemblies are not represented in Chapter 10, values shall be calculated in accordance with Chapters 21-29 in Standard RS-1 listed in Chapter 7, using the framing factors listed in Chapter 10 where applicable.

For envelope assemblies containing metal framing, the U-factor shall be determined by one of the following methods:

1. Results of laboratory or field measurements.
2. Standard RS-25, listed in Chapter 7, where the metal framing is bonded on one or both sides to a metal skin or covering.
3. The zone method as provided in Chapter 24 of Standard RS-1, listed in Chapter 7.
4. Results of parallel path correction factors effective framing/cavity R-values as provided in Table 10-5A - EFFECTIVE R-VALUES FOR METAL FRAMING AND CAVITY ONLY for metal stud walls and roof/ceilings.

502.1.2: For consideration of thermal mass effects, see section 402.4.

502.1.3: 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.

502.1.4 Insulation:

502.1.4.1 General: All insulating materials shall comply with sections 2602 and/or 707 of the Uniform Building Code. Substantial contact of the insulation with the surface being insulated is required. All insulation materials shall be installed according to the manufacturer's instructions to achieve proper densities and maintain uniform R-values and shall be installed in a manner which will permit inspection of the manufacturer's R-value identification mark. To the maximum extent possible, insulation shall extend over the full component area to the intended R-value.

Alternatively, the thickness of roof/ceiling and wall insulation that is either blown in or spray-applied shall be identified by inches of thickness, density and R-value markers installed

at least one for every 300 square feet (28 m²) through the attic, ceiling and/or wall space. In attics, the markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness and minimum settled thickness with numbers a minimum 1.0 inch (25 mm) in height. Each marker shall face the attic access. The thickness of installed attic insulation shall meet or exceed the minimum initial installed thickness shown by the marker. In cathedral ceilings and walls, the markers shall be affixed to the rafter and wall frame at alternating high and low intervals and marked with the minimum installed density and R-value with numbers a minimum 1.0 inch (25 mm) in height. Each marker shall face the conditioned room area.

502.1.4.2 Insulation Materials: All insulation materials including facings such as vapor barriers or breather papers installed within floor/ceiling assemblies, roof/ceiling assemblies, walls, crawl spaces, or attics shall have a flame spread rating of less than 25 and a smoke density not to exceed 450 when tested in accordance with UBC Standard 8-1.

EXCEPTIONS:

1. Foam plastic insulation shall comply with section 2602 of the Uniform Building Code.
2. When such materials are installed in concealed spaces of Types III, IV and V construction, the flame spread and smoke developed limitations do not apply to facing, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
3. Cellulose insulation shall comply with section 707 of the Uniform Building Code.

502.1.4.3 Clearances: Where required, insulation shall be installed with clearances according to manufacturer's specifications. Insulation shall be installed so that required ventilation is unobstructed. For blown or poured loose fill insulation, clearances shall be maintained through installation of a permanent retainer.

502.1.4.4 Access Hatches and Doors: Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer must be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

502.1.4.5 Roof/Ceiling Insulation: Open-blown or poured loose fill insulation may be used in attic spaces where the slope of the ceiling is not more than 3 feet in 12 and there is at least 30 inches of clear distance from the top of the bottom chord of the truss or ceiling joist to the underside of the sheathing at the roof ridge. When eave vents are installed, baffling of the vent openings shall be provided so as to deflect the incoming air above the surface of the insulation. Baffles shall be, rigid material, resistant to wind driven moisture. Requirements for baffles for ceiling insulation shall meet the Uniform Building Code section 1505.3 for minimum ventilation requirements. When feasible, the baffles shall be installed from the top of the outside of the exterior

wall, extending inward, to a point 6 inches vertically above the height of noncompressed insulation, and 12 inches vertically above loose fill insulation.

502.1.4.6 Wall Insulation: Insulation installed in exterior walls shall comply with the provisions of this section. All wall insulation shall fill the entire framed cavity. Exterior wall cavities isolated during framing shall be fully insulated to the levels of the surrounding walls. All faced insulation shall be face stapled to avoid compression.

502.1.4.7 Floor Insulation: Floor insulation shall be installed in a permanent manner in substantial contact with the surface being insulated. Insulation supports shall be installed so spacing is no more than 24 inches on center. Foundation vents shall be placed so that the top of the vent is below the lower surface of the floor insulation.

EXCEPTION: Insulation may be omitted from floor areas over heated basements, heated garages or underfloor areas used as HVAC supply plenums. See Uniform Mechanical Code section 607 for underfloor supply plenum requirements. When foundation walls are insulated, the insulation shall be attached in a permanent manner. The insulation shall not block the airflow through foundation vents when installed. When foundation vents are not placed so that the top of the vent is below the lower surface of the floor insulation, a permanently attached baffle shall be installed at an angle of 30° from horizontal, to divert air flow below the lower surface of the floor insulation.

502.1.4.8 Slab-On-Grade: Slab-on-grade insulation, installed inside the foundation wall, shall extend downward from the top of the slab for a minimum distance of 24 inches or downward and then horizontally beneath the slab for a minimum combined distance of 24 inches. Insulation installed outside the foundation shall extend downward to a minimum of 24 inches or to the frostline. Above grade insulation shall be protected.

EXCEPTION: For monolithic slabs, the insulation shall extend downward from the top of the slab to the bottom of the footing.

502.1.4.9 Radiant Slabs: The entire area of a radiant slab shall be thermally isolated from the soil, with a minimum of R-10 insulation. The insulation shall be an approved product for its intended use. If a soil gas control system is present below the radiant slab, which results in increased convective flow below the radiant slab, the radiant slab shall be thermally isolated from the sub-slab gravel layer.

502.1.4.10 Below Grade Walls: Below grade exterior wall insulation used on the exterior (cold) side of the wall shall extend from the top of the below grade wall to the top of the footing and shall be approved for below grade use. Above grade insulation shall be protected.

Insulation used on the interior (warm) side of the wall shall extend from the top of the below grade wall to the below grade floor level.

502.1.5 Glazing and Door U-factors: Glazing and door U-factors shall be determined in accordance with sections 502.1.5.1 and 502.1.5.2. All products shall be labeled with the NFRC certified or default U-factor. The labeled U-factor shall be used in all calculations to determine compliance with

this Code. Sealed insulating glass shall conform to, or be in test for, ASTM E-774-81 class A.

EXCEPTIONS:

1. For glazed wall systems, assemblies with all of the following features are deemed to satisfy the vertical glazing U-factor requirement in Table 6-1 or 6-2 options with vertical glazing U-0.40 and greater:

a. Double glazing with a minimum 1/2 inch gap width, having a low-emissivity coating with $e=0.10$ maximum, with 90% minimum argon gas fill, and a non-aluminum spacer (as defined in footnote 1 to Table 10-6B), and

b. Frame that is thermal break aluminum (as defined in footnote 9 to Table 10-6B), wood, aluminum clad wood, vinyl, aluminum clad vinyl, or reinforced vinyl.

The only labeling requirement for products using this exception shall be a description of the product and a label stating: "This product is deemed to satisfy the Table 6-1 or 6-2 vertical glazing U-factor requirement using the exception to Section 502.1.5 in the Washington State Energy Code."

2. For overhead glazing, assemblies with all of the following features are deemed to satisfy the overhead glazing U-factor requirement in Table 6-1 or 6-2 options **except** the unlimited glazing area options (Option III in Table 6-1 and Option IV in Table 6-2):

a. Either, double glazing with a minimum 1/2 inch gap width, having a low-emissivity coating with $e=0.20$ maximum, with 90% minimum argon gas fill, or, triple glazed plastic domes, and

b. Frame that is thermal break aluminum (as defined in footnote 9 to Table 10-6B), wood, aluminum clad wood, vinyl, aluminum clad vinyl, or reinforced vinyl.

The only labeling requirement for products using this exception shall be a description of the product and a label stating: "This product is deemed to satisfy the Table 6-1 or 6-2 overhead glazing U-factor requirement using the exception to Section 502.1.5 in the Washington State Energy Code."

3. For solariums with a floor area which does not exceed 300 square feet, assemblies which comply with the features listed in exception 2 are deemed to satisfy the vertical glazing and overhead glazing U-factor requirement in Table 6-1 or 6-2 options with vertical glazing U-0.40 and greater.

The only labeling requirement for products using this exception shall be a description of the product and a label stating: "This product is deemed to satisfy the Table 6-1 or 6-2 vertical glazing and overhead glazing U-factor requirements using the exception to Section 502.1.5 in the Washington State Energy Code."

502.1.5.1 Standard Procedure for Determination of Glazing U-factors: U-factors for glazing shall be determined, certified and labeled in accordance with the National Fenestration Rating Council (NFRC) Product Certification Program (PCP), as authorized by an independent certification and inspection agency licensed by the NFRC. Compliance shall be based on the Residential Model Size. Product samples used for U-factor determinations shall be production line units or representative of units as purchased by the consumer or contractor. Products that are listed in the NFRC Certified Products Directory or certified to the NFRC standard shall not use default values.

EXCEPTIONS:

1. Glazing products without NFRC ratings may be assigned default U-factors from Table 10-6A for vertical glazing and from Table 10-6E for overhead glazing.

2. Units without NFRC ratings produced by a small business may be assigned default U-factors from Table 10-6A for garden windows, from Table 10-6B for other vertical glazing, and from Table 10-6E for overhead glazing.

502.1.5.2 Standard Procedure for Determination of Door U-factors: All doors, including fire doors, shall be assigned default U-factors from Table 10-6C.

- EXCEPTIONS:**
1. U-factors determined, certified and labeled in accordance with the National Fenestration Rating Council (NFRC) Product Certification Program (PCP), as authorized by an independent certification and inspection agency licensed by the NFRC.
 2. The default values for the opaque portions of doors shall be those listed in Table 10-6C, provided that the U-factor listed for a door with a thermal break shall only be allowed if both the door and the frame have a thermal break.
 3. One unlabeled or untested exterior swinging door with the maximum area of 24 square feet may be installed for ornamental, security or architectural purposes. Products using this exception shall not be included in the U-factor calculation requirements, however glazing area shall be included in glazing area calculations.

502.1.6 Moisture Control:

502.1.6.1 Vapor Retarders: Vapor retarders shall be installed on the warm side (in winter) of insulation as specified in the following cases.

- EXCEPTION:** Vapor retarder installed with not more than 1/3 of the nominal R-value between it and the conditioned space.

502.1.6.2 Floors: Floors separating conditioned space from unconditioned space shall have a vapor retarder installed. The vapor retarder shall have a one perm dry cup rating or less (i.e., four mil [0.004 inch thick] polyethylene or kraft faced material).

502.1.6.3 Roof/Ceilings: Roof/ceiling assemblies where the ventilation space above the insulation is less than an average of 12 inches shall be provided with a vapor retarder. Faced batt insulation where used as a vapor retarder shall be face stapled. Single rafter joist vaulted ceiling cavities shall be of sufficient depth to allow a minimum one inch vented air space above the insulation.

502.1.6.4: Vapor retarders shall not be required in roof/ceiling assemblies where the ventilation space above the insulation averages 12 inches or greater.

502.1.6.5: Vapor retarders shall not be required where all of the insulation is installed between the roof membrane and the structural roof deck.

502.1.6.6 Walls: Walls separating conditioned space from unconditioned space shall have a vapor retarder installed. Faced batt insulation shall be face stapled.

502.1.6.7 Ground Cover: 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 12 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 3-1/2 inches.

502.2 Thermal Criteria for Group R Occupancy:

502.2.1 UA Calculations: The proposed UA as calculated using Equations 2 and 3 shall not exceed the target UA

as calculated using Equation 1. For the purpose of determining equivalent thermal performance, the glazing area for the target UA shall be calculated using values in Table 5-1. The opaque door area shall be the same in the target UA and the proposed UA.

- EXCEPTION:** Log and solid timber walls that have a minimum average thickness of 3.5" and with space heat type other than electric resistance, are exempt from wall target UA and proposed UA calculations.

502.2.2 Space Heat Type: The following two categories comprise all space heating types:

1. **Electric Resistance:** Space heating systems which include baseboard units, radiant units and forced air units as either the primary or secondary heating system.

- EXCEPTION:** Electric resistance systems for which the total electric heat capacity in each individual dwelling unit does not exceed the greater of: 1) One thousand watts (1000 w) per dwelling unit, or; 2) One watt per square foot (1 w/ft²) of the gross floor area.

2. **Other:** All gas, wood, oil and propane space heating systems, unless electric resistance is used as a secondary heating system, and all heat pump space heating systems. (See EXCEPTIONS, Electric Resistance, section 502.2.2 above.)

502.3 Reserved.

502.4 Air Leakage:

502.4.1 General: The requirements of this section shall apply to all buildings and structures, or portions thereof, and only to those locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cooled.

502.4.2 Doors and Windows, General: Exterior doors and windows shall be designed to limit air leakage into or from the building envelope. Site-constructed doors and windows shall be sealed in accordance with Section 502.4.3.

502.4.3 Seals and Weatherstripping:

a. Exterior joints around windows and door frames, openings between walls and foundation, between walls and roof and wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other openings in the building envelope for all occupancies and all other openings in between units in R-1 Occupancy shall be sealed, caulked, gasketed or weatherstripped to limit air leakage. Other exterior joints and seams shall be similarly treated, or taped, or covered with moisture vapor permeable housewrap.

b. All exterior doors or doors serving as access to an enclosed unheated area shall be weatherstripped to limit leakage around their perimeter when in a closed position.

c. Site built windows are exempt from testing but shall be made tight fitting. Fixed lights shall have glass retained by stops with sealant or caulking all around. Operating sash shall have weatherstripping working against overlapping trim and a closer/latch which will hold the sash closed. The window frame to framing crack shall be made tight with caulking, overlapping membrane or other approved technique.

d. Openings that are required to be fire resistive are exempt from this section.

502.4.4 Recessed Lighting Fixtures: When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.

2. Type IC rated, installed inside a sealed box constructed from a minimum 1/2 inch thick gypsum wall board, or constructed from a preformed polymeric vapor barrier, or other air tight assembly manufactured for this purpose.

3. Type IC rated, certified under ASTM E283 to have no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 Pascals or 1.57 lbs/ft² pressure difference and have a label attached, showing compliance.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 02-01-112, § 51-11-0502, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0502, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0502, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226, 95-01-126, § 51-11-0502, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW, 94-05-059, § 51-11-0502, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW, 92-01-140, § 51-11-0502, filed 12/19/91, effective 7/1/92. Statutory Authority: RCW 19.27A.020 and 1990 c 2, 91-01-112, § 51-11-0502, filed 12/19/90, effective 7/1/91.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 51-11-0503 Building mechanical systems.

503.1 General: This section covers the determination of design requirements, system and component performance, control requirements, insulating systems and duct construction.

503.2 Calculations of Heating and Cooling Loads, and System Sizing Limits: The design parameters specified in Chapter 3 shall apply for all computations.

503.2.1 Calculation Procedures: Heating and cooling design loads for the purpose of sizing HVAC systems are required and shall be calculated in accordance with accepted engineering practice, including infiltration and ventilation.

503.2.2 Space Heating and Space Cooling System Sizing Limits: Building mechanical systems for all buildings which provide space heating and/or space cooling shall be sized no greater than two hundred percent (200%) of the heating and cooling design loads as calculated above.

EXCEPTIONS: The following limited exemptions from the sizing limit shall be allowed; however, in all cases heating and/or cooling design load calculations shall be submitted.

1. For equipment which provides both heating and cooling in one package unit, including heat pumps with electric heating and cooling and gas-pack units with gas heating and electric cooling, compliance need only be demonstrated for either the space heating or space cooling system size.

2. Natural gas- or oil-fired space heating equipment whose total rated space heating output in any one dwelling unit is

a. 40,000 Btu/h or less is exempt from the sizing limit,

b. larger than 40,000 Btu/h may exceed the two hundred (200%) percent sizing limit provided that the installed equipment has an annual fuel utilization efficiency (AFUE) of not less than ninety (90%) percent.

3. Stand-by equipment may be installed if controls and other devices are provided which allow redundant equipment to operate only when the primary equipment is not operating.

503.3 Simultaneous Heating and Cooling: Systems and equipment that provide simultaneous heating and cooling shall comply with the requirements in, as appropriate, Section 1422 or Section 1435.

503.4 HVAC Equipment Performance Requirements: All heating equipment shall meet the requirements of the 1987 National Appliance Energy Conservation Act (NAECA) and be so labeled. Equipment shall also comply with Section 1411.

503.5 Reserved.

503.6 Balancing: The HVAC system design shall provide a means for balancing air and water systems. Balancing the system shall include, but not be limited to, dampers, temperature and pressure test connections and balancing valves.

503.7 Cooling with Outdoor Air (Economizer Cycle): Systems and equipment that provide mechanical cooling shall comply with Section 1413 and, as appropriate, Section 1423 or 1433.

503.8 Controls:

503.8.1 Temperature Control: Each system shall be provided with at least one adjustable thermostat for the regulation of temperature. Each thermostat shall be capable of being set by adjustment or selection of sensors as follows:

503.8.1.1: When used to control heating only: Fifty-five degrees to seventy-five degrees F.

503.8.1.2: When used to control cooling only: Seventy degrees to eighty-five degrees F.

503.8.1.3: When used to control both heating and cooling, it shall be capable of being set from fifty-five degrees to eighty-five degrees F and shall be capable of operating the system heating and cooling in sequence. The thermostat and/or control system shall have an adjustable deadband of not less than ten degrees F.

503.8.2 Humidity Control: If a system is equipped with a means for adding moisture to maintain specific selected relative humidities in space or zones, a humidistat shall be provided. Humidistats shall be capable of being set to prevent new energy from being used to produce space-relative humidity above thirty percent.

EXCEPTION: Special uses requiring different relative humidities may be permitted when approved by the building official.

503.8.3 Zoning for Temperature Control:

503.8.3.1 One- and Two-Family Dwellings: At least one thermostat for regulation of space temperature shall be provided for each separate system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each zone or floor.

503.8.3.2 Multifamily Dwellings: For multifamily dwellings, each individual dwelling unit shall have at least one thermostat for regulation of space temperature. A readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each room. Spaces other than living units shall meet the requirements of 503.8.3.3.

503.8.3.3 Reserved.

503.8.3.4 Control Setback and Shut-off:

Residential Occupancy Groups. One- and Two-Family and Multifamily dwellings—The thermostat required in section 503.8.3.1 or section 503.8.3.2, or an alternate means such as a switch or clock, shall provide a readily accessible, manual or automatic means for reducing the energy required for heating and cooling during the periods of nonuse or reduced need, such as, but not limited to unoccupied periods and sleeping hours. Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

503.8.3.5 Heat Pump Controls: Programmable thermostats are required for all heat pump systems. The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating shall be higher than the cut-off temperature for the supplementary heat. Heat pump thermostats will be capable of providing at least two programmable setback periods per day. The automatic setback thermostat shall have the capability of limiting the use of supplemental heat during the warm-up period.

503.9 Air Handling Duct System Insulation: Ducts, plenums and enclosures installed in or on buildings shall be thermally insulated per Table 5-11.

EXCEPTIONS: Duct insulation (except where required to prevent condensation) is not required in any of the following cases:

1. When the heat gain or loss of the ducts, without insulation, will not increase the energy requirements of the building.
2. Within the HVAC equipment.
3. Exhaust air ducts.
4. Supply or return air ducts installed in unvented crawl spaces with insulated walls, basements, or cellars in one- and two-family dwellings.

503.10 Duct Construction: All duct work shall be constructed in accordance with Standards RS-15, RS-16, RS-17, RS-18, RS-19 or RS-20, as applicable, and the Uniform Mechanical Code.

503.10.1 Leakage Testing: High-pressure and medium-pressure ducts shall be leak tested in accordance with the applicable standards in Chapter 7 of this Code with the rate of

air leakage not to exceed the maximum rate specified in that standard.

503.10.2 Seams and Joints: All low-pressure supply and return, including enclosed stud bays or joist cavities/space used to transport air, 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. Tapes and mastics used with rigid fibrous glass ducts shall be listed and labeled in accordance with UL 181A. Tapes and mastics used with flexible air ducts shall be listed and labeled in accordance with UL 181B. Duct tape is not permitted as a sealant on any ducts.

EXCEPTION: Ducts or building cavities used for air distribution that are located entirely within the conditioned space of the building are exempt from this section.

503.10.3 Dampers: Requirements for Automatic or manual dampers are found in the Washington State Ventilation and Indoor Air Quality Code.

503.10.4 Duct Insulation: Ducts shall meet the insulation requirements specified in Table 5-11.

503.11 Pipe Insulation: All piping shall be thermally insulated in accordance with Table 5-12.

EXCEPTION: Piping installed within unitary HVAC equipment.

Cold water pipes outside the conditioned space shall be insulated in accordance with the Washington State Plumbing Code (chapter 51-46 WAC).

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 02-01-112, § 51-11-0503, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0503, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.020, 19.27A.045, and 19.27.020. 98-24-075, § 51-11-0503, filed 12/1/98, effective 7/1/99. Statutory Authority: RCW 19.27A.025 and 19.27A.045. 98-03-003, § 51-11-0503, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-0503, filed 10/18/93, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0503, filed 12/19/91, effective 7/1/92. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0503, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0504 Service water heating.

504.1 Scope: The purpose of this section is to provide criteria for design and equipment selection that will produce energy savings when applied to service water heating.

504.2 Water Heaters, Storage Tanks and Boilers:

504.2.1 Performance Efficiency: All Storage water heaters shall meet the requirements of the 1987 National Appliance Energy Conservation Act and be so labeled. All electric water heaters in unheated spaces or on concrete floors shall be placed on an incompressible, insulated surface with a minimum thermal resistance of R-10.

For combination space and service water heaters with a principal function of providing space heat, the Combined Annual Efficiency (CAE) may be calculated by using ASHRAE Standard 124-1991. Storage water heaters used in combination space heat and water heat applications shall have either an Energy Factor (EF) or a Combined Annual Efficiency (CAE) of not less than the following:

	Energy Factor (EF)	Combined Annual Efficiency (CAE)
<50 gallon storage	0.58	0.71
50 to 70 gallon storage	0.57	0.71
>70 gallon storage	0.55	0.70

504.2.2 Insulation: Heat loss from unfired hot-water storage tanks shall be limited to a maximum of 9.6 Btu/hr/ft² of external tank surface area. The design ambient temperature shall be no higher than sixty-five degrees F.

504.2.3 Combination Service Water Heating/Space Heating Boilers: Service water heating equipment shall not be dependent on year round operation of space heating boilers.

EXCEPTIONS:

1. Systems with service/space heating boilers having a standby loss Btu/h less than:
 $(13.3 \text{ pmd} + 400)/n$
determined by the fixture count method where:
pmd = probably maximum demand in gallons/hour as determined in accordance with Chapter 37 of Standard RS-11.
n = fraction of year when outdoor daily mean temperature exceeds 64.9° F.
The standby loss is to be determined for a test period of twenty-four-hour duration while maintaining a boiler water temperature of ninety degrees F above an ambient of sixty degrees F and a five foot stack on appliance.
2. For systems where the use of a single heating unit will lead to energy savings, such unit shall be utilized.

504.3 Automatic Controls: Service water heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use. Temperature setting range shall be set to one hundred twenty degrees F or forty-nine degrees C.

504.4 Shutdown: A separate switch shall be provided to permit turning off the energy supplied to electric service water heating systems. A separate valve shall be provided to permit turning off the energy supplied to the main burner(s) of all other types of service water heater systems.

504.5 Swimming Pools:

504.5.1: All pool heaters shall be equipped with readily accessible ON/OFF switch to allow shutting off the operation of the heater without adjusting the thermostat setting. Controls shall be provided to allow the water temperature to be regulated from the maximum design temperature down to sixty-five degrees F.

504.5.2 Pool Covers: Heated swimming pools shall be equipped with a pool cover, approved by the building official.

504.6 Pump Operation: Circulating hot water systems shall be controlled so that the circulation pump(s) can be conveniently turned off, automatically or manually, when the hot water system is not in operation.

504.7 Pipe Insulation: Piping shall be thermally insulated in accordance with section 503.11.

504.8 Conservation of Hot Water:

504.8.1 Showers and Lavatories: Showers and lavatories used for other than safety reasons shall be equipped with flow control devices or specially manufactured showerheads or aerators to limit the total water flow rate as set forth in chapter 51-26 WAC, as measured with both hot and cold faucets turned on to their maximum flow.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-0504, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0504, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0504, filed 12/19/91, effective 7/1/92. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0504, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0505 Lighting.

505.1 Lighting Controls: Hotel and motel guest rooms and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.

505.2 Lighting Power: Lighting shall comply with the Prescriptive Lighting Option in Section 1520 or the Lighting Power Allowance Option in Section 1530.

EXCEPTIONS:

1. Group R-3 Occupancy and the dwelling unit portions of Group R-1 Occupancy.
2. Lighting exempted by Section 1512.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-0505, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-0505, filed 10/18/93, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0505, filed 12/19/91, effective 7/1/92. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0505, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0530 Table 5-1.

TABLE 5-1
TARGET COMPONENT VALUES FOR GROUP R OCCUPANCY

Component	Climate Zone	
	1	2
Glazing % Floor Area	15%	15%
Vertical Glazing U-Factor	U = 0.400	U = 0.400
Overhead Glazing U-Factor	U = 0.58	U = 0.58
Doors	U = 0.200 (R-5)	U = 0.200 (R-5)
Ceilings		
Attic	U = 0.031 (R-38)	U = 0.031 (R-38)
Single Rafter/ Joist Vaulted	U = 0.034 (R-30)	U = 0.034 (R-30)
Walls ²	U = 0.058 (R-19A)	U = 0.044 (R-19A + R-5)
Space Heat Type: Electric Resistance Other	U = 0.062 ¹ (R-19)	U = 0.062 ¹ (R-19)
Floors	U = 0.029 (R-30)	U = 0.029 (R-30)
Slab on Grade Slab R-Value	F = 0.54 (R-10)	F = 0.54 (R-10)
Below Grade Interior		
Wall R-Value	R-19	R-19
2' Depth: Walls Slab	U = 0.043 F = 0.69	U = 0.043 F = 0.69
3.5' Depth: Walls Slab	U = 0.041 F = 0.64	U = 0.041 F = 0.64
7' Depth: Walls Slab	U = 0.037 F = 0.57	U = 0.037 F = 0.57
Below Grade Exterior		
Wall R-Value	R-10	R-12

2' Depth: Walls	U = 0.070	U = 0.061
Slab	F = 0.60	F = 0.60
3.5' Depth: Walls	U = 0.064	U = 0.057
Slab	F = 0.57	F = 0.57
7' Depth: Walls	U = 0.056	U = 0.050
Slab	F = 0.42	F = 0.42

1. Log and Solid Timber walls that have a minimum average thickness of 3.5" are exempt from wall target UA and proposed UA calculations.

2. "A" means advanced framing. For more information, see Section 1005.2.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0530, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0530, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0530, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0530, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0530, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0533 Table 5-4—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0533, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0533, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0534 Table 5-5—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0534, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0534, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0535 Table 5-6—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0535, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0535, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0536 Table 5-7—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0536, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0536, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0537 Table 5-8—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0537, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0537, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0601 Scope.

601.1 General: This chapter establishes design criteria in terms of prescribed requirements for building construction.

The provisions of this chapter are applicable to all Group R Occupancies. Occupancies shall comply with all the requirements of Chapter 5 except for the modifications herein specified.

For wood frame assemblies, the building envelope requirements of this chapter may be met by installing one of the prescriptive packages in Table 6-1 or 6-2. Installed components shall meet the requirements of section 602. Compliance with nominal R-Values shall be demonstrated for the thermal resistance of the added insulation in framing cavities and/or insulated sheathing only and shall not include the thermal transmittance of other building materials or air films, but shall permit interruption by occasional framing members. Other than wood frame assemblies with continuous insulation uninterrupted by framing shall also be allowed to comply with nominal R-values.

For metal frame assemblies, compliance shall be demonstrated in accordance with Chapter 4 or Chapter 5 based on the assemblies in Chapter 10. Compliance with nominal R-values is not allowed, unless the full nominal R-value of the insulation is installed either inside or outside of the framing and is uninterrupted by framing.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0601, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0601, filed 1/5/01, effective 7/1/01. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0601, filed 2/10/94, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0601, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0602 Building envelope requirements for Group R Occupancy.

602.1 Roof/Ceiling: Ceilings below vented attics and single-rafter, joist-vaulted ceilings shall be insulated to not less than the nominal R-value specified for ceilings in Table 6-1 or 6-2 as applicable.

602.2 Exterior Walls Both Above and Below Grade: Above grade exterior walls shall be insulated to not less than the nominal R-value specified in Table 6-1 or 6-2 as applicable. The following walls should be considered to meet R-21 without additional documentation:

1. 2 x 6 framed and insulated with R-21 fiberglass batts.
2. 2 x 4 framed and insulated with R-15 fiberglass batts plus R-4.0 foam sheathing.
3. 2 x 4 framed and insulated with R-13 fiberglass batts plus R-5.0 foam sheathing.

602.3 Exterior Walls (Below Grade): Below grade exterior walls surrounding conditioned space shall be insulated to not less than the nominal R-value specified for below grade walls in Table 6-1 or 6-2 as applicable.

602.4 Slab-on-grade Floors: Slab-on-grade floors shall be insulated along their perimeter to not less than the nominal R-values specified for slab-on-grade floors in Table 6-1 or 6-2 as applicable. Slab insulation shall be installed in compliance with section 502.1.4.8. See Chapter 5, section 502.1.4.9, for additional requirements for radiant slab heating.

602.5 Floors Over Unconditioned Space: Floors over unconditioned spaces, such as vented crawl spaces, unconditioned basements, and parking garages shall be insulated to not less than the nominal R-value shown for floors over unconditioned spaces, in Table 6-1 or 6-2.

602.6 Exterior Doors: Doors shall comply with Sections 602.6.1 and 602.6.2.

EXCEPTIONS:

1. Doors whose area and U-factor are included in the calculations for compliance with the requirements for glazing in section 602.7 shall be exempt from the door U-factor requirements prescribed in Table 6-1 or 6-2.
2. One unlabeled or untested exterior swinging door with the maximum area of 24 square feet may be installed for ornamental, security or architectural purposes. Products using this exception shall not be included in either the U-factor or glazing area calculation requirements.

602.6.1 Exterior Door Area: For half-lite and full-lite doors, the glazing area shall be included in calculating the

allowed total glazing area in Section 602.7.1. Single glazing used for ornamental, security or architectural purposes shall be calculated using the exception to Section 602.7.2.

602.6.2 Exterior Door U-Factor: Doors, including fire doors, shall have a maximum area weighted average U-factor not exceeding that prescribed in Table 6-1 or 6-2.

602.7 Glazing:

602.7.1 Glazing Area: The total glazing area as defined in Chapter 2 shall not exceed the percentage of gross conditioned floor area specified in Table 6-1 or 6-2. This area shall also include any glazing in doors.

602.7.2 Glazing U-Factor: The total glazing area as defined in Chapter 2 shall have an area weighted average U-factor not to exceed that specified in Table 6-1 or 6-2. U-factors for glazing shall be determined in accordance with section 502.1.5. These areas and U-factors shall also include any doors using the exception of section 602.6.

If the U-factors for all vertical and overhead glazing products are below the appropriate U-factor specified, then no calculations are required. If compliance is to be achieved through an area weighted calculation, then the areas and U-factors shall be included in the plans submitted with a building permit application.

EXCEPTION: Single glazing for ornamental, security, or architectural purposes and double glazed garden windows with a wood or vinyl frame shall be exempt from the U-factor calculations but shall have its area tripled and shall be included in the percentage of the total glazing area as allowed for in Table 6-1 or 6-2. The maximum area (before tripling) allowed for the total of all single glazing and garden windows is one percent of the floor area.

602.8 Air Leakage For Group R Occupancy: The minimum air leakage control measures shall be as specified in section 502.4 as applicable.

WAC 51-11-0625 Table 6-1.

TABLE 6-1
PRESCRIPTIVE REQUIREMENTS^{0,1} FOR GROUP R OCCUPANCY
CLIMATE ZONE 1

Option	Glazing Area ¹⁰ , % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall• int ⁴ Below Grade	Wall• ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹¹								
I.	12%	0.35	0.58	0.20	R-38	R-30	R-15	R-15	R-10	R-30	R-10
II.*	15%	0.40	0.58	0.20	R-38	R-30	R-21	R-21	R-10	R-30	R-10
III.	Unlimited Group R-3 Occupancy only	0.40	0.58	0.20	R-38	R-30	R-21	R-21	R-10	R-30	R-10

* Reference Case

TABLE 6-2
PRESCRIPTIVE REQUIREMENTS^{0,1} FOR GROUP R OCCUPANCY
CLIMATE ZONE 2

Option	Glazing Area ¹⁰ , % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall• int ⁴ Below Grade	Wall• ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹¹								
I.	10%	0.40	0.58	0.20	R-38	R-30	R-21 Int ⁷	R-21	R-12	R-30	R-10
II.*	15%	0.40	0.58	0.20	R-38	R-30	R-19 + R-5 ⁸	R-21	R-12	R-30	R-10
III.	17%	0.37	0.58	0.20	R-38	R-30	R-19 + R-5 ⁸	R-21	R-12	R-30	R-10

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0602, filed 12/18/01, effective 7/1/02; 98-03-003, § 51-11-0602, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0602, filed 2/10/94, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0602, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0603 Building mechanical systems for Group R Occupancy.

603.1: Group R Occupancies that are space heated by air-to-air, ground-to-air, or water-to-air heat pumps shall comply with Table 6-1 or 6-2. System sizing shall be determined by an analysis consistent with section 503.2 of this Code, or, when approved by the building official, Chapter 9. All mechanical equipment efficiencies and service water heating system efficiencies shall comply with standards as stated in sections 503 and 504 of this Code.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0603, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0603, filed 2/10/94, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0603, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0604 Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-0604, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0604, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0605 Lighting. Lighting shall comply with Section 505.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-0605, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-0605, filed 10/18/93, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0605, filed 12/19/90, effective 7/1/91.]

Option	Glazing Area ¹⁰ : % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall [•] int ⁴ Below Grade	Wall [•] ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹¹								
IV.	Unlimited Group R-3 Occupancy only	0.35	0.58	0.20	R-38	R-30	R-21 Int ⁷	R-21	R-12	R-30	R-10

* Reference Case

0. Nominal R-values are for wood frame assemblies only or assemblies built in accordance with Section 601.1.

1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 13%, it shall comply with all of the requirements of the 15% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.

2. Requirement applies to all ceilings except single rafter or joist vaulted ceilings. 'Adv' denotes Advanced Framed Ceiling.

3. Requirement applicable only to single rafter or joist vaulted ceilings.

4. Below grade walls shall be insulated either on the exterior to a minimum level of R-10, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See Section 602.2.

5. Floors over crawl spaces or exposed to ambient air conditions.

6. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See Section 602.4.

7. Int. denotes standard framing 16 inches on center with headers insulated with a minimum of R-5 insulation.

8. This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.

9. Doors, including all fire doors, shall be assigned default U-factors from Table 10-6C.

10. Where a maximum glazing area is listed, the total glazing area (combined vertical plus overhead) as a percent of gross conditioned floor area shall be less than or equal to that value. Overhead glazing with U-factor of U=0.40 or less is not included in glazing area limitations.

11. Overhead glazing shall have U-factors determined in accordance with NFRC 100 or as specified in Section 502.1.5.

12. Log and solid timber walls with a minimum average thickness of 3.5" are exempt from this insulation requirement.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0625, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0625, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0625, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0625, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0625, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0625, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0626 Table 6-2—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0626, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0626, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0626, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0626, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0626, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0626, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0627 Table 6-3—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0627, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0627, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0627, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0627, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0627, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0627, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0628 Table 6-4—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0628, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0628, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0628, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0628, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0628, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0628, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0629 Table 6-5—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0629, filed 12/18/01, effective 7/1/02; 98-03-003, § 51-11-0629, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0629, filed 12/21/94, effective

6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0629, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0629, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0630 Table 6-6—Reserved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0630, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-0630, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0630, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0630, filed 12/21/94, effective 6/30/95. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-0630, filed 2/10/94, effective 4/1/94. Statutory Authority: Chapter 19.27A RCW. 92-01-140, § 51-11-0630, filed 12/19/91, effective 7/1/92.]

WAC 51-11-0701 Scope. The following standards shall apply to Chapters 1 through 20. The standards and portions thereof, which are referred to in various parts of this Code shall be part of the Washington State Energy Code and are hereby declared to be a part of this Code.

REFERENCE STANDARD

NO.	TITLE AND SOURCE
RS-1	Same as RS-27.
RS-2	through RS-3 (Reserved.)
RS-4	ASHRAE Standard 55-92 Thermal Environmental Conditions for Human Occupancy.
RS-5	through RS-8 (Reserved.)
RS-9	ASHRAE/IES Standard 90.1-1989, Efficient Design of New Buildings Except New Low-Rise Residential Buildings.
RS-10	Standard for Packaged Terminal Air Conditioners and Heat Pumps, ARI Standard 310/380-93.
RS-11	1999 ASHRAE HVAC Systems and Applications Handbook.
RS-12	through RS-14 (Reserved.)
RS-15	1996 ASHRAE System and Equipment Handbook.

REFERENCE STANDARD	TITLE AND SOURCE
NO.	
RS-16	SMACNA, Installation Standards for Residential Heating and Air Conditioning Systems, 6th Edition, 1988.
RS-17	Same as RS-18.
RS-18	SMACNA, HVAC Duct Construction Standards Metal and Flexible, 2nd Edition, 1995.
RS-19	SMACNA, Fibrous Glass Duct Construction Standards, 6th Edition, 1992.
RS-20	1998 ASHRAE Refrigeration Handbook.
RS-21	Same as Standard RS-10.
RS-22	through RS-24 (Reserved.)
RS-25	Same as RS-27.
RS-26	Super Good Cents Technical Reference (Builder's Field Guide).
RS-27	1997 ASHRAE Fundamentals Handbook.
RS-28	(Reserved.)
RS-29	Nonresidential Building Design by Systems Analysis.
RS-30	Title 10, Code of Federal Regulations (CFR), Part 430 (March 14, 1988).
RS-31	National Fenestration Rating Council (NFRC) Standard 100-1997.

ACCREDITED AUTHORITATIVE AGENCIES

ANSI refers to the American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036
Phone (212) 642-4900 Fax (212) 398-0023, Internet www.ansi.org

ARI refers to the Air Conditioning and Refrigeration Institute, 4301 N. Fairfax Dr., Suite 425, Arlington, VA 22203
Phone (703) 524-8800 Fax (703) 528-3816, Internet www.ari.org

ASHRAE refers to the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329
Phone (404) 636-8400 Fax (404) 321-5478, Internet www.ashrae.org

ASTM refers to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
Phone (610) 832-9585 Fax (610) 832-9555, Internet www.astm.org

CTI refers to the Cooling Tower Institute, 530 Wells Fargo Drive, Suite 218, Houston, TX 77090
Phone (281) 583-4087 Fax (281) 537-1721, Internet www.cti.org

IES refers to the Illuminating Engineering Society, 120 Wall Street, Floor 17, New York, NY 10005-4001
Phone (212) 248-5000 Fax (212) 248-5017, Internet www.iesna.org

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NFRC refers to the National Fenestration Rating Council, Incorporated, 1300 Spring Street, Suite 500, Silver Spring, Maryland 20910
Phone (301) 589-NFRC Fax (301) 588-0854, Internet www.nfrc.org

SMACNA refers to the Sheet Metal and Air Conditioning Contractors National Association, Inc., 4201 Lafayette Center Drive, P.O. Box 221230, Chantilly, VA 20153-1230
Phone (703) 803-2980 Fax (703) 803-3732, Internet www.smacna.org

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-0701, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-0701, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0701, filed 12/19/90, effective 7/1/91.]

WAC 51-11-0900 Section 0900—Prescriptive heating system sizing. When using the prescriptive approach in Chapter 6, if approved by the building official, design heat load calculations are not required to show compliance to this Code if the heating system installed is equal to or less than the following:

Climate Zone 1	20 Btu/h•ft ²
Climate Zone 2	25 Btu/h•ft ²

Example: A 2000 ft² house in Zone 2, heated with gas, would not have to submit a design heat load if the proposed furnace is 50,000 Btu or less.

$$2000 \times 25 = 50,000$$

Disclaimer: All heating systems shall be designed and installed in accordance with Uniform Building Code Section 310.11.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-0900, filed 12/18/01, effective 7/1/02. Statutory Authority: Chapters 19.27 and 19.27A RCW and 1994 c 226. 95-01-126, § 51-11-0900, filed 12/21/94, effective 6/30/95. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-0900, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1001 Section 1001 General.

1001.1 Scope: The following defaults shall apply to Chapters 1 through 20. This chapter includes tables of seasonal average heat-loss coefficients for specified nominal insulation. The heat-loss coefficients may also be used for heating system sizing.

1001.2 Description: These coefficients were developed primarily from data and procedures from Standard RS-27, and taken specifically from Standard RS-26, listed in Chapter 7.

Coefficients not contained in this chapter may be computed using the procedures listed in these references if the assumptions in the following sections and Standard RS-26, listed in Chapter 7, are used, along with data from the sources referenced above.

1001.3 **Air Films:** Default R-values used for air films shall be as follows:

R-Value	Condition
0.17	All exterior surfaces

R-Value	Condition
0.61	Interior horizontal surfaces, heat flow up
0.92	Interior horizontal surfaces, heat flow down
0.68	Interior vertical surfaces

1001.4 Compression of Insulation: Insulation which is compressed shall be rated in accordance with Table 10-A or reduction in value may be calculated in accordance with the procedures in Standard RS-27, listed in Chapter 7.

TABLE 10-A
R-Value of Fiberglass Batts Compressed within Various Depth Cavities

Insulation R-Value at Standard Thickness													
R-Value		38	30	22	21	19	15	13	11	8	5	3	
Standard Thickness		12"	9-1/2"	6-3/4"	5-1/2"	6-1/4"	3-1/2"	3-5/8"	3-1/2"	2-1/2"	1-1/2"	3/4"	
Nominal Lumber Sizes, Inches	Actual Depth of Cavity, Inches	Insulation R-Values when Installed in a Confined Cavity											
		2 x 12	11-1/4	37	—	—	—	—	—	—	—	—	—
		2 x 10	9-1/4	32	30	—	—	—	—	—	—	—	—
		2 x 8	7-1/4	27	26	—	—	—	—	—	—	—	—
		2 x 6	5-1/2	—	21	20	21	18	—	—	—	—	—
		2 x 4	3-1/2	—	—	14	—	13	15	13	11	—	—
		2 x 3	2-1/2	—	—	—	—	—	9.8	—	—	—	—
		2 x 2	1-1/2	—	—	—	—	—	6.3	6.0	5.7	5.0	—
		2 x 1	3/4	—	—	—	—	—	—	—	—	3.2	3.0

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1001, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-1001, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1002 Section 1002: Below grade walls and slabs.

1002.1 General: Table 10-1 lists heat-loss coefficients for below-grade walls and floors.

Coefficients for below-grade walls are given as U-factors (Btu/hr•ft²•°F of wall area). Coefficients for below-grade slabs are listed as F-factors (Btu/hr•ft•°F per lineal foot of slab perimeter).

Below-grade wall U-factors are only valid when used with the accompanying below-grade slab F-factors, and vice versa.

1002.2 Component Description: All below-grade walls are assumed to be eight-inch concrete. The wall is assumed to extend from the slab upward to the top of the mud sill for the distance specified in Table 10-1, with six inches of concrete wall extending above grade.

Interior insulation is assumed to be fiberglass batts placed in the cavity formed by 2x4 framing on twenty-four inch centers with one-half inch of gypsum board as the interior finish material. Exterior insulation is assumed to be applied directly to the exterior of the below-grade wall from

the top of the wall to the footing. The exterior case does not assume any interior framing or sheetrock.

In all cases, the entire wall surface is assumed to be insulated to the indicated nominal level with the appropriate framing and insulation application. Coefficients are listed for wall depths of two, three and one-half, and seven feet below grade. Basements shallower than two feet should use on-grade slab coefficients.

Heat-loss calculations for wall areas above grade should use above-grade wall U-factors, beginning at the mudsill.

1002.3 Insulation Description: Coefficients are listed for the following four configurations:

1. Uninsulated: No insulation or interior finish.
2. Interior insulation: Interior 2x4 insulated wall without a thermal break between concrete wall and slab.
3. Interior insulation w/thermal break: Interior 2x4 insulated wall with R-5 rigid board providing a thermal break between the concrete wall and the slab.
4. Exterior insulation: Insulation applied directly to the exterior surface of the concrete wall.

TABLE 10-1
DEFAULT WALL U-FACTORS AND SLAB F-FACTORS FOR BASEMENTS

	Below Grade Wall U-factor	Below Grade Slab F-factor
2-Foot Depth Below Grade		
Uninsulated	0.350	0.59
R-11 Interior	0.066	0.68
R-11 Interior w/tb	0.070	0.60
R-19 Interior	0.043	0.69
R-19 Interior w/tb	0.045	0.61
R-10 Exterior	0.070	0.60
R-12 Exterior	0.061	0.60

TABLE 10-1
DEFAULT WALL U-FACTORS AND SLAB F-FACTORS FOR BASEMENTS

	Below Grade Wall U-factor	Below Grade Slab F-factor
3.5-Foot Depth Below Grade		
Uninsulated	0.278	0.53
R-11 Interior	0.062	0.63
R-11 Interior w/tb	0.064	0.57
R-19 Interior	0.041	0.64
R-19 Interior w/tb	0.042	0.57
R-10 Exterior	0.064	0.57
R-12 Exterior	0.057	0.57
7-Foot Depth Below Grade		
Uninsulated	0.193	0.46
R-11 Interior	0.054	0.56
R-11 Interior w/tb	0.056	0.42
R-19 Interior	0.037	0.57
R-19 Interior w/tb	0.038	0.43
R-10 Exterior	0.056	0.42
R-12 Exterior	0.050	0.42

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1002, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1002, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2, 91-01-112, § 51-11-1002, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1003 Section 1003: On-grade slab floors.

1003.1 General: Table 10-2 lists heat-loss coefficients for heated on-grade slab floors, in units of Btu/h•°F per lineal foot of perimeter.

1003.2 Component Description: All on-grade slab floors are assumed to be six-inch concrete poured directly onto the earth. The bottom of the slab is assumed to be at grade line. Monolithic and floating slabs are not differentiated.

Soil is assumed to have a conductivity of 0.75 Btu/hr•°F•ft². Slabs two-feet or more below grade should use basement coefficients.

1003.3 Insulation Description: Coefficients are provided for the following three configurations:

Two-Foot (or four-foot) vertical: Insulation is applied directly to the slab exterior, extending downward from the top of the slab to a depth of two-feet (or four-feet) below grade.

Two-Foot (or four-foot) horizontal: Insulation is applied directly to the underside of the slab, and run horizontally from the perimeter inward for two-feet or four-feet. The slab edge is exposed in this configuration.

Note: A horizontal installation with a thermal break of at least R-5 at the slab edge should use the vertical-case F-factors.

Fully insulated slab: Insulation extends from the top of the slab, along the entire perimeter, and completely covers the area under the slab. Thicker perimeter insulation covers the slab edge and extends 2 feet under the slab.

TABLE 10-2
DEFAULT F-FACTORS FOR ON-GRADE SLABS

Insulation type	R-0	R-5	R-10	R-15
Unheated Slab				
Uninsulated slab	0.73	—	—	—
2-ft Horizontal (No thermal break)	—	0.70	0.70	0.69
4-ft Horizontal (No thermal break)	—	0.67	0.64	0.63
2-ft Vertical	—	0.58	0.54	0.52
4-ft Vertical	—	0.54	0.48	0.45
Fully insulated slab	—	—	0.36	—
Heated Slab				
Uninsulated slab	0.84	—	—	—
Fully insulated slab	—	0.74	0.55	0.44
R-5 Center (With perimeter insulation)	—	—	0.66	0.62
R-10 Center (With perimeter insulation)	—	—	—	0.51
3-ft Vertical	—	—	0.78	—

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1003, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1003, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2, 91-01-112, § 51-11-1003, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1004 Section 1004: Floors over unconditioned space.

1004.1 General: Tables 10-3, 10-4 and 10-4a list heat-loss coefficients for floors over unconditioned spaces in units of Btu/h•ft²•°F.

They are derived from procedures listed in RS-27, listed in Chapter 7, assuming an average outdoor temperature of 45° F, an average indoor temperature of 65° F, and a crawlspace area of 1350 ft² and 100 ft of perimeter. The crawlspace is assumed to be 2.5 feet high, with 24 inches below grade and 6 inches above grade.

1004.2 Crawlspace Description: Four configurations are considered: Vented crawlspace, unvented crawlspace, heated plenum crawlspace and exposed floor.

Vented crawlspaces: Assumed to have 3.0 air-changes per hour, with at least 1.0 ft² of net-free ventilation in the foundation for every three hundred ft² of crawlspace floor area. The crawlspace is not actively heated.

Floors over unheated areas, such as garages, may only use those values which have R-0 perimeter insulation.

Unvented crawlspaces: Assumed to have 1.5 air changes per hour, with less than 1.0 ft² of net-free ventilation in the foundation for every three hundred ft² of crawlspace floor area. The crawlspace is not actively heated. Floors over unheated basements may only use those values which have R-0 perimeter insulation.

Heated-plenum crawlspaces: Assumed to have 0.25 air-changes per hour, with no foundation vents. Heated supply air from central furnace is blown into a crawlspace and allowed to enter the living space unducted via holes cut into the floor.

Enclosed floors: Assumes no buffer space, and a covering of one-half inch of T1-11 on the exterior of the cavity exposed to the outside air or rigid insulation below a concrete floor, such as over parking garages.

1004.3 Construction Description: Floors are assumed to be either joisted floors framed on sixteen inch centers, or post and beam on four by eight foot squares. Insulation is assumed to be installed under the subflooring between the joists or beams with no space between the insulation and the subfloor. Insulation is assumed to be uncompressed. Exposed floors also include concrete with continuous rigid insulation assumed.

Perimeter insulation is assumed to extend from the top of the rim joist to the crawlspace floor and then inward along the ground (on top of the ground cover) for at least twenty-four inches.

Floor coverings are assumed to be light carpet with rubber pad.

TABLE 10-3
DEFAULT U-FACTORS FOR FLOORS OVER VENTED CRAWLSPACE OR UNHEATED BASEMENT

Nominal R-value		U-factor	
Floor	Perimeter	Post & Beam	Joists
0	0	0.112	0.134
	11	0.100	0.116
	19	0.098	0.114
	30	0.093	0.107
11	0	0.052	0.056
	11	0.048	0.052
19	0	0.038	0.041
	11	0.036	0.038
22	0	0.034	0.037
	11	0.033	0.035
25	0	0.032	0.034
	11	0.031	0.033
30	0	0.028	0.029
	11	0.027	0.028
38	0	0.024	0.025
	11	0.024	0.024

TABLE 10-4
DEFAULT U-FACTORS FOR FLOORS OVER HEATED PLENUM CRAWLSPACES

Nominal R-value Perimeter	U-factor
11	0.085
19	0.075
30	0.069

TABLE 10-4A
EXPOSED FLOOR

Nominal R-value	U-factor		
	Concrete	Wood Joist	Metal Joist
R-11	0.077	0.088	0.14
R-15	0.059	0.076	0.12
R-19	0.048	0.062	0.11
R-21	0.043	0.057	0.11
R-25	0.037	0.051	0.10
R-30	0.031	0.040	0.09
R-38	0.025	0.034	0.08

Note: Crawlspaces used as heated plenums have approximately 30% higher heat-loss rate than unvented crawlspaces with the same assumed ACH. Default U-values in Table 10-4 reflect this higher rate of heat loss.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1004, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1004, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2, § 91-01-112, § 51-11-1004, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1005 Section 1005: Above-grade walls.

Section 1005.1 General: Table 10-5, 10-5A and 10-5B list heat-loss coefficients for the opaque portion of above-grade wood stud frame walls, metal stud frame walls and concrete masonry walls (Btu/h•ft²•°F) respectively. They are derived from procedures listed in RS-27, listed in Chapter 7. For intermediate floor slabs which penetrate the insulated wall, use the concrete wall U-factors in Table 10-5B.

Insulation is assumed to uniformly fill the entire cavity and to be installed as per manufacturer's directions. All walls are assumed to be finished on the inside with one-half inch gypsum wallboard, and on the outside with either beveled wood siding over one-half inch plywood sheathing or with five-eighths inch T1-11 siding. Insulated sheathing (either interior or exterior) is assumed to cover the entire opaque wall surface.

1005.2 Framing Description: For wood stud frame walls, three framing types are considered, and defined as follows:

Standard: Studs framed on sixteen inch centers with double top plate and single bottom plate. Corners use three studs and each opening is framed using two studs. Headers consist of double 2X or single 4X material with an air space left between the header and the exterior sheathing. Interior partition wall/exterior wall intersections use two studs in the exterior wall.

Framing weighting factors:	Studs and plates	.19
	Insulated cavity	.77
	Headers	.04

Intermediate: Studs framed on sixteen inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs. Headers consist of double 2X material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall.

Framing weighting factors:	Studs and plates	.18
	Insulated cavity	.78
	Headers	.04

Advanced: Studs framed on twenty-four inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2X material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall.

Framing weighting factors:	Studs and plates	.13
	Insulated cavity	.83
	Headers	.04

1005.3 Component Description: Default coefficients for four types of walls are listed: single-stud walls, metal stud walls, strap walls, and double-stud walls.

Single-Stud Wall: Assumes either 2x4 or 2x6 studs framed on sixteen or twenty-four inch centers. Headers are solid for 2x4 walls and double 2x for 2x6 walls, with either dead-air or rigid-board insulation in the remaining space.

Metal Stud Wall: Assumes metal studs spaced on 16 or 24 inch centers with insulation installed to fill wall cavities. Continuous rigid board insulation is applied without creating uninsulated voids in the wall assembly.

Strap Wall: Assumes 2x6 studs framed on sixteen or twenty-four inch centers. 2x3 or 2x4 strapping is run horizontally along the interior surface of the wall to provide additional space for insulation.

Double-Stud Wall: Assumes an exterior structural wall and a separate interior, non-structural wall. Insulation is placed in both wall cavities and in the space between the 2 walls. Stud spacing is assumed to be on 24 inch centers for both walls.

TABLE 10-5
DEFAULT U-FACTORS FOR ABOVE-GRADE WALLS

2 x 4 Single Wood Stud: R-11 Batt

NOTE:

Nominal Batt R-value:
R-11 at 3.5 inch thickness

Installed Batt R-value:
R-11 in 3.5 inch cavity

Siding Material/Framing Type				
R-value of Foam Board	Lapped Wood		T1-11	
	STD	ADV	STD	ADV
0	0.088	0.084	0.094	0.090
1	0.080	0.077	0.085	0.082
2	0.074	0.071	0.078	0.075
3	0.069	0.066	0.072	0.070
4	0.064	0.062	0.067	0.065
5	0.060	0.058	0.063	0.061
6	0.056	0.055	0.059	0.057
7	0.053	0.052	0.055	0.054
8	0.051	0.049	0.052	0.051
9	0.048	0.047	0.050	0.049
10	0.046	0.045	0.047	0.046
11	0.044	0.043	0.045	0.044
12	0.042	0.041	0.043	0.042

2 x 4 Single Wood Stud: R-13 Batt**NOTE:**

Nominal Batt R-value:
R-13 at 3.63 inch thickness

Installed Batt R-value:
R-12.7 in 3.5 inch cavity

Siding Material/Framing Type				
R-value of Foam Board	Lapped Wood		T1-11	
	STD	ADV	STD	ADV
0	0.082	0.078	0.088	0.083
1	0.075	0.072	0.080	0.076
2	0.069	0.066	0.073	0.070
3	0.065	0.062	0.068	0.065
4	0.060	0.058	0.063	0.061
5	0.057	0.055	0.059	0.057
6	0.053	0.052	0.056	0.054
7	0.051	0.049	0.052	0.051
8	0.048	0.047	0.050	0.048
9	0.046	0.045	0.047	0.046
10	0.044	0.043	0.045	0.044
11	0.042	0.041	0.043	0.042
12	0.040	0.039	0.041	0.040

2 x 4 Single Wood Stud: R-15 Batt**NOTE:**

Nominal Batt R-value:
R-15 at 3.5 inch thickness

Installed Batt R-value:
R-15 in 3.5 inch cavity

Siding Material/Framing Type				
R-value of Foam Board	Lapped Wood		T1-11	
	STD	ADV	STD	ADV
0	0.076	0.071	0.081	0.075
1	0.069	0.065	0.073	0.069
2	0.064	0.061	0.068	0.069
3	0.060	0.057	0.063	0.059
4	0.056	0.053	0.059	0.056
5	0.053	0.051	0.055	0.052
6	0.050	0.048	0.052	0.050
7	0.047	0.046	0.049	0.047
8	0.045	0.044	0.047	0.045
9	0.043	0.042	0.044	0.043
10	0.041	0.040	0.042	0.041
11	0.039	0.038	0.041	0.039
12	0.038	0.037	0.039	0.038

2 x 6 Single Wood Stud: R-19 Batt**NOTE:**

Nominal Batt R-value:
R-19 at 6 inch thickness

Installed Batt R-value:
R-18 in 5.5 inch cavity

Siding Material/Framing Type						
R-value of Foam Board	Lapped Wood			T1-11		
	STD	INT	ADV	STD	INT	ADV
0	0.062	0.058	0.055	0.065	0.061	0.058
1	0.058	0.055	0.052	0.060	0.057	0.055
2	0.054	0.052	0.050	0.056	0.054	0.051
3	0.051	0.049	0.047	0.053	0.051	0.049
4	0.048	0.046	0.045	0.050	0.048	0.046
5	0.046	0.044	0.043	0.048	0.046	0.044
6	0.044	0.042	0.041	0.045	0.044	0.042
7	0.042	0.040	0.039	0.043	0.042	0.040
8	0.040	0.039	0.038	0.041	0.040	0.039
9	0.038	0.037	0.035	0.039	0.038	0.037
10	0.037	0.036	0.035	0.038	0.037	0.036
11	0.036	0.035	0.034	0.036	0.035	0.035
12	0.034	0.033	0.033	0.035	0.034	0.033

2 x 6 Single Wood Stud: R-21 Batt**NOTE:**

Nominal Batt R-value:
R-21 at 5.5 inch thickness

Installed Batt R-value:
R-21 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.057	0.054	0.051	0.060	0.056	0.053
1	0.054	0.051	0.048	0.056	0.053	0.050
2	0.050	0.048	0.045	0.052	0.050	0.047
3	0.048	0.045	0.043	0.049	0.047	0.045
4	0.045	0.043	0.041	0.047	0.045	0.043
5	0.043	0.041	0.040	0.044	0.042	0.041
6	0.041	0.039	0.038	0.042	0.041	0.039
7	0.039	0.038	0.036	0.040	0.039	0.037
8	0.038	0.036	0.035	0.039	0.037	0.036
9	0.036	0.035	0.034	0.037	0.036	0.035
10	0.035	0.034	0.033	0.036	0.035	0.033
11	0.033	0.033	0.032	0.034	0.033	0.032
12	0.032	0.031	0.031	0.033	0.032	0.031

2 x 6 Single Wood Stud: R-22 Batt**NOTE:**

Nominal Batt R-value:
R-22 at 6.75 inch thickness

Installed Batt R-value:
R-20 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.059	0.055	0.052	0.062	0.058	0.054
1	0.055	0.052	0.049	0.057	0.054	0.051
2	0.052	0.049	0.047	0.054	0.051	0.048
3	0.049	0.046	0.044	0.050	0.048	0.046
4	0.046	0.044	0.042	0.048	0.046	0.044
5	0.044	0.042	0.041	0.045	0.043	0.042
6	0.042	0.040	0.039	0.043	0.042	0.040
7	0.040	0.039	0.037	0.041	0.040	0.038
8	0.038	0.037	0.036	0.039	0.038	0.037
9	0.037	0.036	0.035	0.038	0.037	0.035
10	0.035	0.034	0.033	0.036	0.035	0.034
11	0.034	0.033	0.032	0.035	0.034	0.033
12	0.033	0.032	0.031	0.034	0.033	0.032

2 x 6 Single Wood Stud: Two R-11 Batts**NOTE:**

Nominal Batt R-value:
R-22 at 7 inch thickness

Installed Batt R-value:
R-18.9 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.060	0.057	0.054	0.063	0.059	0.056
1	0.056	0.053	0.051	0.059	0.056	0.053
2	0.053	0.050	0.048	0.055	0.052	0.050
3	0.050	0.048	0.046	0.052	0.049	0.047
4	0.047	0.045	0.044	0.049	0.047	0.045
5	0.045	0.043	0.042	0.046	0.045	0.043
6	0.043	0.041	0.040	0.044	0.043	0.041
7	0.041	0.040	0.038	0.042	0.041	0.039
8	0.039	0.038	0.037	0.040	0.039	0.038
9	0.038	0.037	0.036	0.039	0.038	0.036
10	0.036	0.035	0.034	0.037	0.036	0.035
11	0.035	0.034	0.033	0.036	0.035	0.034
12	0.034	0.033	0.032	0.034	0.034	0.033

2 x 8 Single Stud: R-25 Batt**NOTE:**

Nominal Batt R-value:
R-25 at 8 inch thickness

Installed Batt R-value:
R-23.6 in 7.25 inch cavity

Siding Material/Framing Type						
R-value of Foam Board	Lapped Wood			T1-11		
	STD	INT	ADV	STD	INT	ADV
0	0.051	0.047	0.045	0.053	0.049	0.046
1	0.048	0.045	0.043	0.049	0.046	0.044
2	0.045	0.043	0.041	0.047	0.044	0.042
3	0.043	0.041	0.039	0.044	0.042	0.040
4	0.041	0.039	0.037	0.042	0.040	0.038
5	0.039	0.037	0.036	0.040	0.038	0.037
6	0.037	0.036	0.035	0.038	0.037	0.036
7	0.036	0.035	0.033	0.037	0.035	0.034
8	0.035	0.033	0.032	0.035	0.034	0.033
9	0.033	0.032	0.031	0.034	0.033	0.032
10	0.032	0.031	0.030	0.033	0.032	0.031
11	0.031	0.030	0.029	0.032	0.031	0.030
12	0.030	0.029	0.028	0.031	0.030	0.029

2 x 6: Strap Wall

	Siding Material/Frame Type			
	Lapped Wood		T1-11	
	STD	ADV	STD	ADV
R-19 + R-11 Batts	0.036	0.035	0.038	0.036
R-19 + R-8 Batts	0.041	0.039	0.042	0.040

2 x 6 + 2 x 4: Double Wood Stud

Batt Configuration			Siding Material/Frame Type			
			Lapped Wood		T1-11	
Exterior	Middle	Interior	STD	ADV	STD	ADV
R-19	_____	R-11	0.040	0.037	0.041	0.038
R-19	_____	R-19	0.034	0.031	0.035	0.032
R-19	R-8	R-11	0.029	0.028	0.031	0.029
R-19	R-11	R-11	0.027	0.026	0.028	0.027
R-19	R-11	R-19	0.024	0.023	0.025	0.023
R-19	R-19	R-19	0.021	0.020	0.021	0.020

2 x 4 + 2 x 4: Double Wood Stud

Batt Configuration			Siding Material/Frame Type			
			Lapped Wood		T1-11	
Exterior	Middle	Interior	STD	ADV	STD	ADV
R-11	_____	R-11	0.050	0.046	0.052	0.048
R-19	_____	R-11	0.039	0.037	0.043	0.039
R-11	R-8	R-11	0.037	0.035	0.036	0.036
R-11	R-11	R-11	0.032	0.031	0.033	0.032
R-13	R-13	R-13	0.029	0.028	0.029	0.028
R-11	R-19	R-11	0.026	0.026	0.027	0.026

Log Walls

NOTE:

R-value of wood:
R-1.25 per inch thickness

Average wall thickness
90% average log diameter

Average Log Diameter, Inches	U-factor
6	0.148
8	0.111
10	0.089
12	0.074
14	0.063
16	0.056

Stress Skin Panel

NOTE:

R-value of expanded polystyrene: R-3.85 per inch

Framing: 6%
Spline: 8%

No thermal bridging between interior and exterior splines

Panel Thickness, Inches	U-factor
3 1/2	0.071
5 1/2	0.048
7 1/4	0.037
9 1/4	0.030
11 1/4	0.025

Metal Stud Walls: The nominal R-values in Table 10-5A may be used for purposes of calculating metal stud wall section U-factors in lieu of the ASHRAE zone calculation method as provided in Chapter 24 of Standard RS-27.

TABLE 10-5A

Default U-factors for Overall Assembly Metal Stud Walls, Effective R-values for Metal Framing and Cavity Only, and Default Metal Building U-factors

OVERALL ASSEMBLY U-FACTORS FOR METAL STUD WALLS

Metal Framing	R-Value of Continuous Foam Board Insulation	Cavity Insulation					
		R-11	R-13	R-15	R-19	R-21	R-25
16" o.c.	R-0 (none)	U-0.14	U-0.13	U-0.12	U-0.10	U-0.097	U-0.091
	R-1	U-0.12	U-0.12	U-0.11	U-0.094	U-0.089	U-0.083
	R-2	U-0.11	U-0.10	U-0.099	U-0.086	U-0.081	U-0.077
	R-3	U-0.10	U-0.095	U-0.090	U-0.079	U-0.075	U-0.071
	R-4	U-0.091	U-0.087	U-0.082	U-0.073	U-0.070	U-0.067
	R-5	U-0.083	U-0.080	U-0.076	U-0.068	U-0.065	U-0.062
	R-6	U-0.077	U-0.074	U-0.071	U-0.064	U-0.061	U-0.059
	R-7	U-0.071	U-0.069	U-0.066	U-0.060	U-0.058	U-0.055
	R-8	U-0.067	U-0.064	U-0.062	U-0.057	U-0.055	U-0.053
	R-9	U-0.062	U-0.060	U-0.058	U-0.054	U-0.052	U-0.050
	R-10	U-0.059	U-0.057	U-0.055	U-0.051	U-0.049	U-0.048
24" o.c.	R-0 (none)	U-0.13	U-0.12	U-0.11	U-0.091	U-0.085	U-0.079
	R-1	U-0.11	U-0.10	U-0.098	U-0.084	U-0.078	U-0.073
	R-2	U-0.10	U-0.091	U-0.089	U-0.077	U-0.073	U-0.068
	R-3	U-0.092	U-0.083	U-0.082	U-0.072	U-0.068	U-0.064
	R-4	U-0.084	U-0.077	U-0.076	U-0.067	U-0.063	U-0.060
	R-5	U-0.078	U-0.071	U-0.070	U-0.063	U-0.060	U-0.057
	R-6	U-0.072	U-0.067	U-0.066	U-0.059	U-0.056	U-0.054
	R-7	U-0.067	U-0.063	U-0.062	U-0.056	U-0.053	U-0.051
	R-8	U-0.063	U-0.059	U-0.058	U-0.053	U-0.051	U-0.048
	R-9	U-0.059	U-0.056	U-0.055	U-0.050	U-0.048	U-0.046
	R-10	U-0.056	U-0.053	U-0.052	U-0.048	U-0.046	U-0.044

EFFECTIVE R-VALUES FOR METAL FRAMING AND CAVITY ONLY

	Cavity		Insulation		
	Nominal Depth, Inches	Actual Depth, Inches	Nominal R-Value	Effective R-Value	
				16" O.C.	24" O.C.
Air Cavity	any	any	R-0.91 (air)	0.79	0.91
Wall	4	3-1/2	R-11	5.5	6.6
	4	3-1/2	R-13	6.0	7.2
	4	3-1/2	R-15	6.4	7.8
	6	5-1/2	R-19	7.1	8.6
	6	5-1/2	R-21	7.4	9.0
	8	7-1/4	R-25	7.8	9.6
Roof		Insulation is uncompressed	R-11	5.5	6.1

	Cavity		Insulation		
	Nominal Depth, Inches	Actual Depth, Inches	Nominal R-Value	Effective R-Value	
				16" O.C.	24" O.C.
			R-19	7.0	9.1
			R-30	9.3	11.4

DEFAULT METAL BUILDING U-FACTORS

	R-10	R-11	R-13	R-19	R-24	R-30
Faced fiber glass blanket insulation rolled over and perpendicular to structural frame. Metal covering sheets fastened to the frame, holding insulation in place.	0.133	0.127	0.114	0.091	na	na
Faced fiber glass batt insulation suspended between structural frame. Metal covering sheets fastened directly to frame.	0.131	0.123	0.107	0.079	0.065	0.057
Faced fiber glass blanket insulation rolled over and perpendicular to structural frame. Rigid insulation blocks placed over insulation to align with structural frame.	0.102	0.096	0.084	0.065	na	na
Faced fiber glass batt insulation suspended between structural frame. Rigid insulation blocks placed over insulation to align with structural frame.	0.099	0.093	0.080	0.059	0.048	0.041

Concrete Masonry Walls: The nominal R-values in Table 10-5B may be used for purposes of calculating concrete masonry wall section U-factors in lieu of the ASHRAE isothermal planes calculation method as provided in Chapter 24 of Standard RS-27.

TABLE 10-5B

Default U-Factors for Concrete and Masonry Walls

8" CONCRETE MASONRY				
WALL DESCRIPTION	CORE TREATMENT			
	Partial Grout with UngROUTED Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Block, Both Sides	0.40	0.23	0.24	0.43
R-5 Interior Insulation, Wood Furring	0.14	0.11	0.12	0.15
R-6 Interior Insulation, Wood Furring	0.14	0.11	0.11	0.14
R-10.5 Interior Insulation, Wood Furring	0.11	0.09	0.09	0.11
R-8 Interior Insulation, Metal Clips	0.11	0.09	0.09	0.11
R-6 Exterior Insulation	0.12	0.10	0.10	0.12
R-10 Exterior Insulation	0.08	0.07	0.07	0.08
R-9.5 Rigid Polystyrene Integral Insulation, Two Webbed Block	0.11	0.09	0.09	0.12

12" CONCRETE MASONRY				
	CORE TREATMENT			
	Partial Grout with UngROUTED Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Block, Both Sides	0.35	0.17	0.18	0.33
R-5 Interior Insulation, Wood Furring	0.14	0.10	0.10	0.13
R-6 Interior Insulation, Wood Furring	0.13	0.09	0.10	0.13
R-10.5 Interior Insulation, Wood Furring	0.11	0.08	0.08	0.10
R-8 Interior Insulation, Metal Clips	0.10	0.08	0.08	0.09
R-6 Exterior Insulation	0.11	0.09	0.09	0.11
R-10 Exterior Insulation	0.08	0.06	0.06	0.08
R-9.5 Rigid Polystyrene Integral Insulation, Two Webbed Block	0.11	0.08	0.09	0.12

8" CLAY BRICK				
WALL DESCRIPTION	CORE TREATMENT			
	Partial Grout with UngROUTED Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Block, Both Sides	0.50	0.31	0.32	0.56
R-5 Interior Insulation, Wood Furring	0.15	0.13	0.13	0.16
R-6 Interior Insulation, Wood Furring	0.15	0.12	0.12	0.15
R-10.5 Interior Insulation, Wood Furring	0.12	0.10	0.10	0.12
R-8 Interior Insulation, Metal Clips	0.11	0.10	0.10	0.11
R-6 Exterior Insulation	0.12	0.11	0.11	0.13
R-10 Exterior Insulation	0.08	0.08	0.08	0.09

6" CONCRETE POURED OR PRECAST				
WALL DESCRIPTION	CORE TREATMENT			
	Partial Grout with UngROUTED Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Concrete, Both Sides	NA	NA	NA	0.61
R-5 Interior Insulation, Wood Furring	NA	NA	NA	0.16
R-6 Interior Insulation, Wood Furring	NA	NA	NA	0.15
R-10.5 Interior Insulation, Wood Furring	NA	NA	NA	0.12
R-8 Interior Insulation, Metal Clips	NA	NA	NA	0.12
R-6 Exterior Insulation	NA	NA	NA	0.13
R-10 Exterior Insulation	NA	NA	NA	0.09

Notes for Default Table 10-5B

1. Grouted cores at 40" x 48" on center vertically and horizontally in partial grouted walls.
2. Interior insulation values include 1/2" gypsum board on the inner surface.
3. Furring and stud spacing is 16" on center. Insulation is assumed to fill furring space and is not compressed.
4. Intermediate values may be interpolated using this table. Values not contained in this table may be computed using the procedures listed in Standard RS-27.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1005, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1005, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2, § 91-01-112, § 51-11-1005, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1006 Section 1006 Default U-factors for glazing and doors.

1006.1 Glazing and Doors without NFRC Certification: Glazing and doors that do not have NFRC certification shall be assigned the following U-factors:

TABLE 10-6

Other than Group R Occupancy: DEFAULT U-FACTORS FOR VERTICAL GLAZING, OVERHEAD GLAZING AND OPAQUE DOORS

Vertical Glazing		
	U-Factor	
	Any Frame	Vinyl/Wood Frame
Single	1.45	1.45
Double	0.90	0.75
1/2 Inch Air, Fixed	0.75	0.60
1/2 Inch Air, Low-e ^(0.40) , Fixed	0.60	0.50
1/2 Inch Argon, Low-e ^(0.10) , Fixed	0.50	0.40

Overhead Glazing		
	U-Factor	
	Any Frame	Vinyl/Wood Frame
Single	2.15	2.15
Double	1.45	1.00
Low-e ^(0.40) or Argon	1.40	0.95
Low-e ^(0.40) + Argon	1.30	0.85
Low-e ^(0.20) Air	1.30	0.90
Low-e ^(0.20) + Argon	1.25	0.80
Triple	1.25	0.80

Opaque Doors	
	U-Factor
Uninsulated Metal	1.20
Insulated Metal (Including Fire Door and Smoke Vent)	0.60
Wood	0.50

Notes:

Where a gap width is listed (i.e.: 1/2 inch), that is the minimum allowed.

Where a low-emissivity emittance is listed (i.e.: 0.40, 0.20, 0.10), that is the maximum allowed.

Where a gas other than air is listed (i.e.: Argon), the gas fill shall be a minimum of 90%.

Where an operator type is listed (i.e.: Fixed), the default is only allowed for that operator type.

Where a frame type is listed (i.e.: Wood/vinyl), the default is only allowed for that frame type. Wood/vinyl frame includes reinforced vinyl and aluminum-clad wood.

TABLE 10-6A
Group R Occupancy: DEFAULT U-FACTORS FOR VERTICAL GLAZING

Description ^{1,2,3,4}			Frame Type ^{5,6}		
			Aluminum	Aluminum Thermal Break ⁷	Wood/Vinyl
Windows	Single		1.20	1.20	1.20
	Double, < 1/2"	Clear	0.92	0.75	0.63
		Clear+ Argon	0.87	0.71	0.60
		Low-e	0.85	0.69	0.58
		Low-e+Argon	0.79	0.62	0.53
	Double, ≥ 1/2"	Clear	0.86	0.69	0.58
		Clear+ Argon	0.83	0.67	0.55
		Low-e	0.78	0.61	0.51
		Low-e+Argon	0.75	0.58	0.48
	Triple,	Clear	0.70	0.53	0.43
		Clear+ Argon	0.69	0.52	0.41
		Low-e	0.67	0.49	0.40
		Low-e+Argon	0.63	0.47	0.37
Garden Windows	Single		2.60	n.a.	2.31
	Double	Clear	1.81	n.a.	1.61
		Clear+ Argon	1.76	n.a.	1.56
		Low-e	1.73	n.a.	1.54
		Low-e+Argon	1.64	n.a.	1.47

- 1 <1/2"= a minimum dead air space of less than 0.5 inches between the panes of glass.
 ≥ 1/2"= a minimum dead air space of 0.5 inches or greater between the panes of glass.
 Where no gap width is listed, the minimum gap width is 1/4".
- 2 Any low-e (emissivity) coating (0.1, 0.2 or 0.4).
- 3 U-factors listed for argon shall consist of sealed, gas-filled insulated units for argon, CO₂, SF₆, argon/SF₆ mixtures and Krypton.
- 4 "Glass block" assemblies may use a U-factor of 0.51.
- 5 Insulated fiberglass framed products shall use wood/vinyl U-factors.
- 6 Aluminum clad wood windows shall use the U-factors listed for wood/vinyl windows.
- 7 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/ft²/°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.

TABLE 10-6B¹
Group R Occupancy: SMALL BUSINESS COMPLIANCE TABLE FOR VERTICAL GLAZING

DESCRIPTION ^{2,3,4,6}	FRAME TYPE ^{7,8}			
	ALUMINUM	ALUM. THERMAL BREAK ⁹	WOOD/VINYL	ALUM. CLAD WOOD/REINFORCED VINYL ¹⁰
Double, Clear 1/4"	0.82	0.66	0.56	0.59
Double, Clear 1/4"+ argon	0.77	0.63	0.53	0.56
Double, Low-e4 1/4"	0.76	0.61	0.52	0.54
Double, Low-e2 1/4"	0.73	0.58	0.49	0.51
Double, Low-e1 1/4"	0.70	0.55	0.47	0.49
Double, Low-e4 1/4"+ argon	0.70	0.55	0.47	0.49
Double, Low-e2 1/4"+ argon	0.66	0.52	0.43	0.46
Double, Low-e1 1/4"+ argon	0.64	0.50	0.41	0.43
Double, Clear 3/8"	0.78	0.63	0.54	0.57
Double, Clear 3/8"+ argon	0.75	0.60	0.51	0.54
Double, Low-e4 3/8"	0.72	0.57	0.48	0.51
Double, Low-e2 3/8"	0.69	0.54	0.45	0.48
Double, Low-e1 3/8"	0.66	0.51	0.43	0.46
Double, Low-e4 3/8"+ argon	0.68	0.53	0.44	0.47
Double, Low-e2 3/8"+ argon	0.63	0.49	0.41	0.44
Double, Low-e1 3/8"+ argon	0.61	0.47	0.39	0.41

TABLE 10-6B¹
Group R Occupancy: SMALL BUSINESS COMPLIANCE TABLE FOR VERTICAL GLAZING

DESCRIPTION ^{2,3,4,6}	FRAME TYPE ^{7,8}			
	ALUMINUM	ALUM. THERMAL BREAK ⁹	WOOD/VINYL	ALUM. CLAD WOOD/REINFORCED VINYL ¹⁰
Double, Clear 1/2"	0.75	0.60	0.50	0.54
Double, Clear 1/2"+ argon	0.72	0.58	0.48	0.51
Double, Low-e4 1/2"	0.68	0.53	0.44	0.47
Double, Low-e2 1/2"	0.64	0.50	0.40	0.44
Double, Low-e1 1/2"	0.61	0.47	0.35	0.42
Double, Low-e4 1/2"+ argon	0.65	0.50	0.42	0.44
Double, Low-e2 1/2"+ argon	0.60	0.46	0.37	0.40
Double, Low-e1 1/2"+ argon	0.58	0.43	0.35	0.38
Triple, Clear 1/4"	0.66	0.52	0.42	0.44
Triple, Clear 1/4"+ argon	0.63	0.49	0.39	0.42
Triple, Low-e4 1/4"	0.64	0.50	0.40	0.40
Triple, Low-e2 1/4"	0.62	0.48	0.39	0.41
Triple, Low-e1 1/4"	0.61	0.47	0.38	0.40
Triple, Low-e4 1/4"+ argon	0.60	0.46	0.37	0.39
Triple, Low-e2 1/4"+ argon	0.58	0.43	0.34	0.37
Triple, Low-e1 1/4" + argon	0.57	0.42	0.34	0.36
Triple, Clear 1/2"	0.61	0.46	0.37	0.40
Triple, Clear 1/2"+ argon	0.59	0.45	0.36	0.38
Triple, Low-e4 1/2"	0.58	0.43	0.35	0.37
Triple, Low-e2 1/2"	0.55	0.41	0.32	0.35
Triple, Low-e1 1/2"	0.54	0.39	0.31	0.33
Triple, Low-e4 1/2"+ argon	0.55	0.41	0.32	0.35
Triple, Low-e2 1/2"+ argon	0.52	0.38	0.30	0.32
Triple, Low-e1 1/2"+ argon	0.51	0.37	0.29	0.31

Footnotes to Table 10-6B

- 1 Subtract 0.02 from the listed default U-factor for non-aluminum spacer. Acceptable spacer materials may include but is not limited to fiberglass, wood and butyl or other material with an equivalent thermal performance.
- 2 1/4"= a minimum dead air space of 0.25 inches between the panes of glass.
3/8"= a minimum dead air space of 0.375 inches between the panes of glass.
1/2"= a minimum dead air space of 0.5 inches between the panes of glass.
Product with air spaces different than those listed above shall use the value for the next smaller air space; i.e. 3/4 inch= 1/2 inch U-factors, 7/16 inch= 3/8 inch U-factors, 5/16 inch= 1/4 inch U-factors.
- 3 Low-e4 (emissivity) shall be 0.4 or less.
Low-e2 (emissivity) shall be 0.2 or less.
Low-e1 (emissivity) shall be 0.1 or less.
- 4 U-factors listed for argon shall consist of sealed, gas-filled insulated units for argon, CO2, SF6, and argon/SF6 mixtures. The following conversion factor shall apply to Krypton gas-filled units: 1/4" or greater with krypton is equivalent to 1/2" argon.
- 5 Reserved.
- 6 "Glass block" assemblies may use a U-factor of 0.51.
- 7 Insulated fiberglass framed products shall use wood/vinyl U-factors.
- 8 Subtract 0.02 from the listed default values for solariums.
- 9 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/ft²/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.
- 10 Aluminum clad wood windows shall use the U-factors listed for Aluminum Clad Wood/Reinforced Vinyl windows. Vinyl clad wood window shall use the U-factors listed for Wood/Vinyl windows. Any vinyl frame window with metal reinforcement in more than one rail shall use the U-factors listed for Aluminum Clad Wood/Reinforced Vinyl window.

TABLE 10-6C
Group R Occupancy: DEFAULT U-FACTORS FOR DOORS

Door Type	No Glazing	Single Glazing	Double Glazing with 1/4 in. Airspace	Double Glazing with 1/2 in. Airspace	Double Glazing with e=0.10, 1/2 in. Argon
SWINGING DOORS (Rough opening - 38 in. x 82 in.)					
<i>Slab Doors</i>					
Wood slab in wood frame ^a	0.46				
6% glazing (22 in. x 8 in. lite)	-	0.48	0.47	0.46	0.44
25% glazing (22 in. x 36 in. lite)	-	0.58	0.48	0.46	0.42
45% glazing (22 in. x 64 in. lite)	-	0.69	0.49	0.46	0.39
More than 50% glazing		Use Table 10-6A			
Insulated steel slab with wood edge in wood frame ^a	0.16				
6% glazing (22 in. x 8 in. lite)	-	0.21	0.20	0.19	0.18
25% glazing (22 in. x 36 in. lite)	-	0.39	0.28	0.26	0.23
45% glazing (22 in. x 64 in. lite)	-	0.58	0.38	0.35	0.26
More than 50% glazing		Use Table 10-6A			
Foam insulated steel slab with metal edge in steel frame ^b	0.37				
6% glazing (22 in. x 8 in. lite)	-	0.44	0.42	0.41	0.39
25% glazing (22 in. x 36 in. lite)	-	0.55	0.50	0.48	0.44
45% glazing (22 in. x 64 in. lite)	-	0.71	0.59	0.56	0.48
More than 50% glazing		Use Table 10-6A			
Cardboard honeycomb slab with metal edge in steel frame ^b	0.61				
<i>Style and Rail Doors</i>					
Sliding glass doors/French doors		Use Table 10-6A			
<i>Site-Assembled Style and Rail Doors</i>					
Aluminum in aluminum frame	-	1.32	0.99	0.93	0.79
Aluminum in aluminum frame with thermal break	-	1.13	0.80	0.74	0.63
REVOLVING DOORS (Rough opening - 82 in. x 84 in.)					
Aluminum in aluminum frame					
Open	-	1.32	-	-	-
Closed	-	0.65	-	-	-
SECTIONAL OVERHEAD DOORS (Nominal - 10 ft x 10 ft)					
Uninsulated steel (nominal U =1.15) ^c	1.15	-	-	-	-
Insulated steel (nominal U =0.11) ^c	0.24	-	-	-	-
Insulated steel with thermal break (nominal U = 0.08) ^c	0.13	-	-	-	-

a. Thermally broken sill (add 0.03 for nonthermally broken sill)

b. Nonthermally broken sill

c. Nominal U-factors are through the center of the insulated panel before consideration of thermal bridges around the edges of the door sections and due to the frame.

TABLE 10-6D
Group R Occupancy: DEFAULT U-FACTORS FOR GLAZED DOORS
 See Table 10-6C

TABLE 10-6E
Group R Occupancy: DEFAULT U-FACTORS FOR OVERHEAD GLAZING

Glazing 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

TABLE 10-6E
Group R Occupancy: DEFAULT U-FACTORS FOR OVERHEAD GLAZING

Glazing 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
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

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 9 to Table 10-6B.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 02-01-112, § 51-11-1006, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-1006, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1006, filed 1/8/98, effective 7/1/98. Statutory Authority: Chapters 19.27, 19.27A and 34.05 RCW. 94-05-059, § 51-11-1006, filed 2/10/94, effective 4/1/94. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-1006, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1007 Section 1007 Ceilings.

1007.1 General: Table 10-7 lists heat-loss coefficients for the opaque portion of exterior ceilings below vented attics, vaulted ceilings, and roof decks in units of Btu/h·ft²·°F of ceiling.

They are derived from procedures listed in Standard RS-27, listed in Chapter 7. Ceiling U-factors are modified for the buffering effect of the attic, assuming an indoor temperature of 65° F and an outdoor temperature of 45°F.

Metal Framed Ceilings: The nominal R-values in Table 10-5A - EFFECTIVE R-VALUES FOR METAL FRAMING AND CAVITY ONLY may be used for purposes of calculating metal framed ceiling section U-factors in lieu of the ASHRAE zone calculation method as provided in Chapter 24 of Standard RS-27.

1007.2 Component Description: The four types of ceilings are characterized as follows:

Ceilings Below a Vented Attic: Attic insulation is assumed to be blown-in, loose-fill fiberglass with a K-value of 2.6 hr·ft²·°F/Btu per inch. Full bag count for specified R-value is assumed in all cases. Ceiling dimensions for flat ceiling calculations are forty-five by thirty feet, with a gabled roof having a 4/12 pitch. The attic is assumed to vent naturally at the rate of three air changes per hour through soffit and ridge vents. A void fraction of 0.002 is assumed for all attics with insulation baffles. Standard-framed, unbaffled attics assume a void fraction of 0.008.

Attic framing is either standard or advanced. Standard framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation. Advanced framing assumes full and even depth of insulation extending to the

outside edge of exterior walls. Advanced framing does not change from the default value.

U-factors for flat ceilings below vented attics with standard framing may be modified with the following table:

Roof Pitch	U-Factor for Standard Framing	
	R-30	R-38
4/12	.036	.031
5/12	.035	.030
6/12	.034	.029
7/12	.034	.029
8/12	.034	.028
9/12	.034	.028
10/12	.033	.028
11/12	.033	.027
12/12	.033	.027

Vented scissors truss attics assume a ceiling pitch of 2/12 with a roof pitch of either 4/12 or 5/12. Unbaffled standard framed scissors truss attics are assumed to have a void fraction of 0.016.

Vaulted Ceilings: Insulation is assumed to be fiberglass batts installed in roof joist cavities. In the vented case, at least 1.5-inches between the top of the batts and the underside of the roof sheathing is left open for ventilation in each cavity. A ventilation rate of 3.0 air changes per hour is assumed. In the unvented or dense pack case, the ceiling cavity is assumed to be fully packed with insulation, leaving no space for ventilation.

Roof Decks: Rigid insulation is applied to the top of roof decking with no space left for ventilation. Roofing materials are attached directly on top of the insulation. Framing members are often left exposed on the interior side.

Metal Truss Framing: Overall system tested values for the roof/ceiling U_o for metal framed truss assemblies from approved laboratories shall be used, when such data is acceptable to the building official.

Alternatively, the U_o for roof/ceiling assemblies using metal truss framing may be obtained from Tables 10-7A, 10-7B, 10-7C, 10-7D and 10-7E.

TABLE 10-7
DEFAULT U-FACTORS FOR CEILINGS

Ceilings Below Vented Attics

			Standard Frame	Advanced Frame
Flat Ceiling			Baffled	
R-19			0.049	0.047
R-30			0.036	0.032
R-38			0.031	0.026
R-49			0.027	0.020
R-60			0.025	0.017
Scissors Truss				
R-30 (4/12 roof pitch)			0.043	0.031
R-38 (4/12 roof pitch)			0.040	0.025
R-49 (4/12 roof pitch)			0.038	0.020
R-30 (5/12 roof pitch)			0.039	0.032
R-38 (5/12 roof pitch)			0.035	0.026
R-49 (5/12 roof pitch)			0.032	0.020
Vaulted Ceilings				
			16" O.C.	24" O.C.
Vented				
R-19 2x10 joist			0.049	0.048
R-30 2x12 joist			0.034	0.033
R-38 2x14 joist			0.027	0.027
Unvented				
R-30 2x10 joist			0.034	0.033
R-38 2x12 joist			0.029	0.027
R-21 + R-21 2x12 joist			0.026	0.025
Roof Deck				
			4x Beams, 48" O.C.	
R-12.5	2"	Rigid insulation	0.064	
R-21.9	3.5"	Rigid insulation	0.040	
R-37.5	6"	Rigid insulation	0.025	
R-50	8"	Rigid insulation	0.019	

Table 10-7A Steel Truss ¹ Framed Ceiling U _O													
Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.1075	0.0991	0.0928	0.0878	0.0839	0.0807	0.0780	0.0757	0.0737	0.0720	0.0706	0.0693	0.0681
30	0.0907	0.0823	0.0760	0.0710	0.0671	0.0638	0.0612	0.0589	0.0569	0.0552	0.0538	0.0525	0.0513
38	0.0844	0.0759	0.0696	0.0647	0.0607	0.0575	0.0548	0.0525	0.0506	0.0489	0.0474	0.0461	0.0449
49	0.0789	0.0704	0.0641	0.0592	0.0552	0.0520	0.0493	0.0470	0.0451	0.0434	0.0419	0.0406	0.0395

Table 10-7B Steel Truss ¹ Framed Ceiling U _O with R-3 Sheathing ²													
Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0809	0.0763	0.0728	0.0701	0.0679	0.0661	0.0647	0.0634	0.0623	0.0614	0.0606	0.0599	0.0592
30	0.0641	0.0595	0.0560	0.0533	0.0511	0.0493	0.0478	0.0466	0.0455	0.0446	0.0438	0.0431	0.0424
38	0.0577	0.0531	0.0496	0.0469	0.0447	0.0430	0.0415	0.0402	0.0392	0.0382	0.0374	0.0367	0.0361
49	0.0523	0.0476	0.0441	0.0414	0.0393	0.0375	0.0360	0.0348	0.0337	0.0328	0.0319	0.0312	0.0306

Table 10-7C Steel Truss ¹ Framed Ceiling U _O with R-5 Sheathing ²													
Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0732	0.0697	0.0670	0.0649	0.0633	0.0619	0.0608	0.0598	0.0590	0.0583	0.0577	0.0571	0.0567
30	0.0564	0.0529	0.0502	0.0481	0.0465	0.0451	0.0440	0.0430	0.0422	0.0415	0.0409	0.0403	0.0399
38	0.0501	0.0465	0.0438	0.0418	0.0401	0.0388	0.0376	0.0367	0.0359	0.0351	0.0345	0.0340	0.0335
49	0.0446	0.0410	0.0384	0.0363	0.0346	0.0333	0.0322	0.0312	0.0304	0.0297	0.0291	0.0285	0.0280

Table 10-7D Steel Truss ¹ Framed Ceiling U _O with R-10 Sheathing ²													
Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0626	0.0606	0.0590	0.0578	0.0569	0.0561	0.0555	0.0549	0.0545	0.0541	0.0537	0.0534	0.0531
30	0.0458	0.0437	0.0422	0.0410	0.0401	0.0393	0.0387	0.0381	0.0377	0.0373	0.0369	0.0366	0.0363
38	0.0394	0.0374	0.0359	0.0347	0.0337	0.0330	0.0323	0.0318	0.0313	0.0309	0.0305	0.0302	0.0299
49	0.0339	0.0319	0.0304	0.0292	0.0283	0.0275	0.0268	0.0263	0.0258	0.0254	0.0251	0.0247	0.0245

Table 10-7E Steel Truss ¹ Framed Ceiling U _O with R-15 Sheathing ²													
Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0561	0.0550	0.0541	0.0535	0.0530	0.0526	0.0522	0.0519	0.0517	0.0515	0.0513	0.0511	0.0509
30	0.0393	0.0382	0.0373	0.0367	0.0362	0.0358	0.0354	0.0351	0.0349	0.0347	0.0345	0.0343	0.0341
38	0.0329	0.0318	0.0310	0.0303	0.0298	0.0294	0.0291	0.0288	0.0285	0.0283	0.0281	0.0279	0.0278
49	0.0274	0.0263	0.0255	0.0249	0.0244	0.0239	0.0236	0.0233	0.0230	0.0228	0.0226	0.0225	0.0223

1 - Assembly values based on 24 inch on center truss spacing; 11 Truss member connections penetrating insulation (4 at the eaves, 7 in the interior space); 1/2 inch drywall ceiling; all truss members are 2x4 "C" channels with a solid web.

2 - Ceiling sheathing installed between bottom chord and drywall.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1007, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1007, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2, 91-01-112, § 51-11-1007, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1008 Section 1008 Air infiltration.

1008.1 General: Tables 10-8 and 10-8A list effective air change rates and heat capacities for heat loss due to infiltration for Group R Occupancy.

Estimated seasonal average infiltration rate in air changes per hour (ACH) is given for standard air-leakage control (see section 502.4 of this code for air leakage requirements for Group R Occupancy). The effective air-change rate shall be used in calculations for compliance under either the Component Performance or Systems Analysis approaches.

Heat loss due to infiltration shall be computed using the following equation:

$$Q_{\text{infil}} = \text{ACH}_{\text{eff}} * \text{HCP}$$

where: Q_{infil} = Heat loss due to air infiltration

ACH_{eff} = the effective air infiltration rate in Table 10-8

HCP = the Heat Capacity Density Product for the appropriate elevation or climate zone as given below.

TABLE 10-8
ASSUMED EFFECTIVE AIR CHANGES
PER HOUR

Air-Leakage Control Package	Air Changes per Hour	
	Natural	Effective
Standard	0.35	0.35

TABLE 10-8A
DEFAULT HEAT CAPACITY/DENSITY PRODUCT FOR AIR

Zone	Average Elevation	Heat Capacity/Density
1	Mean Sea Level	0.0180 Btu/h·°F
2	2000	0.0168 Btu/h·°F
3	3000	0.0162 Btu/h·°F

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1008, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1008, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-1008, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1009 Section 1009 Mass.

1009.1 General: Tables 10-9 and 10-10 list default mass values for concrete masonry construction. Calculations are based on standard ASHRAE values for heat-storage capacity as listed in Standard RS-27, Chapter 24.

Thermal capacity of furniture is ignored, as is heat storage beyond the first four inches of mass thickness. All mass is assumed to be in direct contact with the conditioned space. Concrete separated from the heated volume by other materials must multiply the listed concrete mass value by the result of the following formula:

$$\text{Ln(R-value)} \times (-.221) + 0.5$$

Where:

Ln= Natural log

R-value= R-value of material covering concrete

Note: All default values for covered concrete slabs have been adjusted according to this procedure.

1009.2 Mass Description: Mass is divided into two types: Structural and additional.

Structural Mass: Includes heat-storage capacity of all standard building components of a typical residential structure, including floors, ceilings, and interior and exterior walls in Btu/ft²•°F of floor area. It also assumes exterior wall, inte-

rior wall and ceiling surface area approximately equals three times the floor area.

Additional Mass: Includes any additional building material not part of the normal structure, which is added specifically to increase the building's thermal-storage capability. This category includes masonry fireplaces, water or trombe walls, and extra layers of sheetrock. Coefficients are in Btu/ft²•°F of surface area of material exposed to conditioned space. The coefficient for water is Btu/°F•gallon.

1009.3 Component Description: Light frame assumes one inch thick wood flooring with five-eighths inch sheetrock on ceilings and interior walls, and walls consisting of either five-eighths inch sheetrock or solid logs. Slab assumes a four-inch concrete slab on or below grade, with five-eighths inch sheetrock on exterior and interior walls and ceiling, and with separate values for interior or exterior wall insulation. Adjustments for slab covering is based on R-value of material. Additional mass values are based on the density multiplied by the specific heat of the material adjusted for listed thickness.

TABLE 10-9
HEAT CAPACITY

	Partial Grout	Solid Grout
8" CMU	9.65	15.0
12" CMU	14.5	23.6
8" Brick	10.9	16.4
6" Concrete	NA	14.4

TABLE 10-10
DEFAULT MASS VALUES

Structural Mass M-value	Btu/ft ² •°F floor area
Light Frame:	
Joisted/post & beam floor, sheetrock walls and ceilings	3.0
Joisted/post & beam floor, log walls, sheetrock ceilings	4.0
Slab With Interior Wall Insulation:	
Slab, no covering or tile, sheetrock walls and ceilings	10.0
Slab, hardwood floor covering, sheetrock walls and ceilings	7.0
Slab, carpet and pad, sheetrock walls and ceilings	5.0
Slab With Exterior Wall Insulation:	
Slab, no covering or tile, sheetrock walls and ceilings	12.0
Slab, hardwood floor covering, sheetrock walls and ceilings	9.0
Slab, carpet and pad, sheetrock walls and ceilings	7.0
Additional Mass M-Value:	Btu/ft ² •°F surface area
Gypsum wallboard, 1/2 inch thickness	0.54
Gypsum wallboard, 5/8 inch thickness	0.68
Hardwood floor	1.40
Concrete/Brick, 4 inch-thickness	10.30
Concrete/Brick, 6 inch-thickness	15.40
	Btu/°F•gallon
Water, 1 gallon	8.0

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1009, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1009, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.020 and 1990 c 2. 91-01-112, § 51-11-1009, filed 12/19/90, effective 7/1/91.]

WAC 51-11-1132 Alterations and repairs. Alterations and repairs to buildings or portions thereof originally constructed subject to the requirements of this Code shall conform to the provisions of this Code without the use of the exception in Section 1130. Other alterations and repairs may be made to existing buildings and moved buildings without making the entire building comply with all of the requirements of this Code for new buildings, provided the following requirements are met:

1132.1 Building Envelope: Alterations or repairs shall comply with nominal R-values and glazing requirements in Table 13-1 or 13-2.

EXCEPTIONS:

1. Storm windows installed over existing glazing.
2. Glass replaced in existing sash and frame provided that glazing is of equal or lower U-factor.
3. For solar heat gain coefficient compliance, glazing with a solar heat gain coefficient equal to or lower than that of the other existing glazing.
4. Existing roof/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 Sections 1311 and 1313.
5. Existing walls and floors without framing cavities, provided that any new cavities added to existing walls and floors comply with Exception 4.
6. Existing roofs where the roof membrane is being replaced and
 - a. The roof sheathing or roof insulation is not exposed; or
 - b. If there is existing roof insulation below the deck.
 In no case shall the energy efficiency of the building be decreased.

1132.2 Building Mechanical Systems: Those parts of systems which are altered or replaced shall comply with Chapter 14 of this Code.

1132.3 Lighting and Motors: Tenant improvements, alterations or repairs where 60 percent or more of the fixtures in a use (as defined in Table 15-1) within a tenant space or in an entire floor (whichever is smaller) are new shall comply with Sections 1531 and 1532. Where less than 60 percent of the fixtures are new, the installed lighting wattage shall be maintained or reduced. Where 60 percent or more of the lighting fixtures in a suspended ceiling are new, and the existing insulation is on the suspended ceiling, the roof/ceiling assembly shall be insulated according to the provisions of Chapter 13 Section 1311.2.

Where new wiring is being installed to serve added fixtures and/or fixtures are being relocated to a new circuit, controls shall comply with Sections 1513.1 through 1513.5. 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, controls shall comply with Section 1513.6.

Those motors which are altered or replaced shall comply with Section 1511.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1132, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1132, filed 1/8/98,

effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1132, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1201 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-1210 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-1312 Glazing and doors.

1312.1 Standard Procedure for Determination of Glazing and Door U-Factors: U-Factors for glazing and doors shall be determined, certified and labeled in accordance with Standard RS-31 by a certified independent agency licensed by the National Fenestration Rating Council (NFRC). Compliance shall be based on the Residential or the Nonresidential Model Size. Product samples used for U-factor determinations shall be production line units or representative of units as purchased by the consumer or contractor. Unlabeled glazing and doors shall be assigned the default U-factor in Table 10-6.

1312.2 Solar Heat Gain Coefficient and Shading Coefficient: Solar Heat Gain Coefficient (SHGC), shall be determined, certified and labelled in accordance with the National Fenestration Rating Council (NFRC) Standard by a certified, independent agency, licensed by the NFRC.

EXCEPTION:

Shading coefficients (SC) shall be an acceptable alternate for compliance with solar heat gain coefficient requirements. Shading coefficients for glazing shall be taken from Chapter 29 of RS-27 or from the manufacturer's test data.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1312, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1312, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1312, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1313 Moisture control.

1313.1 Vapor Retarders: Vapor retarders shall be installed on the warm side (in winter) of insulation as required by this section.

EXCEPTION:

Vapor retarder installed with not more than 1/3 of the nominal R-value between it and the conditioned space.

1313.2 Roof/Ceiling Assemblies: Roof/ceiling assemblies where the ventilation space above the insulation is less than an average of twelve inches shall be provided with a vapor retarder. (For enclosed attics and enclosed rafter spaces see Section 1505.3 of the Washington State Building Code.) Roof/ceiling assemblies without a vented airspace, allowed only where neither the roof deck nor the roof structure are made of wood, shall provide a continuous vapor retarder with taped seams.

EXCEPTION:

Vapor retarders need not be provided where all of the insulation is installed between the roof membrane and the structural roof deck.

1313.3 Walls: Walls separating conditioned space from unconditioned space shall be provided with a vapor retarder.

1313.4 Floors: Floors separating conditioned space from unconditioned space shall be provided with a vapor retarder.

1313.5 Crawl Spaces: 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 twelve 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 three and one-half inches.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1313, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1313, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1322 Opaque envelope. Roof/ceilings, opaque exterior walls, opaque doors, floors over unconditioned space, below grade walls, slab on grade floors, and radiant floors enclosing conditioned spaces shall be insulated according to Section 1311 and Tables 13-1 or 13-2. Compliance with nominal R-values shall be demonstrated for the thermal resistance of the added insulation in framing cavities and/or insulated sheathing only. Nominal R-values shall not include the thermal transmittance of other building materials or air films.

For metal frame assemblies used in spaces with electric resistance space heat, compliance shall be demonstrated with the component U-factor for the overall assembly based on the assemblies in Chapter 10.

EXCEPTIONS:

1. Opaque smoke vents are not required to meet insulation requirements.
2. The perimeter edge of an above grade floor slab which penetrates the exterior wall may be left uninsulated provided that the wall insulation is increased by R-2 above that required in Tables 13-1 and 13-2.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1322, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1322, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1323 Glazing. Glazing shall comply with Section 1312 and Tables 13-1 or 13-2. All glazing shall be, at a minimum, double glazing.

EXCEPTIONS:

1. Vertical glazing located on the display side of the street level story of a retail occupancy provided the glazing
 - a. is double-glazed with a minimum 1/2 inch airspace and with a low-e coating having a maximum emittance of e-0.40 or has an area weighted U-factor of 0.60 or less. (When this exception is used, there are no SHGC requirements) and,
 - b. does not exceed 75 percent of the gross exterior wall area of the display side of the street level story. However, if the display side of the street level story exceeds 20 feet in height, then this exception may only be used for the first 20 feet of that story.
 When this exception is utilized, 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. The 75 percent area may be exceeded on the street level, if the additional glass area is provided from allowances from other areas of the building.
2. Single glazing for ornamental, security, or architectural purposes shall be included in the percentage of the total glazing area, U-factor calculation and SHGC as allowed in the Tables 13-1 or 13-2. The maximum area allowed for the total of all single glazing is one percent of the gross exterior wall floor area.

not be greater than the appropriate value from Tables 13-1 or 13-2 for the vertical glazing U-factor, overhead glazing U-factor and solar heat gain coefficient selected.

1323.2 U-Factor: The area-weighted average U-factor of vertical glazing shall not be greater than that specified in Tables 13-1 or 13-2 for the appropriate area and solar heat gain coefficient. The area-weighted average U-factor of overhead glazing shall not be greater than that specified in Tables 13-1 or 13-2 for the appropriate area and solar heat gain coefficient. U-factors for glazing shall be determined in accordance with Section 1312.

1323.3 Solar Heat Gain Coefficient: The area-weighted average solar heat gain coefficient of all glazing shall not be greater than that specified in Tables 13-1 or 13-2 for the appropriate area and U-factor.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1323, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1323, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1323, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1331 General. Buildings or structures whose design heat loss rate (UA_p) and solar heat gain coefficient rate ($SHGC \cdot A_p$) are less than or equal to the target heat loss rate (UA_t) and solar heat gain coefficient rate ($SHGC \cdot A_t$) shall be considered in compliance with this section. The stated U-factor, F-factor or allowable area of any component assembly, listed in Tables 13-1 or 13-2, such as roof/ceiling, opaque wall, opaque door, glazing, floor over conditioned space, slab on grade floor, radiant floor or opaque floor may be increased and the U-factor or F-factor for other components decreased, provided that the total heat gain or loss for the entire building envelope does not exceed the total resulting from compliance to the U-factors, F-factors or allowable areas specified in this section.

EXCEPTION: For buildings or structures utilizing the other space heat type (including heat pumps and VAV) compliance path, for the gross opaque wall, opaque door and glazing (vertical and overhead) area only, compliance may also be shown using the ENVSTD diskette version 2.1 of ASHRAE/IESNA Standard 90.1-1989, or an approved alternative, with the following additional requirements:

1. Only the Exterior Wall Requirements portion of the ENVSTD computer program may be used under this exception.
2. Overhead glazing shall be added to vertical glazing, and shall be input as 1/4 north, 1/4 east, 1/4 south and 1/4 west facing.
3. Lighting loads shall be determined according to Table 15-1.
4. Equipment loads shall be determined from Table 3-1 of Standard RS-29.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1331, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1331, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1331, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1334 Solar heat gain coefficient rate calculations. Solar heat gain coefficient shall comply with Section 1323.3. The target $SHGCA_t$ and the proposed $SHGCA_p$ shall be calculated using Equation 13-3 and 13-4 and the corresponding areas and SHGCs from Table 13-1 or 13-2.

1323.1 Area: The percentage of total glazing (vertical and overhead) area relative to the gross exterior wall area shall

Equation 13-1:

Target $UA_{[t]}$

UA_t	=	$U_{rat}A_{rat} + U_{ograt}A_{ograt} + U_{ort}A_{ort} + U_{ogort}A_{ogort} + U_{wt}A_{wt} + U_{vgt}A_{vgt} + U_{dt}A_{dt} + U_{ft}A_{ft} + F_{st}P_{st} + U_{bgwt}A_{bgwt}$
UA_t	=	The target combined specific heat transfer of the gross roof/ceiling assembly, exterior wall and floor area.
Where:		
U_{rat}	=	The thermal transmittance value for roofs over attics found in Table 13-1 or 13-2.
U_{ograt}	=	The thermal transmittance for overhead glazing found in Table 13-1 or 13-2 which corresponds to the proposed total glazing area as a percent of gross exterior wall area.
U_{ort}	=	The thermal transmittance value for other roofs found in Table 13-1 or 13-2.
U_{ogort}	=	The thermal transmittance for overhead glazing found in Table 13-1 or 13-2 which corresponds to the proposed total glazing area as a percent of gross exterior wall area.
U_{wt}	=	The thermal transmittance value for opaque walls found in Table 13-1 or 13-2.
U_{vgt}	=	The thermal transmittance value for vertical glazing found in Table 13-1 or 13-2 which corresponds to the proposed total glazing area as a percent of gross exterior wall area.
U_{dt}	=	The thermal transmittance value for opaque doors found in Table 13-1 or 13-2.
U_{ft}	=	The thermal transmittance value for floors over unconditioned space found in Table 13-1 or 13-2.
F_{st}	=	The F-factor for slab-on-grade and radiant slab floors found in Table 13-1 or 13-2.
U_{bgwt}	=	The thermal transmittance value for opaque walls found in Table 13-1 or 13-2.
A_{dt}	=	The proposed opaque door area, A_d .
A_{ft}	=	The proposed floor over unconditioned space area, A_f .
P_{st}	=	The proposed linear feet of slab-on-grade and radiant slab floor perimeter, P_s .
A_{bgwt}	=	The proposed below grade wall area, A_{bgw} .
and;		
if the total amount of glazing area as a percent of gross exterior wall area does not exceed the maximum allowed in Table 13-1 or 13-2:		
A_{rat}	=	The proposed roof over attic area, A_{ra} .
A_{ograt}	=	The proposed overhead glazing area in roofs over attics, A_{ogra} .
A_{ort}	=	The proposed other roof area, A_{or} .
A_{ogort}	=	The proposed overhead glazing area in other roofs, A_{ogor} .
A_{wt}	=	The proposed opaque above grade wall area, A_w .
A_{vgt}	=	The proposed vertical glazing area, A_{vg} .
or;		
if the total amount of glazing area as a percent of gross exterior wall area exceeds the maximum allowed in Table 13-1 or 13-2:		
A_{rat}	=	The greater of: the proposed roof over attic area, and the gross roof over attic area minus A_{ograt} .
A_{ograt}	=	The lesser of: proposed overhead glazing area in roofs over attics, and the maximum allowed glazing area from Table 13-1 or 13-2.
A_{ort}	=	The greater of: the proposed other roof area, and the gross other roof area minus A_{ogort} .
A_{ogort}	=	The lesser of: the proposed overhead glazing area in other roofs, and the maximum allowed glazing area from Table 13-1 or 13-2 minus A_{ograt} .
A_{wt}	=	The greater of: proposed opaque above grade wall area, and the gross exterior above grade wall area minus A_{dt} minus A_{vgt} .
A_{vgt}	=	The lesser of: the proposed vertical glazing area, and the maximum allowed glazing area from Table 13-1 or 13-2 minus A_{ograt} minus A_{ogort} .

EQUATION 13-2**Proposed UA_p**

$$UA_p = U_{ra}A_{ra} + U_{or}A_{or} + U_{og}A_{og} + U_wA_w + U_dA_d + U_{vg}A_{vg} + U_fA_f + F_sP_s + U_{bgw}A_{bgw}$$

Where:

UA_p	=	The combined proposed specific heat transfer of the gross exterior wall, floor and roof/ceiling assembly area.
U_{ra}	=	The thermal transmittance of the roof over attic area.
A_{ra}	=	Opaque roof over attic area.
U_{or}	=	The thermal transmittance of the other roof area.
A_{or}	=	Opaque other roof area.
U_{og}	=	The thermal transmittance for the overhead glazing
A_{og}	=	Overhead glazing area.
U_w	=	The thermal transmittance of the opaque wall area.
A_w	=	Opaque above grade wall area (not including opaque doors).
U_{vg}	=	The thermal transmittance of the vertical glazing area.
A_{vg}	=	Vertical glazing area.
U_d	=	The thermal transmittance value of the opaque door area.
A_d	=	Opaque door area.
U_f	=	The thermal transmittance of the floor over unconditioned space area.
A_f	=	Floor area over unconditioned space.
F_s	=	Slab-on-grade or radiant floor component F-factor.
P_s	=	Lineal feet of slab-on-grade or radiant floor perimeter.
U_{bgw}	=	The thermal transmittance value of the below grade wall area.
A_{bgw}	=	Below grade wall area as defined in Tables 13-1 or 13-2.

NOTE: Where more than one type of wall, window, roof/ceiling, door and skylight is used, the U and A terms for those items shall be expanded into sub-elements as:

$$U_{w1}A_{w1} + U_{w2}A_{w2} + U_{w3}A_{w3} + \dots \text{etc.}$$

EQUATION 13-3**Target $SHGCA_t$**

$$SHGCA_t = SHGC_t (A_{ograt} + A_{ogort} + A_{vgt})$$

Where:

$SHGCA_t$	=	The target combined specific heat gain of the target glazing area.
$SHGC_t$	=	The solar heat gain coefficient for glazing found in Table 13-1 or 13-2 which corresponds to the proposed total glazing area as a percent of gross exterior wall area, and
A_{ograt} , A_{ogort} , and A_{vgt} are defined under Equation 13-1.		

EQUATION 13-4**Proposed $SHGCA_p$**

$$SHGCA_p = SHGC_{og}A_{og} + SHGC_{vg}A_{vg}$$

Where:

$SHGCA_t$	=	The combined proposed specific heat gain of the proposed glazing area.
$SHGC_{og}$	=	The solar heat gain coefficient of the overhead glazing.
A_{og}	=	The overhead glazing area.
$SHGC_{vg}$	=	The solar heat gain coefficient of the vertical glazing.
A_{vg}	=	The vertical glazing area.

TABLE 13-1
BUILDING ENVELOPE REQUIREMENTS FOR CLIMATE ZONE 1
MINIMUM INSULATION R-VALUES OR
MAXIMUM COMPONENT U-FACTORS FOR ZONE 1

Building Components

Space Heat Type	Components					
	Roofs Over Attic	All Other Roofs	Opaque Walls ^{1,2}	Opaque Doors	Floor Over Uncond Space	Slab On Grade ⁵
1. Electric resistance heat**	R-38 or U=0.031	R-30 or U=0.034	R-19 or U=0.062	U=0.60	R-30 or U=0.029	R-10 or F=0.54
2. All others including Heat pumps and VAV	R-30 or U=0.036	R-21 or U=0.050	R-11 or U=0.14	U=0.60	R-19 or U=0.056	R-10 or F=0.54

** Compliance with nominal prescriptive R-values requires wood framing.

MAXIMUM GLAZING AREAS AND U-FACTORS AND
MAXIMUM GLAZING SOLAR HEAT GAIN COEFFICIENTS
FOR ZONE 1

Glazing

Maximum Glazing Area as % of Wall	0% to 15%			>15% to 20%			>20% to 30%			>30% to 40%		
	Maximum U-Factor		Max. SHGC ⁴	Maximum U-Factor		Max. SHGC ⁴	Maximum U-Factor		Max. SHGC ⁴	Maximum U-Factor		Max. SHGC ⁴
	VG	OG		VG	OG		VG	OG		VG	OG	
1. Electric resistance heat	0.40	0.80	1.0	0.40	0.80	1.0	PRESCRIPTIVE PATH NOT ALLOWED					
2. All others including Heat pumps and VAV	0.90	1.45	1.0	0.75	1.40	1.0	0.60	1.30	0.65	0.50	1.25	0.45

Footnotes**1. Below Grade Walls:**

When complying by the prescriptive approach, Section 1322:

- walls insulated on the interior shall use opaque wall values,
- walls insulated on the exterior shall use a minimum of R-10 insulation,
- those portions of below grade walls and footings that are more than 10 feet below grade, and not included in the gross exterior wall area, may be left uninsulated.

When complying by the component performance approach, Section 1331:

- walls insulated on the interior shall use the opaque wall values when determining U_{bgwt} ,
- walls insulated on the exterior shall use a target U-factor of $U=0.070$ for U_{bgwt} ,
- those portions of below grade walls and footings that are more than 10 feet below grade, and not included in the gross exterior wall area, need not be included when determining A_{bgwt} and A_{bgw} .

- Concrete Masonry Walls:** If the area weighted heat capacity of the total opaque above grade wall is a minimum of $9.0 \text{ Btu/ft}^2 \cdot ^\circ\text{F}$, then the U-factor may be increased to 0.19 for interior insulation and 0.25 for integral and exterior insulation for insulation position as defined in Chapter 2. Individual walls with heat capacities less than $9.0 \text{ Btu/ft}^2 \cdot ^\circ\text{F}$ and below grade walls shall meet opaque wall requirements listed above. Glazing shall comply with the following:

Maximum Glazing Area as % of Wall	0 to 10 %			>10 to 15 %			>15% to 20 %			>20% to 25 %		
	Maximum U-Factor		Max. SHGC ⁴	Maximum U-Factor		Max. SHGC ⁴	Maximum U-Factor		Max. SHGC ⁴	Maximum U-Factor		Max. SHGC ⁴
	VG	OG		VG	OG		VG	OG		VG	OG	
1. Electric resistance heat	0.40	0.80	1.0	0.40	0.80	1.0	0.40	0.80	1.0	NOT ALLOWED		
2. All others including Heat pumps and VAV	0.90	1.45	1.0	0.75	1.40	1.0	0.65	1.30	0.80	0.60	1.30	0.65

3. Reserved.

- SHGC (Solar Heat Gain Coefficient per Section 1312.2):** May substitute Maximum Shading Coefficient (SC) for SHGC (See Chapter 2 for definition of Shading Coefficient).

- Radiant Floors:** Where insulation is required under the entire slab, radiant floors shall use a minimum of R-10 insulation or $F=0.55$ maximum. Where insulation is not required under the entire slab, radiant floors shall use R-10 perimeter insulation according to Section 1311.6 or $F=0.78$ maximum.

**TABLE 13-2
BUILDING ENVELOPE REQUIREMENTS
FOR CLIMATE ZONE 2
MINIMUM INSULATION R-VALUES OR
MAXIMUM COMPONENT U-FACTORS FOR ZONE 2**

Building Components

Space Heat Type	Components					
	Roofs Over Attic	All Other Roofs	Opaque Walls ^{1,2}	Opaque Doors	Floor Over Uncond Space	Slab On Grade
1. Electric resistance heat**	R-38 or U=0.031	R-30 or U=0.034	R-24 or U=0.044	U=0.60	R-30 or U=0.029	R-10 or F=0.54
2. All others including Heat pumps and VAV	R-38 or U=0.031	R-25 or U=0.040	R-19 or U=0.11	U=0.60	R-21 or U=0.047	R-10 or F=0.54

** Compliance with nominal prescriptive R-values requires wood framing.

**MAXIMUM GLAZING AREAS AND U-FACTORS AND
MAXIMUM GLAZING SOLAR HEAT GAIN COEFFICIENTS
FOR ZONE 2**

Glazing

Maximum Glazing Area as % of Wall	0% to 15%		>15% to 20%		>20% to 25%		>25% to 30%	
	Maximum U-Factor		Maximum U-Factor		Maximum U-Factor		Maximum U-Factor	
	VG	OG	VG	OG	VG	OG	VG	OG
1. Electric resistance heat	0.40	0.80	1.0	0.40	0.80	1.0	PRESCRIPTIVE PATH NOT ALLOWED	
2. All others including Heat pumps and VAV	0.90	1.45	1.0	0.75	1.40	1.0	0.60	1.30

Footnotes**1. Below Grade Walls:**

When complying by the prescriptive approach, Section 1322:

- walls insulated on the interior shall use opaque wall values,
- walls insulated on the exterior shall use a minimum of R-12 insulation,
- those portions of below grade walls and footings that are more than 10 feet below grade, and not included in the gross exterior wall area, may be left uninsulated.

When complying by the component performance approach, Section 1331:

- walls insulated on the interior shall use the opaque wall values when determining U_{bgwt} ,
- walls insulated on the exterior shall use a target U-factor of $U=0.061$ for U_{bgwt} ,
- those portions of below grade walls and footings that are more than 10 feet below grade, and not included in the gross exterior wall area, need not be included when determining A_{bgwt} and A_{bgw} .

- Concrete Masonry Walls:** If the area weighted heat capacity of the total opaque above grade wall is a minimum of 9.0 Btu/ft² • °F, then the U-factor may be increased to 0.19 for interior insulation and 0.25 for integral and exterior insulation for insulation position as defined in Chapter 2. Individual walls with heat capacities less than 9.0 Btu/ft² • °F and below grade walls shall meet opaque wall requirements listed above. Glazing shall comply with the following:

Maximum Glazing Area as % of Wall	0 to 5 %		>5 to 7 %		>7% to 10 %		>10% to 15 %	
	Maximum U-Factor		Maximum U-Factor		Maximum U-Factor		Maximum U-Factor	
	VG	OG	VG	OG	VG	OG	VG	OG
1. Electric resistance heat	0.40	0.80	1.0	0.40	0.80	1.0	NOT ALLOWED	
2. All others including Heat pumps and VAV	0.90	1.45	1.0	0.60	1.30	0.70	0.50	1.25

3. Reserved.

- SHGC (Solar Heat Gain Coefficient per Section 1312.2):** May substitute Maximum Shading Coefficient (SC) for SHGC (See Chapter 2 for definition of Shading Coefficient).

- Radiant Floors:** Where insulation is required under the entire slab, radiant floors shall use a minimum of R-10 insulation or F=0.55 maximum. Where insulation is not required under the entire slab, radiant floors shall use R-10 perimeter insulation according to Section 1311.6 or F=0.78 maximum.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1334, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1334, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1334, filed 10/18/93, effective 4/1/94.]

Reviser's note: RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 51-11-1401 Scope. This section covers the determination of requirements, system and component performance, control requirements and duct construction.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 02-01-112, § 51-11-1401, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1401, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1410 General requirements. The building mechanical system shall comply with Sections 1411 through 1416, Sections 1440 through 1443 and Sections 1450 through 1454, and with one of the following paths:

- Simple Systems (Packaged Unitary Equipment) Sections 1420 through 1424.
- Complex Systems Sections 1430 through 1439.
- Systems Analysis. See Section 1141.4.

FIGURE 14A
Mechanical Systems Compliance Paths

Section Number	Subject	Simple Systems Path	Complex Systems Path	Systems Analysis Option
1410	General Requirements	X	X	X
1411	HVAC Equipment Performance Requirements	X	X	X
1412	Controls	X	X	X
1413	Air Economizers	X	X	X
1414	Ducting Systems	X	X	X
1415	Piping Systems	X	X	X
1416	Completion Requirements	X	X	X
1420	Simple Systems (Packaged Unitary Equipment)	X		
1421	System Type	X		
1422	Controls	X		
1423	Economizers	X		
1424	Separate Air Distribution Systems	X		
1430	Complex Systems		X	
1431	System Type		X	
1432	Controls		X	
1433	Economizers		X	
1434	Separate Air Distribution Systems		X	
1435	Simultaneous Heating and Cooling		X	
1436	Heat Recovery		X	
1437	Electric Motor Efficiency		X	
1438	Variable Flow Systems		X	
1439	Exhaust Hoods		X	
RS-29	Systems Analysis			X
1440	Service Water Heating	X	X	X
1441	Water Heater Installation	X	X	X
1442	Shut Off Controls	X	X	X
1443	Pipe Insulation	X	X	X
1450	Heated Pools	X	X	X
1451	General	X	X	X
1452	Pool Water Heaters	X	X	X
1453	Controls	X	X	X
1454	Pool Covers	X	X	X

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1410, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1410, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1411 HVAC equipment performance requirements.

1411.1 General: Equipment shall have a minimum performance at the specified rating conditions not less than the values shown in Tables 14-1A through 14-1G. If a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency rat-

ings, then the product shall be listed in the certification program.

Gas-fired and oil-fired forced air furnaces with input ratings $\geq 225,000$ Btu/h (65 kW) 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 $\geq 225,000$ Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75% of the input rating.

1411.2 Rating Conditions: Cooling equipment shall be rated at ARI test conditions and procedures when available. Where no applicable procedures exist, data shall be furnished by the equipment manufacturer.

1411.3 Combination Space and Service Water Heating: For combination space and service water heaters with a principal function of providing space heat, the Combined Annual Efficiency (CAE) may be calculated by using ASHRAE Standard 124-1991. Storage water heaters used in combination space heat and water heat applications shall have either an Energy Factor (EF) or a Combined Annual Efficiency (CAE) of not less than the following:

	Energy Factor (EF)	Combined Annual Efficiency (CAE)
< 50 gallon storage	0.58	0.71
50 to 70 gallon storage	0.57	0.71
> 70 gallon storage	0.55	0.70

1411.4 Packaged Electric Heating and Cooling Equipment: Packaged electric equipment providing both heating and cooling with a total cooling capacity greater than 20,000 Btu/h shall be a heat pump.

EXCEPTION: Unstaffed equipment shelters or cabinets used solely for personal wireless service facilities.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1411, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-1411, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1411, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1411, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1412 Controls.

1412.1 Temperature Controls: Each system shall be provided with at least one temperature control device. Each zone shall be controlled by individual thermostatic controls responding to temperature within the zone. At a minimum, each floor of a building shall be considered as a separate zone.

1412.2 Deadband Controls: When used to control both comfort heating and cooling, zone thermostatic controls shall be capable of a deadband of at least 5 degrees F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

EXCEPTIONS:

1. Special occupancy, special usage, or code requirements where deadband controls are not appropriate.
2. Buildings complying with Section 1141.4, if in the proposed building energy analysis, heating and cooling thermostat setpoints are set to the same temperature between 70 degrees F and 75 degrees F inclusive, and assumed to be constant throughout the year.
3. Thermostats that require manual changeover between heating and cooling modes.

1412.3 Humidity Controls: If a system is equipped with a means for adding moisture, a humidistat shall be provided.

1412.4 Setback and Shut-Off: HVAC systems shall be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of nonuse or alternate use of the spaces served by the system. The automatic controls shall have a minimum seven-day clock and be capable of being set for seven different day types per week.

EXCEPTIONS:

1. Systems serving areas which require continuous operation at the same temperature setpoint.
2. Equipment with full load demands of 2 Kw (6,826 Btu/h) or less may be controlled by readily accessible manual off-hour controls.

1412.4.1 Dampers: Outside air intakes, exhaust outlets and relief outlets serving conditioned spaces shall be equipped with motorized dampers which close automatically when the system is off or upon power failure.

EXCEPTIONS:

1. Systems serving areas which require continuous operation.
2. Combustion air intakes.
3. Gravity (nonmotorized) dampers are acceptable in buildings less than 3 stories in height.
4. Gravity (nonmotorized) dampers are acceptable in exhaust and relief outlets in the first story and levels below the first story of buildings three or more stories in height.

Dampers installed to comply with this section, including dampers integral to HVAC equipment, shall have a maximum leakage rate when tested in accordance with AMCA Standard 500 of:

(a) Motorized dampers: 10 cfm/ft² of damper area at 1.0 in w.g.

(b) Nonmotorized dampers: 20 cfm/ft² of damper area at 1.0 in w.g., except that for nonmotorized dampers smaller than 24 inches in either dimension: 40 cfm/ft² of damper area at 1.0 in w.g.

Drawings shall indicate compliance with this section.

1412.4.2 Optimum Start Controls: Heating and cooling systems with design supply air capacities exceeding 10,000 cfm shall have optimum start controls. Optimum start controls shall be designed to automatically adjust the start time of an HVAC system each day to bring the space to desired occupied temperature levels immediately before scheduled occupancy. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.

1412.5 Heat Pump Controls: 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).

1412.6 Combustion Heating Equipment Controls: Combustion heating equipment with a capacity over 225,000 Btu/h shall have modulating or staged combustion control.

EXCEPTIONS:

- Boilers.
- Radiant heaters.

1412.7 Balancing: Each air supply outlet or air or water terminal device shall have a means for balancing, including but not limited to, dampers, temperature and pressure test connections and balancing valves.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1412, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-1412, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1412, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1412, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1413 Economizers.

1413.1 Operation: Air economizers shall be capable of automatically modulating outside and return air dampers to provide 100 percent of the design supply air as outside air to reduce or eliminate the need for mechanical cooling. Air economizers shall be used for RS-29 analysis base case for all systems without exceptions in Sections 1413, 1423, or 1433. Water economizers shall be capable of providing the total concurrent cooling load served by the connected terminal equipment lacking airside economizer, at outside air temperatures of 45°F dry-bulb/40°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.

EXCEPTION: Water economizers using air-cooled heat rejection equipment may use a 35°F dry-bulb outside air temperature for this calculation. This exception is limited to a maximum of 20 tons per building.

1413.2 **Documentation:** Water economizer plans submitted for approval shall include the following information:

1. Maximum outside air conditions for which economizer is sized to provide full cooling.
2. Design cooling load to be provided by economizer at this outside air condition.
3. Heat rejection and terminal equipment performance data including model number, flow rate, capacity, entering and leaving temperature in full economizer cooling mode.

1413.3 Integrated Operation: The HVAC system and its controls shall allow economizer operation when mechanical cooling is required simultaneously. Air and water economizers shall be capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

EXCEPTIONS:

1. Individual, direct expansion units that have a rated capacity less than 65,000 Btu/h and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.
2. Water-cooled water chillers.

1413.4 **Humidification:** If an air economizer is required on a cooling system for which humidification equipment is to be provided to maintain minimum indoor humidity levels, then the humidifier shall be of the adiabatic type (direct evaporative media or fog atomization type) that cools return air while humidifying outside air while in economizer. If a water economizer or no economizer is provided, the isothermal type of humidifier may be used (steam injection, gas, electric resistance or infrared generator type that uses new energy to boil moisture to be added).

EXCEPTION: Health care facilities where WAC 246-320-525 allows only steam injection humidifiers in ductwork downstream of final filters.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1413, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1413, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1414 Ducting systems.

1414.1 Sealing: Duct work which is designed to operate at pressures above 1/2 inch water column static pressure shall

be sealed in accordance with Standard RS-18. Extent of sealing required is as follows:

1. Static pressure: 1/2 inch to 2 inches; seal transverse joints.
2. Static pressure: 2 inches to 3 inches; seal all transverse joints and longitudinal seams.
3. Static pressure: Above 3 inches; seal all transverse joints, longitudinal seams and duct wall penetrations.

Duct tape and other pressure sensitive tape shall not be used as the primary sealant where ducts are designed to operate at static pressures of 1 inch W.C. or greater.

1414.2 Insulation: Ducts and plenums that are constructed and function as part of the building envelope, by separating interior space from exterior space, shall meet all applicable requirements of Chapter 13. These requirements include insulation installation, moisture control, air leakage, and building envelope insulation levels. Unheated equipment rooms with combustion air louvers must be isolated from the conditioned space by insulating interior surfaces to a minimum of R-11 and any exterior envelope surfaces per Chapter 13. Outside air ducts serving individual supply air units with less than 2,800 cfm of total supply air capacity shall be insulated to a minimum of R-7 and are not considered building envelope. Other outside air duct runs are considered building envelope until they,

1. connect to the heating or cooling equipment, or
2. are isolated from the exterior with an automatic shut-off damper complying with Section 1412.4.1.

Once outside air ducts meet the above listed requirements, any runs within conditioned space shall comply with Table 14-5 requirements.

Other ducts and plenums shall be thermally insulated per Table 14-5.

EXCEPTIONS:

1. Within the HVAC equipment.
2. Exhaust air ducts not subject to condensation.
3. Exposed ductwork within a zone that serves that zone.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1414, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1414, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1414, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1415 Piping systems.

1415.1 Insulation: Piping shall be thermally insulated in accordance with Table 14-6.

EXCEPTION: Piping installed within unitary HVAC equipment.

Cold water pipes outside the conditioned space shall be insulated in accordance with the Washington State Plumbing Code (chapter 51-46 WAC).

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1415, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1415, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1416 Completion requirements.

1416.1 Drawings: Construction documents shall require that within 90 days after the date of system acceptance, record drawings of the actual installation be provided to the building

owner. Record drawings shall include as a minimum the location and performance data on each piece of equipment, general configuration of duct and pipe distribution system, including sizes, and the terminal air and water design flow rates.

1416.2 Manuals: Construction documents shall require an operating manual and maintenance manual be provided to the building owner. The manual shall be in accordance with industry accepted standards and shall include, at a minimum, the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Operation and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field determined set points shall be permanently recorded on control drawings at control devices, or, for digital control systems, in programming comments.

5. A complete narrative of how each system is intended to operate including suggested set points.

1416.3 System Balancing

1416.3.1 General: Construction documents shall require that all HVAC systems 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 10% of design rates, except variable flow distribution systems need not be balanced upstream of the controlling device (for example, VAV box or control valve). Construction documents shall require a written balance report be provided to the owner.

1416.3.2 Air System Balancing: Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

1416.3.3 Hydronic System Balancing: 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 ability to measure pressure across the pump, or test ports at each side of each pump.

EXCEPTIONS:

1. Pumps with pump motors of 10 hp or less.
2. When throttling results in no greater than 5% of the nameplate horsepower draw above that required if the impeller were trimmed.

1416.4 Systems Commissioning

1416.4.1 Simple Systems: For simple systems, as defined in Section 1421, and for warehouses and semi-heated spaces, HVAC control systems shall be tested to ensure that control

devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications. A complete report of test procedures and results shall be prepared and filed with the owner. Drawing notes shall require commissioning in accordance with this paragraph.

1416.4.2 Other Systems: All other HVAC control systems, and other automatically controlled systems for which energy consumption, performance, or mode of operation are regulated by this code, shall be tested to ensure that control devices, equipment and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications.

1416.4.2.1 Documentation: Drawing notes shall require commissioning in accordance with this section. Drawing notes may refer to specifications for further commissioning requirements. Plans and specifications shall require tests mandated by this section be performed and the results recorded. Plans and specifications shall require preparation of preliminary and final reports of test procedures and results as described in Section 1416.4.2.2. Plans and specifications shall identify the following for each test:

1. Equipment and systems to be tested, including the extent of sampling tests,
2. Functions to be tested (for example calibration, economizer control, etc.),
3. Conditions under which the test shall be performed (for example winter design conditions, full outside air, etc.),
4. Measurable criteria for acceptable performance.

1416.4.2.2 Commissioning Reports

1416.4.2.2.1 Preliminary Commissioning Report: A preliminary commissioning report of test procedures and results shall be prepared. The preliminary report shall identify:

1. Deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

1416.4.2.2.2 Final Commissioning Report: A complete report of test procedures and results shall be prepared and filed with the owner.

1416.4.2.3 Acceptance: Buildings or portions thereof, required by this code to comply with this section, shall not be issued a final certificate of occupancy until such time that the building official determines that the preliminary commissioning report required by this section has been completed.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1416, filed 1/5/01, effective 7/1/01.]

WAC 51-11-1423 Economizers. Economizers meeting the requirements of Section 1413 shall be installed on single package unitary fan-cooling units having a supply capacity of greater than 1,900 cfm or a total cooling capacity greater than 54,000 Btu/h including those serving computer server rooms, electronic equipment, radio equipment, telephone switchgear.

The total capacity of all units without economizers shall not exceed 240,000 Btu/h per building, or 10% of its aggregate cooling (economizer) capacity, whichever is greater. That portion of the equipment serving Group R Occupancy is not included in determining the total capacity of all units without economizers in a building.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1423, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-1423, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1423, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1423, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1433 Economizers. Air economizers meeting the requirements of Section 1413 shall be provided on all new systems including those serving computer server rooms, electronic equipment, radio equipment, telephone switchgear.

EXCEPTIONS:

1. Single package unitary fan-cooling units installed outdoors or in a mechanical room adjacent to outdoors with a total cooling capacity less than 20,000 Btu/h. Other single package unitary fan-cooling units with a total cooling capacity less than 54,000 Btu/h. The total capacity of all such systems without economizers shall not exceed 240,000 Btu/h per building, or 10% of its air economizer capacity, whichever is greater. That 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. Water-cooled refrigeration equipment provided with a water economizer meeting the requirements of Section 1413. Water economizer capacity per building shall not exceed 500 tons. This exception shall not be used for RS-29 analysis.
3. Systems for which at least 75% of the annual energy used for mechanical cooling is provided from site-recovery or site-solar energy source.
4. Systems where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes an air economizer infeasible.
5. Systems that affect other systems (such as dehumidification and supermarket refrigeration systems) so as to increase the overall building energy consumption. New humidification equipment shall comply with Section 1413.4.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1433, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-1433, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1433, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1433, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1435 Simultaneous heating and cooling. Systems which provide heating and cooling simultaneously to a zone are prohibited. Zone thermostatic and humidistatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the zone. Such controls shall prevent:

- a. Reheating for temperature control.

- b. Recooling for temperature control.
- c. Mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by economizer systems or by mechanical refrigeration.
- d. Other simultaneous operation of heating and cooling systems to the same zone.
- e. Reheating for humidity control.

EXCEPTIONS:

1. Zones for which the volume of air that is reheated, recooled, or mixed is no greater than the larger of the following:
 - i. The volume of air required to meet the ventilation requirements of the Washington State Ventilation and Indoor Air Quality Code for the zone.
 - ii. 0.4 cfm/ft² of the zone conditioned floor area, provided that the temperature of the primary system air is, by design or through reset controls, 0-12°F below the design space heating temperature when outside air temperatures are below 60°F for reheat systems and the cold deck of mixing systems and 0-12°F above design space temperature when outside air temperatures are above 60°F for recooling systems and the hot deck of mixing systems. For multiple zone systems, each zone need not comply with this exception provided the average of all zones served by the system that have both heating and cooling ability comply.
 - iii. 300 cfm. This exception is for zones whose peak flow rate totals no more than 10% of the total fan system flow rate.
 - iv. Any higher rate that can be demonstrated, to the satisfaction of the building official, to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in outdoor air intake in accordance with the multiple space requirements defined in ASHRAE Standard 62.
2. Zones where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical.
3. Zones where at least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered (including condenser heat) or site solar energy source.
4. Zones where specific humidity levels are required to satisfy process needs, such as computer rooms, museums, surgical suites, and buildings with refrigerating systems, such as supermarkets, refrigerated warehouses, and ice arenas.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1435, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1435, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1437 Electric motor efficiency. Design A & B squirrel-cage, T-frame induction permanently wired polyphase motors of 1 hp or more having synchronous speeds of 3,600, 1,800 and 1,200 rpm shall have a nominal full-load motor efficiency no less than the corresponding values for energy efficient motors provided in Table 14-4.

EXCEPTIONS:

1. Motors used in systems designed to use more than one speed of a multi-speed motor.
2. Motors used as a component of the equipment meeting the minimum equipment efficiency requirements of Section 1411 and Tables 14-1A through 14-1G provided that the motor input is included when determining the equipment efficiency.
3. Motors that are an integral part of specialized process equipment.
4. Where the motor is integral to a listed piece of equipment for which no complying motor has been approved.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1437, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1437, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1438 Variable flow systems. For fans and pumps greater than 10 horsepower, where the application involves variable flow, there shall be variable speed drives or variable flow devices installed. Acceptable variable flow devices include variable inlet vanes, variable blade pitch, and variable fan geometry. Throttling valves (dampers), scroll dampers or bypass circuits shall not be allowed.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1438, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1438, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1439 Exhaust hoods.

1439.1 Kitchen Hoods. Individual kitchen exhaust hoods larger than 5000 cfm shall be provided with make-up air sized so that at least 50% of exhaust air volume be (a) unheated or heated to no more than 60°F and (b) uncooled or cooled without the use of mechanical cooling.

EXCEPTIONS:

1. Where hoods are used to exhaust ventilation air which would otherwise exfiltrate or be exhausted by other fan systems.
2. Certified grease extractor hoods that require a face velocity no greater than 60 fpm.

1439.2 Fume Hoods. Each fume hood in buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm shall include at least one of the following features:

(a) Variable air volume hood exhaust and room supply systems capable of reducing exhaust and make-up air volume to 50% or less of design values.

(b) Direct make-up (auxiliary) air supply equal to at least 75% of the exhaust rate, heated no warmer than 2°F below

room set point, cooled to no cooler than 3°F above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.

(c) Heat recovery systems to precondition make-up air in accordance with Section 1436, without using any exception.

(d) Constant volume fume hood designed and installed to operate at less than 50 fpm face velocity.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1439, filed 1/5/01, effective 7/1/01.]

WAC 51-11-1443 Pipe insulation. Piping shall be thermally insulated in accordance with Section 1415.1.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1443, filed 1/5/01, effective 7/1/01.]

WAC 51-11-1452 Pool water heaters. Heat pump pool heaters shall have a minimum COP of 4.0 determined in accordance with ASHRAE Standard 146, Method of Testing for Rating Pool Heaters. Other pool heating equipment shall comply with the applicable efficiencies in Tables 14-1A through 14-1G.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 02-01-112, § 51-11-1452, filed 12/18/01, effective 7/1/02; 98-03-003, § 51-11-1452, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1452, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1454 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90 degrees F shall have a pool cover with a minimum insulation value of R-12.

Table 14-1A
Unitary Air Conditioners and Condensing Units, Electrically Operated, Minimum Efficiency Requirements

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
Air Conditioners, Air Cooled	< 65,000 Btu/h ^d	Split System	10.0 SEER	ARI 210/240
		Single Package	9.7 SEER	
	≥65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	10.3 EER ^c	ARI 340/360
	≥135,000 Btu/h and < 240,000 Btu/h	Split System and Single Package	9.7 EER ^c	
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split System and Single Package	9.5 EER ^c 9.7 IPLV ^c	
	≥760,000 Btu/h	Split System and Single Package	9.2 EER ^c 9.4 IPLV ^c	
Air Conditioners, Water and Evaporatively Cooled	< 65,000 Btu/h	Split System and Single Package	12.1 EER	ARI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	11.5 EER ^c	
	≥135,000 Btu/h and ≤240,000 Btu/h	Split System and Single Package	11.0 EER ^c	ARI 340/360
	> 240,000 Btu/h	Split System and Single Package	11.0 EER ^c 10.3 IPLV ^c	
Condensing Units, Air Cooled	≥135,000 Btu/h		10.1 EER 11.2 IPLV	ARI 365
Condensing Units, Water or Evaporatively Cooled	≥135,000 Btu/h		13.1 EER 13.1 IPLV	

^a Reserved.

^b IPLVs are only applicable to equipment with capacity modulation.

^c Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

^d Single-phase air-cooled air-conditioners < 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

Table 14-1B
Unitary and Applied Heat Pumps, Electrically Operated, Minimum Efficiency Requirements

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
Air Cooled, (Cooling Mode)	< 65,000 Btu/h ^d	Split System	10.0 SEER	ARI 210/240
		Single Package	9.7 SEER	
	≥65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	10.1 EER ^c	ARI 340/360
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	9.3 EER ^c	
Water-Source (Cooling Mode)	< 17,000 Btu/h	86°F Entering Water	11.2 EER	ARI/ISO-13256-1
	≥ 17,000 Btu/h and <65,000 Btu/h	86°F Entering Water	12.0 EER	ARI/ISO-13256-1
	≥65,000 Btu/h and < 135,000 Btu/h	86°F Entering Water	12.0 EER	ARI/ISO-13256-1
Groundwater-Source (Cooling Mode)	< 135,000 Btu/h	59°F Entering Water	16.2 EER	ARI/ISO-13256-1
Ground Source (Cooling Mode)	< 135,000 Btu/h	77°F Entering Water	13.4 EER	ARI/ISO-13256-1
Air Cooled (Heating Mode)	< 65,000 Btu/h ^d (Cooling Capacity)	Split System	6.8 HSPF	ARI 210/240
		Single Package	6.6 HSPF	
	≥65,000 Btu/h and < 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.2 COP	ARI 340/360
		17°F db/15°F wb Outdoor Air	2.2 COP	
Water-Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.1 COP	ARI 340/360
		17°F db/15°F wb Outdoor Air	2.0 COP	
	≥135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.1 COP	ARI 340/360
Water-Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	68°F Entering Water	4.2 COP	ARI/ISO-13256-1
Groundwater-Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	50°F Entering Water	3.6 COP	ARI/ISO-13256-1
Ground Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	32°F Entering Water	3.1 COP	ARI/ISO-13256-1

^a Reserved.

^b IPLVs and part load rating conditions are only applicable to equipment with capacity modulation.

^c Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

^d Single-phase air-cooled heat pumps < 65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.

Table 14-1C
Water Chilling Packages, Minimum Efficiency Requirements

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
Air Cooled, With Condenser, Electrically Operated	All Capacities		2.80 COP	ARI 550/590
Air Cooled, Without Condenser, Electrically Operated	All Capacities		3.05 IPLV	
			3.10 COP	
			3.45 IPLV	

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
Air Cooled, With Condenser, Electrically Operated	All Capacities		2.80 COP 3.05 IPLV	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities		4.20 COP 5.05 IPLV	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)	< 150 Tons		4.45 COP 5.20 IPLV	ARI 550/590
	≥150 Tons and < 300 Tons		4.90 COP 5.60 IPLV	
	≥300 Tons		5.50 COP 6.15 IPLV	
Water Cooled, Electrically Operated, Centrifugal	< 150 Tons		5.00 COP 5.25 IPLV	ARI 550/590
	≥150 Tons and < 300 Tons		5.55 COP 5.90 IPLV	
	≥300 Tons		6.10 COP 6.40 IPLV	
Air Cooled Absorption Single Effect	All Capacities		0.60 COP	ARI 560
Water Cooled Absorption Single Effect	All Capacities		0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities		1.00 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities		1.00 COP 1.00 IPLV	

^a Reserved.

^b The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is less than or equal to 40°F.

Table 14-1D

Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps, Electrically Operated, Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
PTAC (Cooling Mode) New Construction	All Capacities	95°F db Outdoor Air	12.5 - (0.213 x Cap/1000) ^b EER	ARI 310/380
PTAC (Cooling Mode) Replacements ^c	All Capacities	95°F db Outdoor Air	10.9 - (0.213 x Cap/1000) ^b EER	
PTHP (Cooling Mode) New Construction	All Capacities	95°F db Outdoor Air	12.3 - (0.213 x Cap/1000) ^b EER	
PTHP (Cooling Mode) Replacements ^c	All Capacities	95°F db Outdoor Air	10.8 - (0.213 x Cap/1000) ^b EER	
PTHP (Heating Mode) New Construction	All Capacities		3.2 - (0.026 x Cap/1000) ^b COP	
PTHP (Heating Mode) Replacements ^c	All Capacities		2.9 - (0.026 x Cap/1000) ^b COP	
Room Air Conditioners, with Louvered Sides	< 6,000 Btu/h		9.7 EER	ANSI/AHAM RAC-1
	≥6,000 Btu/h and < 8,000 Btu/h		9.7 EER	
	≥ 8,000 Btu/h and < 14,000 Btu/h		9.8 EER	
	≥14,000 Btu/h and < 20,000 Btu/h		9.7 EER	
	≥20,000 Btu/h		8.5 EER	

Room Air Conditioners, without Louvered Sides	< 8,000 Btu/h		9.0 EER	
	≥8,000 Btu/h and < 20,000 Btu/h		8.5 EER	
	≥20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps with Louvered Sides	< 20,000 Btu/h		9.0 EER	
Room Air Conditioner Heat Pumps without Louvered Sides	≥ 20,000 Btu/h		8.5 EER	
	< 14,000 Btu/h		8.5 EER	
	≥ 14,000 Btu/h		8.0 EER	
Room Air Conditioner, Casement Only	All Capacities		8.7 EER	
Room Air Conditioner, Casement – Slider	All Capacities		9.5 EER	

^a Reserved.

^b Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

^c Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16-in. high and less than 42-in. wide.

^d Casement room air conditioners are not separate product classes under current minimum efficiency column.

^e New room air conditioner standards, covered by NAECA became effective October 1, 2000.

Table 14-1E

Warm Air Furnaces and Combination Warm Air Furnaces/Air-Conditioning Units, Warm Air Duct Furnaces and Unit Heaters, Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
Warm Air Furnace, Gas-Fired	< 225,000 Btu/h (66 kW)		78% AFUE or 80% E _t ^c	DOE 10 CFR Part 430 or ANSI Z21.47
	≥225,000 Btu/h (66 kW)	Maximum Capacity ^c Minimum Capacity ^c	80% E _c ^f	ANSI Z21.47
Warm Air Furnace, Oil-Fired	< 225,000 Btu/h (66 kW)		78% AFUE or 80% E _t ^c	DOE 10 CFR Part 430 or UL 727
	≥225,000 Btu/h (66 kW)	Maximum Capacity ^b Minimum Capacity ^b	81% E _t ^g	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity ^b Minimum Capacity ^b	80% E _c ^e —	ANSI Z83.9
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity ^b Minimum Capacity ^b	80% E _c ^e —	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity ^b Minimum Capacity ^b	80% E _c ^e —	UL 731

^a Reserved.

^b Minimum and maximum ratings as provided for and allowed by the unit's controls.

^c Combination units not covered by NAECA (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) may comply with either rating.

^d E_t = Thermal efficiency. See test procedure for detailed discussion.

^e E_c = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

^f E_c = Combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

^g E_t = Thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

Table 14-1F
Boilers, Gas- and Oil-Fired, Minimum Efficiency Requirements

Equipment Type ^f	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure
Boilers, Gas-Fired	< 300,000 Btu/h	Hot Water	80% AFUE	DOE 10 CFR Part 430
		Steam	75% AFUE	
	≥300,000 Btu/h and ≤ 2,500,000 Btu/h	Maximum Capacity ^b	75% E _t	H.I. Htg Boiler Std
		Hot Water	80% E _c	
		Steam	80% E _c	
Boilers, Oil-Fired	< 300,000 Btu/h		80% AFUE	DOE 10 CFR Part 430
	≥300,000 Btu/h and ≤ 2,500,000 Btu/h	Maximum Capacity ^b	78% E _t	H.I. Htg Boiler Std
		Hot Water	83% E _c	
		Steam	83% E _c	
Oil-Fired (Residual)	≥300,000 Btu/h and ≤ 2,500,000 Btu/h	Maximum Capacity ^b	78% E _t	H.I. Htg Boiler Std
	> 2,500,000 Btu/h ^f	Hot Water	83% E _c	
	> 2,500,000 Btu/h ^f	Steam	83% E _c	

^a Reserved.

^b Minimum and maximum ratings as provided for and allowed by the unit's controls.

^c E_c = Combustion efficiency (100% less flue losses). See reference document for detailed information.

^d E_t = Thermal efficiency. See reference document for detailed information.

^e Alternate test procedures used at the manufacturer's option are ASME PTC-4.1 for units over 5,000,000 Btu/h input, or ANSI Z21.13 for units greater than or equal to 300,000 Btu/h and less than or equal to 2,500,000 Btu/h input.

^f These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

Table 14-1G
Performance Requirements for Heat Rejection Equipment

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^c
Propeller or Axial Fan Cooling Towers	All	95°F (35°C) Entering Water 85°F (29°C) Leaving Water 75°F (24°C) wb Outdoor Air	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal Fan Cooling Towers	All	95°F (35°C) Entering Water 85°F (29°C) Leaving Water 75°F (24°C) wb Outdoor Air	≥ 20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Air Cooled Condensers	All	125°F (52°C) Condensing Temperature R22 Test Fluid 190°F (88°C) Entering Gas Temperature 15°F (8°C) Subcooling 95°F (35°C) Entering Drybulb	≥176,000 Btu/h•hp	ARI 460

^a For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.

^b For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.

^c Reserved.

TABLE 14-2 RESERVED

TABLE 14-3 RESERVED

TABLE 14-4
Energy Efficient Electric Motors
Minimum Nominal Full-Load Efficiency

	Open Motors			Closed Motors		
Synchronous Speed (RPM)	3,600	1,800	1,200	3,600	1,800	1,200
HP	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency
1.0	-	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2.0	84.0	84.0	85.5	84.0	84.0	86.5
3.0	84.0	86.5	86.5	85.5	87.5	87.5
5.0	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10.0	88.5	89.5	90.2	89.5	89.5	89.5
15.0	89.5	91.0	90.2	90.2	91.0	90.2
20.0	90.2	91.0	91.0	90.2	91.0	90.2
25.0	91.0	91.7	91.7	91.0	92.4	91.7
30.0	91.0	92.4	92.4	91.0	92.4	91.7
40.0	91.7	93.0	93.0	91.7	93.0	93.0
50.0	92.4	93.0	93.0	92.4	93.0	93.0
60.0	93.0	93.6	93.6	93.0	93.6	93.6
75.0	93.0	94.1	93.6	93.0	94.1	93.6
100.0	93.0	94.1	94.1	93.6	94.5	94.1
125.0	93.6	94.5	94.1	94.5	94.5	94.1
150.0	93.6	95.0	94.5	94.5	95.0	95.0
200.0	94.5	95.0	94.5	95.0	95.0	95.0

TABLE 14-5
Duct Insulation

Duct Type	Duct Location	Insulation R-Value	Other Requirements
Supply, Return	Not within conditioned space: On exterior of building, on roof, in attic, in enclosed ceiling space, in walls, in garage, in crawl spaces	R-7	Approved weather proof barrier
Outside air intake	Within conditioned space	R-7	See Section 1414.2
Supply, Return, Outside air intake	Not within conditioned space: in concrete, in ground	R-5.3	
Supply with supply air temperature <55°F or >105°F	Within conditioned space	R-3.3	

Note: Requirements apply to the duct type listed, whether heated or mechanically cooled. Mechanically cooled ducts requiring insulation shall have a vapor retarder, with a perm rating not greater than 0.5 and all joints sealed.

TABLE 14-6
Minimum Pipe Insulation (inches)¹

Fluid Design Operating Temp. Range, °F	Insulation Conductivity		Nominal Pipe Diameter (in.)					
	Conductivity Range Btu • in. / (h • ft ² • °F)	Mean Rating Temp. °F	Runouts ² up to 2	1 and less	>1 to 2	>2 to 4	>4 to 6	>6
Heating systems (Steam, Steam Condensate[,], and Hot water)			Nominal Insulation Thickness					
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.5	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	0.5	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	0.5	1.0	1.0	1.0	1.5	1.5
Domestic and Service Hot Water Systems								
105 and Greater	0.24-0.28	100	0.5	1.0	1.0	1.5	1.5	1.5
Cooling Systems (Chilled Water, Brine[,], and Refrigerant)								

Fluid Design Operating Temp. Range, °F	Insulation Conductivity		Nominal Pipe Diameter (in.)					
	Conductivity Range Btu • in. / (h • ft ² • °F)	Mean Rating Temp. °F	Runouts ² up to 2	1 and less	>1 to 2	>2 to 4	>4 to 6	>6
40-55	0.23-0.27	75	0.5	0.5	0.75	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5

1. Alternative Insulation Types. Insulation thicknesses in Table 14-6 are based on insulation with thermal conductivities within the range listed in Table 14-6 for each fluid operating temperature range, rated in accordance with ASTM C 335-84 at the mean temperature listed in the table. For insulation that has a conductivity outside the range shown in Table 14-6 for the applicable fluid operating temperature range at the mean rating temperature shown (when rounded to the nearest 0.01 Btu • in. / (h • ft² • °F)), the minimum thickness shall be determined in accordance with the following equation:

$$T = PR \left[\left(\frac{1}{1 + t/PR} \right)^{K/k} - 1 \right]$$

Where

T = Minimum insulation thickness for material with conductivity K, inches.

PR = Pipe actual outside radius, inches[.]

t = Insulation thickness from Table 14-6, inches

K = conductivity of alternate material at the mean rating temperature indicated in Table 14-6 for the applicable fluid temperature range, Btu • in. / (h • ft² • °F)

k = the lower value of the conductivity range listed in Table 14-6 for the applicable fluid temperature range, Btu • in. / (h • ft² • °F)

2. Runouts to individual terminal units not exceeding 12 ft. in length.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 02-01-112, § 51-11-1454, filed 12/18/01, effective 7/1/02; 01-03-010, § 51-11-1454, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1454, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1454, filed 10/18/93, effective 4/1/94.]

Reviser's note: RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 51-11-1512 Exempt lighting.

1512.1 Exempt Spaces: The following rooms, spaces, and areas, are exempt from the lighting power requirements in Sections 1520 and 1530 but shall comply with all other requirements of this chapter.

1. Areas in which medical or dental tasks are performed.
2. High risk security areas or any area identified by building officials as requiring additional lighting.
3. Spaces designed for primary use by the visually impaired, hard of hearing (lip-reading) or by senior citizens.
4. Food preparation areas.
5. Outdoor manufacturing, greenhouses, and processing areas.
6. Electrical/mechanical equipment rooms.
7. Outdoor athletic facilities.
8. Inspection and restoration areas in galleries and museums.
9. The sanctuary portion of a house of worship, defined as the space or room where the worship service takes place. Classrooms, meeting rooms, offices and multipurpose rooms that are part of the same facility are not exempt.

1512.2 Exempt Lighting Equipment: The following lighting equipment and tasks are exempt from the lighting requirements of Section 1520 and need not be included when calcu-

lating the installed lighting power under Section 1530 but shall comply with all other requirements of this chapter. All other lighting in areas that are not exempted by Section 1512.2, where exempt tasks and equipment are used, shall comply with all of the requirements of this chapter.

1. Special lighting needs for research.
2. Emergency lighting that is automatically OFF during normal building operation.
3. Lighting integral to signs, and permanently ballasted lighting fixtures for walkways and pathways.
4. Lighting that is part of machines, equipment or furniture.
5. Lighting that is used solely for indoor plant growth during the hours of 10:00 p.m. to 6:00 a.m.
6. Lighting for theatrical productions, television broadcasting (including sports facilities), audio-visual presentations, and special effects lighting for stage areas and dance floors in entertainment facilities.
7. Lighting for art exhibits, nonretail displays, portable plug in display fixtures, and show case lighting.
8. Exterior lighting for public monuments.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 01-03-010, § 51-11-1512, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1512, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025, 93-21-052, § 51-11-1512, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1513 Lighting controls. Lighting, including exempt lighting in Section 1512, shall comply with this section. Where occupancy sensors are cited, they shall have the features listed in Section 1513.6.1. Where automatic time switches are cited, they shall have the features listed in Section 1513.6.2.

1513.1 Local Control and Accessibility: Each space, enclosed by walls or ceiling-height partitions, shall be provided with lighting controls located within that space. The lighting controls, whether one or more, shall be capable of turning off all lights within the space. The controls shall be

readily accessible, at the point of entry/exit, to personnel occupying or using the space.

EXCEPTIONS: The following lighting controls may be centralized in remote locations:

1. Lighting controls for spaces which must be used as a whole.
2. Automatic controls.
3. Controls requiring trained operators.
4. Controls for safety hazards and security.

1513.2 Area Controls: The maximum lighting power that may be controlled from a single switch or automatic control shall not exceed that which is provided by a twenty ampere circuit loaded to not more than eighty 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.

EXCEPTIONS:

1. Industrial or manufacturing process areas, as may be required for production.
2. Areas less than five percent of footprint for footprints over 100,000 square feet.

1513.3 Daylight Zone Control: All daylighted zones, as defined in Chapter 2, both under overhead glazing and adjacent to vertical glazing, shall be provided with individual controls, or daylight-or occupant-sensing automatic controls, which control the lights independent of general area lighting.

Contiguous daylight zones adjacent to vertical glazing are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under overhead glazing more than 15 feet from the perimeter shall be controlled separately from daylight zones adjacent to vertical glazing.

EXCEPTION: Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer light fixtures are not required to have a separate switch for general area lighting.

1513.4 Display, Exhibition, and Specialty Lighting Controls: All display, exhibition, or specialty lighting shall be controlled independently of general area lighting.

1513.5 Automatic Shut-Off Controls, Exterior: Exterior lighting not intended for 24-hour continuous use shall be automatically switched by timer, photocell, or a combination of timer and photocell. Automatic time switches must also have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted.

1513.6 Automatic Shut-Off Controls, Interior: Office buildings greater than 5,000 sq. ft. and all school classrooms shall be equipped with separate automatic controls to shut off the lighting during unoccupied hours. Automatic controls may be an occupancy sensor, time switch, or other device capable of automatically shutting off lighting.

EXCEPTIONS:

1. Areas that must be continuously illuminated, or illuminated in a manner requiring manual operation of the lighting.
2. Emergency lighting systems.
3. Switching for industrial or manufacturing process facilities as may be required for production.

1513.6.1 Occupancy Sensors: Occupancy sensors shall be capable of automatically turning off all the lights in an area, no more than 30 minutes after the area has been vacated.

1513.6.2 Automatic Time Switches: Automatic time switches shall have a minimum 7 day clock and be capable of being set for 7 different day types per week and incorporate an automatic holiday "shut-off" feature, which turns off all loads for at least 24 hours and then resumes normally scheduled operations. Automatic time switches shall also have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted.

Automatic time switches shall incorporate an over-ride switching device which:

- a. is readily accessible;
- b. is located so that a person using the device can see the lights or the areas controlled by the switch, or so that the area being illuminated is annunciated; and
- c. is manually operated;
- d. allows the lighting to remain on for no more than two hours when an over-ride is initiated; and
- e. controls an area not exceeding 5,000 square feet or 5 percent of footprint for footprints over 100,000 square feet, whichever is greater.

1513.7 Commissioning Requirements: For lighting controls which include daylight or occupant sensing automatic controls, automatic shut-off controls, occupancy sensors, or automatic time switches, the lighting controls shall be tested to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications. A complete report of test procedures and results shall be prepared and filed with the owner. Drawing notes shall require commissioning in accordance with this paragraph.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1513, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1513, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1521 Prescriptive interior lighting requirements. Spaces for which the Unit Lighting Power Allowance in Table 15-1 is 0.8 watts per square foot or greater may use unlimited numbers of lighting fixtures and lighting energy, provided that the installed lighting fixtures comply with all four of the following criteria:

- a. one- or two-lamp (but not three- or more lamp);
- b. non-lensed, fluorescent fixtures;
- c. fitted with type T-1, T-2, T-4, T-5, T-6, T-8 or compact fluorescent lamps from 5 to 50 watts (but not T-10 or T-12 lamps); and
- d. electronic ballasts (electronic ballasts that screw into medium base sockets do not comply with this section).

EXCEPTIONS:

1. Up to a total of 5 percent of installed lighting fixtures need not be ballasted and may use any type of lamp.
2. Clear safety lenses are allowed in food prep and serving areas and patient care areas in otherwise compliant fixtures.
3. Exit lights are not included in the count of fixtures provided that they do not exceed 5 watts per fixture and are light emitting diode (LED) type or T-1 fluorescent type only. (See the Uniform Fire Code for face illumination footcandle requirements and other requirements.)

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1521, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1521, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1530 Lighting power allowance option.

The installed lighting wattage shall not exceed the lighting power allowance. Lighting wattage includes lamp and ballast wattage. Wattage for fluorescent lamps and ballasts shall be tested per ANSI Standard C82.2-1984.

The wattage used for any unballasted fixture shall be the maximum UL listed wattage for that fixture regardless of the lamp installed. The wattage used for track lighting shall be:

- for line voltage track, 50 watts per lineal foot of track or actual luminaire wattage, whichever is greater
- for low voltage track, 25 watts per lineal foot of track or the VA rating of the transformer, whichever is greater.

No credit towards compliance with the lighting power allowances shall be given for the use of any controls, automatic or otherwise.

Exit lights that are 5 watts or less per fixture shall not be included in the lighting power allowance calculations. Other exit lights shall be included in the lighting power allowance calculations.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1530, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-1530, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1530, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1531 Interior lighting power allowance.

The interior lighting power allowance shall be calculated by multiplying the gross interior floor area, in square feet, by the appropriate unit lighting power allowance, in watts per square foot, for the use as specified in Table 15-1. Accessory uses, including corridors, lobbies and toilet facilities shall be included with the primary use.

The lighting power allowance for each use shall be separately calculated and summed to obtain the interior lighting power allowance.

In cases where a lighting plan for only a portion of a building is submitted, the interior lighting power allowance shall be based on the gross interior floor area covered by the plan. Plans submitted for common areas only, including corridors, lobbies and toilet facilities shall use the lighting power allowance for common areas in Table 15-1.

When insufficient information is known about the specific use of the space, the allowance shall be based on the apparent intended use of the space.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1531, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1531, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1532 Exterior lighting power allowance.

The exterior lighting power allowance shall be the sum of the calculated allowances for parking, outdoor areas and building exteriors. The lighting allowance for covered parking, open parking and outdoor areas that are illuminated shall be 0.20 watts per square foot. The lighting allowance for building exteriors shall be calculated either by multiplying the build-

ing facade area by 0.25 watts per square foot or multiplying the building perimeter in feet by 7.5 watts per linear foot.

- EXCEPTIONS:
- Group U Occupancy accessory to Group R-3 Occupancy.
 - For covered parking, 0.30 w/sf may be used for the lighting provided that the ceilings and walls are painted or stained with a reflectance value of 0.70 or higher.

TABLE 15-1
Unit Lighting Power Allowance (LPA)

Use ¹	LPA ² (watts/sq. ft.)
Painting, welding, carpentry, machine shops	2.3
Barber shops, beauty shops	2.0
Hotel banquet/conference/exhibition hall ^{3,4}	2.0
Laboratories	2.0
Aircraft repair hangars	1.5
Cafeterias, fast food establishments ⁵	1.5
Factories, workshops, handling areas	1.5
Gas stations, auto repair shops ⁶	1.5
Institutions	1.5
Libraries ⁵	1.5
Nursing homes and hotel/motel guest rooms	1.5
Retail ¹⁰ , retail banking	1.5
Wholesale stores (pallet rack shelving)	1.5
Mall concourses	1.4
Schools buildings (Group E Occupancy only), school classrooms, day care centers	1.35
Laundries	1.3
Office buildings, office/administrative areas in facilities of other use types (including but not limited to schools, hospitals, institutions, museums, banks, churches) ^{5,7,11}	1.2
Police and fire stations ⁸	1.2
Atria (atriums)	1.0
Assembly spaces ⁹ , auditoriums, gymnasias ⁹ , theaters	1.0
Group R-1 common areas	1.0
Process plants	1.0
Restaurants/bars ⁵	1.0
Locker and/or shower facilities	0.8
Warehouses ¹¹ , storage areas	0.5
Aircraft storage hangars	0.4
Parking garages	See Section 1532
Plans Submitted for Common Areas Only⁷	
Main floor building lobbies ³ (except mall concourses)	1.2
Common areas, corridors, toilet facilities and wash-rooms, elevator lobbies	0.8

Footnotes for Table 15-1

- In cases in which a general use and a specific use are listed, the specific use shall apply. In cases in which a use is not mentioned specifically, the *Unit Power Allowance* shall be determined by the building official. This determination shall be based upon the most comparable use specified in the table. See Section 1512 for exempt areas.

2. The watts per square foot may be increased, by two percent per foot of ceiling height above twenty feet, unless specifically directed otherwise by subsequent footnotes.
3. Watts per square foot of room may be increased by two percent per foot of ceiling height above twelve feet.
4. For all other spaces, such as seating and common areas, use the *Unit Light Power Allowance* for assembly.
5. Watts per square foot of room may be increased by two percent per foot of ceiling height above nine feet.
6. Includes pump area under canopy.
7. In cases in which a lighting plan is submitted for only a portion of a floor, a *Unit Lighting Power Allowance* of 1.35 may be used for usable office floor area and 0.80 watts per square foot shall be used for the common areas, which may include elevator space, lobby area and rest rooms. Common areas, as herein defined do not include mall concourses.
8. For the fire engine room, the *Unit Lighting Power Allowance* is 1.0 watts per square foot.
9. For indoor sport tournament courts with adjacent spectator seating, the *Unit Lighting Power Allowance* for the court area is 2.6 watts per square foot.
10. Display window illumination installed within 2 feet of the window, lighting for free-standing display where the lighting moves with the display, and building showcase illumination where the lighting is enclosed within the showcase are exempt.

An additional 1.5 w/ft² of merchandise display luminaires are exempt provided that they comply with all three of the following:

- (a) located on ceiling-mounted track or directly on or recessed into the ceiling itself (not on the wall).
- (b) adjustable in both the horizontal and vertical axes (vertical axis only is acceptable for fluorescent and other fixtures with two points of track attachment).
- (c) fitted with tungsten halogen, fluorescent, or high intensity discharge lamps.

This additional lighting power is allowed only if the lighting is actually installed.

11. Provided that a floor plan, indicating rack location and height, is submitted, the square footage for a warehouse may be defined, for computing the interior *Unit Lighting Power Allowance*, as the floor area not covered by racks plus the vertical face area (access side only) of the racks. The height allowance defined in footnote 2 applies only to the floor area not covered by racks.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-1532, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-1532, filed 10/18/93, effective 4/1/94.]

WAC 51-11-1701 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2000 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2001 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2002 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2003 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2004 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2005 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2006 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2007 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2008 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-2009 Repealed. See Disposition Table at beginning of this chapter.

WAC 51-11-99902 Section 2—General principles and requirements.

2.1 Energy Analysis: Compliance with this Standard will require an analysis of the annual energy usage, hereinafter called an annual energy analysis.

A building designed in accordance with this Standard will be deemed as complying with this Code, if

- a. The calculated annual energy consumption is not greater than that of a corresponding "standard design," as defined below and in Section 3,

and;

- b. Whose enclosure elements and energy-consuming systems comply with Sections 1310 through 1314, 1410 through 1416, 1440 through 1443, 1450 through 1454 and 1510 through 1513. Buildings shall only vary from those requirements in Sections 1330 through 1334, 1432 through 1439 and 1530 through 1532 where those variations have been accurately and completely modeled. Where variations are not specifically analyzed, the building shall comply with these requirements.

For a proposed building design to be considered similar to a "standard design," it shall utilize the same energy source(s) for the same functions and have equal floor area and the same ratio of envelope area to floor area, environmental requirements, occupancy, climate data and usage operational schedule. Inputs to the energy analysis relating to occupancy and usage shall correspond to the expected occupancy and usage of the building.

Except as noted below, the systems identified, and, to the extent possible, the assumptions made in assigning energy inputs to each system, shall be the same for the standard design and the proposed design. When electrically driven heat pumps, other than multiple units connected to a common water loop, are employed to provide all or part of the heat for the proposed design, the standard design shall also, for the purposes of the analysis, assume that electrically driven heat pump, in conformance with Chapter 14 of the Code and having capacity at least as great as those used in the proposed design are employed.

2.2 Design: The standard design and the proposed design shall be designed on a common basis as specified herein:

a. The comparison shall be expressed as kBtu input per square foot of conditioned floor area per year at the building site. Buildings which use electricity as the only fuel source, comparisons may be expressed in kWh. When converting electricity in kWh to kBtu a multiplier of 3.413 kWh/kBtu shall be used.

b. If the proposed design results in an increase in consumption of one energy source and a decrease in another energy source, even though similar sources are used for similar purposes, the difference in each energy source shall be converted to equivalent energy units for purposes of comparing the total energy used.

2.3 Analysis Procedure: The analysis of the annual energy usage of the standard and the proposed building and system design shall meet the following criteria:

a. The building heating/cooling load calculation procedure used for annual energy consumption analysis shall be detailed to permit the evaluation of effect of factors specified in Section 2.4.

b. The calculation procedure used to simulate the operation of the building and its service systems through a full-year operating period shall be detailed to permit the evaluation of the effect of system design, climatic factors, operational characteristics and mechanical equipment on annual energy usage. Manufacturer's data or comparable field test data shall be used when available in the simulation of systems and equipment. The calculation procedure shall be based upon 8,760 hours of operation of the building and its service systems and shall utilize the design methods, specified in Standards RS-27, -11, -12 and -13 listed in Chapter 7 of the Code or in other programs approved by the building official.

2.4 Calculation Procedure: The calculation procedure shall cover the following items:

a. Design requirements—Design heating conditions and design cooling conditions as defined in Chapter 2 of the Code.

b. Climatic data—Coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.

c. Building data—Orientation, size, shape, mass, air and heat transfer characteristics.

d. Operational characteristics—Temperature, humidity, ventilation, illumination and control mode for occupied and unoccupied hours.

e. Mechanical equipment—Design capacity and part load profile.

f. Building loads—Internal heat generation, lighting, equipment and number of people during occupied and unoccupied periods.

2.5 Documentation: All analyses submitted shall be accompanied by an energy analysis comparison report. The report shall provide technical detail on the two building and system designs and on the data used in and resulting from the comparative analysis to verify that both the analysis and the designs meet the criteria of Section 1.

The calculation procedure for the standard design and the proposed design shall separately identify the calculated annual energy consumption for each different occupancy type, if possible, for each of the following end uses:

- a. Interior lighting;
- b. Parking lighting;
- c. Exterior lighting;
- d. Space heating;
- e. Space cooling;
- f. Interior ventilation/fans;
- g. Parking ventilation/fans;
- h. Exhaust fans;
- i. Service water heating;
- j. Elevators;
- k. Appliances.

Energy consumption of the following items shall be included but is not required to be separated out by each individual item.

- a. Office equipment;
- b. Refrigeration other than comfort cooling;
- c. Cooking; and
- d. Any other energy-consuming equipment.

The specifications of the proposed building project used in the analysis shall be as similar as is reasonably practical to those in the plans submitted for a building permit.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-99902, filed 1/5/01, effective 7/1/01. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-99902, filed 10/18/93, effective 4/1/94.]

WAC 51-11-99903 Section 3—Specific modeling assumptions.

The specific modeling assumptions consist of methods and assumptions for calculating the standard energy consumption for the standard building and the proposed energy consumption of the proposed design. In order to maintain consistency between the standard and the proposed design energy consumptions, the input assumptions in this section shall be used.

"Prescribed" assumptions shall be used without variation. "Default" assumptions shall be used unless the designer can demonstrate that a different assumption better characterizes the building's use over its expected life. Any modification of a default assumption shall be used in modeling both the standard building and the proposed design unless the designer demonstrates a clear cause to do otherwise.

3.1 Orientation and Shape: The standard building shall consist of the same number of stories and gross floor area for each story as the proposed design. Each floor shall be oriented exactly as the proposed design. The geometric form shall be the same as the proposed design.

3.2 Internal Loads: Internal loads shall be modeled as noted in the following parts of Section 3.2. The systems specified for calculating the standard energy consumption in Section 3.2 are intended only as constraints in calculating the consumption. They are not intended as requirements or recommendations for systems to be used in the proposed building or for the calculation of the proposed energy consumption.

3.2.1 Occupancy: Occupancy schedules shall be default assumptions. The same assumptions shall be made in computing proposed energy consumption as were used in calculating the standard energy consumption. Occupancy levels vary by building type and time of day. Table 3-1 establishes the density presented as ft²/person of conditioned floor area that will be used by each building type. Table 3-2 establishes the percentage of the people that are in the building by hours of the day for each building type.

3.2.2 Lighting: The interior and exterior lighting power allowance for calculating the standard energy consumption shall be determined from Sections 1531 and 1532. The lighting power used to calculate the proposed energy consumption shall be the actual lighting power of the proposed lighting design. Exempt lighting in the standard design shall be equal to the exempt lighting in the proposed design.

Lighting levels in buildings vary based on the type of uses within buildings, by area and by time of day. Table 3-2 contains the lighting energy profiles which establish the percentage of the lighting load that is switched ON in each prototype or reference building by hour of the day. These profiles are default assumptions and can be changed if required when calculating the standard energy consumption to provide, for example, a 12 hour rather than an 8 hour work day or to reflect the use of automatic lighting controls. The lighting schedules used in the standard and proposed designs shall be identical and shall reflect the type of controls to be installed in the proposed design. The controls in the proposed design shall comply with the requirements in Section 1513 and no credit shall be given for the use of any additional controls, automatic or otherwise.

3.2.3 Receptacle: Receptacle loads and profiles are default assumptions. The same assumptions shall be made in calculating proposed energy consumption as were used in calculating the standard energy consumption. Receptacle loads include all general service loads that are typical in a building. These loads should include additional process electrical usage but exclude HVAC primary or auxiliary electrical usage. Table 3-1 establishes the density in W/ft² to be used. The receptacle energy profiles shall be the same as the lighting energy profiles in Table 3-2. This profile establishes the percentage of the receptacle load that is switched ON by hour of the day and by building type.

3.3 Envelope

3.3.1 Insulation and Glazing: Glazing area and U-factor of the standard building envelope shall be determined by using the Target UA requirements of Equation 13-1 and U-factor values in Table 13-1 or 13-2. The glazing solar heat gain coefficient (SHGC) or shading coefficient of the standard building shall be the lesser of 0.65 and the SHGC required by Table 13-1 or 13-2 for the vertical or overhead glazing area for the appropriate wall type. The opaque area U-factors of the standard building shall be determined by using the Target UA requirements from Equation 13-1 including the appropriate mass for walls. The insulation characteristics and glazing area are prescribed assumptions for the standard building for calculating the standard energy consumption. In the calculation of the proposed energy consumption of the proposed design, the envelope characteristics of the proposed design shall be used. The standard design shall use the maximum glazing areas listed in Tables 13-1 or 13-2 for the appropriate use. The distribution of vertical glazing in the gross wall area of the standard design shall be equal to the distribution of vertical glazing in the proposed design or shall constitute an equal percentage of gross wall area on all sides of the standard building. The distribution of overhead glazing in the gross roof/ceiling area of the standard design shall be equal to the distribution of overhead glazing in the proposed design. The distribution of doors in the gross opaque wall area of the standard design shall be identical to the distribution of doors in the proposed design.

3.3.2 Infiltration: For standard and proposed buildings, infiltration assumptions shall be equal.

3.3.3 Envelope and Ground Absorptivities: For the standard building, absorptivity assumptions shall be default assumptions for computing the standard energy consumption and default assumptions for computing the proposed energy consumption. The solar absorptivity of opaque elements of the building envelope shall be assumed to be 70 percent. The solar absorptivity of ground surfaces shall be assumed to be 80 percent (20 percent reflectivity).

3.3.4 Window Treatment: No draperies or blinds shall be modeled for the standard or proposed building.

3.3.5 Shading: For standard building and the proposed design, shading by permanent structures and terrain shall be taken into account for computing energy consumption whether or not these features are located on the building site. A permanent fixture is one that is likely to remain for the life of the proposed design. Credit may be taken for external shading devices that are part of the proposed design.

3.4 HVAC Systems and Equipment: For the standard building, the HVAC system used shall be the system type used in the proposed design. If the proposed HVAC system type does not comply with Sections 1432 through 1439, the standard design system shall comply in all respects with those sections.

EXCEPTION: When approved by the building official, a prototype HVAC system may be used, if the proposed design system cannot be modified to comply with Sections 1422 and 1432 through 1439, as a standard design.

Use of prototype HVAC systems shall only be permitted for the building types listed below. For mixed-use buildings, the floor space of each building type is allocated within the floor space of the standard building. The specifications and requirements for the HVAC systems of prototype buildings shall be those in Table 3-3.

- | | |
|-------------------------|-------------------------|
| 1. assembly | 6. restaurant |
| 2. health/institutional | 7. retail (mercantile) |
| 3. hotel/motel | 8. school (educational) |
| 4. light manufacturing | 9. warehouse (storage) |
| 5. office (business) | |

3.4.1 HVAC Zones: HVAC zones for calculating the standard energy consumption and proposed energy consumption shall consist of at least four perimeter and one interior zone per floor, with at least one perimeter zone facing each orientation. The perimeter zones shall be fifteen feet in width or one-third the narrow dimension of the building when this dimension is between 30 and 45 feet inclusive or half the narrow dimension of the building when this dimension is less than thirty feet.

EXCEPTIONS:

1. Building types such as assembly or warehouse may be modeled as a single zone if there is only one space.
2. Thermally similar zones, such as those facing one orientation on different floors, may be grouped together for the purposes of either the standard or proposed building simulation.

3.4.2 Process Equipment Sizing: Process sensible and latent loads shall be equal in calculating both the standard energy consumption and the proposed energy consumption. The designer shall document the installation of process equipment and the size of process loads.

3.4.3 HVAC Equipment Sizing: The equipment shall be sized to include the capacity to meet the process loads. For calculating the proposed energy consumption, actual air flow rates and installed equipment size shall be used in the simulation. Equipment sizing in the simulation of the proposed design shall correspond to the equipment intended to be selected for the design and the designer shall not use equipment sized automatically by the simulation tool.

Equipment sizing for the standard design shall be based on the same as the proposed design or lesser sizing ratio of installed system capacity to the design load for heating and for cooling.

Chilled water systems for the standard building shall be modeled using a reciprocating chiller for systems with total cooling capacities less than 175 tons, and centrifugal chillers for systems with cooling capacities of 175 tons or greater. For systems with cooling capacities of 600 tons or more the standard energy consumption shall be calculated using two centrifugal chillers, lead/lag controlled. Chilled water shall be assumed to be controlled at a constant 44 degree F temperature rise, from 44 degrees F to 56 degrees F, operating at 65 percent combined impeller and motor efficiency. Condenser water pumps shall be sized using a 10 degree F temperature rise, operating at 60 percent combined impeller and motor efficiency. The cooling tower shall be an open circuit, centrifugal blower type sized for the larger of 85 degrees F leaving water temperature or 10 degrees F approach to design wet-bulb temperature. The tower shall be controlled to provide a 65 degrees F leaving water temperature whenever weather

conditions permit, floating up to design leaving water temperature at design conditions.

3.4.4 Fans: The power of the combined fan system per air volume at design conditions (w/cfm) of the proposed design shall be equal to that of the standard design.

Variable air volume fan systems in the standard building shall be variable speed.

3.5 Service Water Heating: The service water heating loads for prototype buildings are defined in terms of Btu/person-hour in Table 3-1. The values in the table refer to energy content of the heated water. The service water heating loads from Table 3-1 are default for all buildings. The same service-water-heating load assumptions shall be made in calculating proposed energy consumption as were used in calculating the standard energy consumption. The service water heating system for the standard building shall be modeled as closely as possible as if it were designed in accordance with RS-11 and meeting all the requirements of Sections 1440 through 1443.

3.6 Controls

3.6.1: All occupied conditioned spaces in standard and proposed design buildings in all climates shall be simulated as being both heated and cooled.

EXCEPTIONS:

1. If a building or portion of a building is to be provided with only heating or cooling, both the standard building and the proposed design shall be simulated using the same assumptions.
2. If warehouses are not intended to be mechanically cooled, both the standard and proposed energy consumption shall be modeled assuming no mechanical cooling.

3.6.2: Space temperature controls for the standard building, shall be set at 70 degrees F for space heating and 75 degrees F for space cooling, with a deadband in accordance with Section 1412.2. The system shall be OFF during off-hours according to the appropriate schedule in Table 3-2, except that the heating system shall cycle ON if any space should drop below the night setback setting 55 degrees F. There shall be no similar setpoint during the cooling season. Lesser deadband ranges may be used in calculating the proposed energy consumption.

EXCEPTIONS:

1. Setback shall not be modeled in determining either the standard or proposed energy consumption if setback is not realistic for the proposed design such as a facility being operated 24 hours/day. For instance, health facilities need not have night setback during the heating season.
2. If deadband controls are not to be installed, the proposed energy consumption shall be calculated with both heating and cooling thermostat setpoints set to the same value between 70 degrees F and 75 degrees F inclusive, assumed to be constant for the year.

3.6.3: When providing for outdoor air ventilation when calculating the standard energy consumption, controls shall be assumed to close the outside air intake to reduce the flow of outside air to 0.0 cfm during "setback" and "unoccupied" periods. Ventilation using inside air may still be required to maintain scheduled setback temperature. Outside air ventilation, during occupied periods, shall be as required by the Washington State Ventilation and Indoor Air Quality Code chapter 51-13 WAC.

3.6.4: If humidification is to be used in the proposed design, the same level of humidification and system type shall be used in the standard building.

TABLE 3-1
Acceptable Occupancy Densities, Receptacle Power Densities and Service Hot Water Consumption¹

Building Type	Occupancy Density ² Sq. Ft./Person (Btu/h·ft ²)	Receptacle Power Density ³ Watts/Sq. Ft. (Btu/h·ft ²)	Service Hot Water Quantities ⁴ Btu/h·person
Assembly	50 (4.60)	0.25 (0.85)	215
Health/Institutional	200 (1.15)	1.00 (3.41)	135
Hotel/Motel	250 (0.92)	0.25 (0.85)	1,110
Light Manufacturing	750 (0.31)	0.20 (0.68)	225
Office	275 (0.84)	0.75 (2.56)	175
Parking Garage	N.A.	N.A.	N.A.
Restaurant	100 (2.30)	0.10 (0.34)	390

Building Type	Occupancy Density ² Sq. Ft./Person (Btu/h·ft ²)	Receptacle Power Density ³ Watts/Sq. Ft. (Btu/h·ft ²)	Service Hot Water Quantities ⁴ Btu/h·person
Retail	300 (0.77)	0.25 (0.85)	135
School	75 (3.07)	0.50 (1.71)	215
Warehouse	15,000 (0.02)	0.10 (0.34)	225

1. The occupancy densities, receptacle power densities and service hot water consumption values are from ASHRAE Standard 90.1-1989 and addenda.
2. Values are in square feet of conditioned floor area per person. Heat generation in Btu per person per hour is 230 sensible and 190 latent. Figures in parentheses are equivalent Btu per hour per square foot.
3. Values are in Watts per square foot of conditioned floor area. Figures in parentheses are equivalent Btu per hour per square foot. These values are the minimum acceptable. If other process loads are not input (such as for computers, cooking, refrigeration, etc.), it is recommended that receptacle power densities be increased until total process energy consumption is equivalent to 25% of the total.
4. Values are in Btu per person per hour.

TABLE 3-2A
Assembly Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	5	5	5	off	off	off	0	0	0	0	0	0
2 (1-2am)	0	0	0	5	5	5	off	off	off	0	0	0	0	0	0
3 (2-3am)	0	0	0	5	5	5	off	off	off	0	0	0	0	0	0
4 (3-4am)	0	0	0	5	5	5	off	off	off	0	0	0	0	0	0
5 (4-5am)	0	0	0	5	5	5	off	off	off	0	0	0	0	0	0
6 (5-6am)	0	0	0	5	5	5	on	off	off	0	0	0	0	0	0
7 (6-7am)	0	0	0	40	5	5	on	on	on	0	0	0	0	0	0
8 (7-8am)	0	0	0	40	30	30	on	on	on	0	0	0	0	0	0
9 (8-9am)	20	20	10	40	30	30	on	on	on	0	0	0	0	0	0
10 (9-10am)	20	20	10	75	50	30	on	on	on	5	5	5	0	0	0
11 (10-11am)	20	20	10	75	50	30	on	on	on	5	5	5	0	0	0
12 (11-12pm)	80	60	10	75	50	30	on	on	on	35	20	10	0	0	0
13 (12-1pm)	80	60	10	75	50	65	on	on	on	5	0	0	0	0	0
14 (1-2pm)	80	60	70	75	50	65	on	on	on	5	0	0	0	0	0
15 (2-3pm)	80	60	70	75	50	65	on	on	on	5	0	0	0	0	0
16 (3-4pm)	80	60	70	75	50	65	on	on	on	5	0	0	0	0	0
17 (4-5pm)	80	60	70	75	50	65	on	on	on	5	0	0	0	0	0
18 (5-6pm)	80	60	70	75	50	65	on	on	on	0	0	0	0	0	0
19 (6-7pm)	20	60	70	75	50	65	on	on	on	0	0	0	0	0	0
20 (7-8pm)	20	60	70	75	50	65	on	on	on	0	65	65	0	0	0
21 (8-9pm)	20	60	70	75	50	65	on	on	on	0	30	30	0	0	0
22 (9-10pm)	20	80	70	75	50	65	on	on	on	0	0	0	0	0	0
23 (10-11pm)	10	10	20	25	50	5	on	on	on	0	0	0	0	0	0
24 (11-12am)	0	0	0	5	5	5	off	off	off	0	0	0	0	0	0
Total/Day	710	750	700	1155	800	845	1800	1700	1700	70	125	115	0	0	0
Total/Week		50.50	hours		74.20	hours		124	hours		5.9	hours		0	hours
Total/Year		2633	hours		3869	hours		6465	hours		308	hours		0	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2B
Health Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
2 (1-2am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
3 (2-3am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
4 (3-4am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
5 (4-5am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
6 (5-6am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
7 (6-7am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
8 (7-8am)	10	10	0	50	20	5	on	on	on	17	1	1	2	2	0
9 (8-9am)	50	30	5	90	40	10	on	on	on	58	20	1	75	46	2
10 (9-10am)	80	40	5	90	40	10	on	on	on	66	28	1	100	70	2
11 (10-11am)	80	40	5	90	40	10	on	on	on	78	30	1	100	70	2
12 (11-12pm)	80	40	5	90	40	10	on	on	on	82	30	1	100	70	2
13 (12-1pm)	80	40	5	90	40	10	on	on	on	71	24	1	75	51	2
14 (1-2pm)	80	40	5	90	40	10	on	on	on	82	24	1	100	51	2
15 (2-3pm)	80	40	5	90	40	10	on	on	on	78	23	1	100	51	2
16 (3-4pm)	80	40	5	90	40	10	on	on	on	74	23	1	100	51	2
17 (4-5pm)	80	40	0	30	40	5	on	on	on	63	23	1	100	51	0
18 (5-6pm)	50	10	0	30	40	5	on	on	on	41	10	1	100	25	0
19 (6-7pm)	30	10	0	30	10	5	on	on	on	18	1	1	52	2	0
20 (7-8pm)	30	0	0	30	10	5	on	on	on	18	1	1	52	0	0
21 (8-9pm)	20	0	0	30	10	5	on	on	on	18	1	1	52	0	0
22 (9-10pm)	20	0	0	30	10	5	on	on	on	10	1	1	28	0	0
23 (10-11pm)	0	0	0	30	10	5	on	on	on	1	1	1	0	0	0
24 (11-12am)	0	0	0	10	10	5	on	on	on	1	1	1	0	0	0
Total/Day	850	380	40	1060	550	160	2400	2400	2400	783	249	24	1136	540	16
Total/Week		46.70	hours		60.10	hours		168	hours		41.88	hours		62.36	hours
Total/Year		2435	hours		3134	hours		8760	hours		2148	hours		3251	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2C
Hotel/Motel Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	90	90	70	20	20	30	on	on	on	20	20	25	40	44	55
2 (1-2am)	90	90	70	15	20	30	on	on	on	15	15	20	33	35	55
3 (2-3am)	90	90	70	10	10	20	on	on	on	15	15	20	33	35	43
4 (3-4am)	90	90	70	10	10	20	on	on	on	15	15	20	33	35	43
5 (4-5am)	90	90	70	10	10	20	on	on	on	20	20	20	33	35	43
6 (5-6am)	90	90	70	20	10	20	on	on	on	25	25	30	33	35	43
7 (6-7am)	70	70	70	40	30	30	on	on	on	50	40	50	42	40	52
8 (7-8am)	40	50	70	50	30	40	on	on	on	60	50	50	42	32	52
9 (8-9am)	40	50	50	40	40	40	on	on	on	55	50	50	52	45	65
10 (9-10am)	20	30	50	40	40	30	on	on	on	45	50	55	52	45	65
11 (10-11am)	20	30	50	25	30	30	on	on	on	40	45	50	40	42	53
12 (11-12pm)	20	30	30	25	25	30	on	on	on	45	50	50	51	60	60
13 (12-1pm)	20	30	30	25	25	30	on	on	on	40	50	40	51	65	53
14 (1-2pm)	20	30	20	25	25	20	on	on	on	35	45	40	51	65	51
15 (2-3pm)	20	30	20	25	25	20	on	on	on	30	40	30	51	65	50
16 (3-4pm)	30	30	20	25	25	20	on	on	on	30	40	30	51	65	44
17 (4-5pm)	50	30	30	25	25	20	on	on	on	30	35	30	63	65	64
18 (5-6pm)	50	50	40	25	25	20	on	on	on	40	40	40	80	75	62
19 (6-7pm)	50	60	40	60	60	50	on	on	on	55	55	50	86	80	65
20 (7-8pm)	70	60	60	80	70	70	on	on	on	60	55	50	70	80	63
21 (8-9pm)	70	60	60	90	70	80	on	on	on	50	50	40	70	75	63

	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
Hour of Day	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
22 (9-10pm)	80	70	80	80	70	60	on	on	on	55	55	50	70	75	63
23 (10-11pm)	90	70	80	60	60	50	on	on	on	45	40	40	45	55	40
24 (11-12am)	90	70	80	30	30	30	on	on	on	25	30	20	45	55	40
Total/Day	1390	1390	1300	855	785	810	2400	2400	2400	915	930	900	1217	1303	1287
Total/Week		96.40	hours		58.70	hours		168.0	hours		64.05	hours		86.75	hours
Total/Year		5026	hours		3061	hours		8760	hours		3340	hours		4523	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2D
Light Manufacturing Occupancy¹

	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
Hour of Day	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
(time)	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
2 (1-2am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
3 (2-3am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
4 (3-4am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
5 (4-5am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
6 (5-6am)	0	0	0	10	5	5	off	off	off	8	8	7	0	0	0
7 (6-7am)	10	10	5	10	10	5	on	on	off	7	7	4	0	0	0
8 (7-8am)	20	10	5	30	10	5	on	on	off	19	11	4	35	16	0
9 (8-9am)	95	30	5	90	30	5	on	on	off	35	15	4	69	14	0
10 (9-10am)	95	30	5	90	30	5	on	on	off	38	21	4	43	21	0
11 (10-11am)	95	30	5	90	30	5	on	on	off	39	19	4	37	18	0
12 (11-12pm)	95	30	5	90	30	5	on	on	off	47	23	6	43	25	0
13 (12-1pm)	50	10	5	80	15	5	on	on	off	57	20	6	58	21	0
14 (1-2pm)	95	10	5	90	15	5	on	on	off	54	19	9	48	13	0
15 (2-3pm)	95	10	5	90	15	5	on	on	off	34	15	6	37	8	0
16 (3-4pm)	95	10	5	90	15	5	on	on	off	33	12	4	37	4	0
17 (4-5pm)	95	10	5	90	15	5	on	on	off	44	14	4	46	5	0
18 (5-6pm)	30	5	5	50	5	5	on	on	off	26	7	4	62	6	0
19 (6-7pm)	10	5	0	30	5	5	on	off	off	21	7	4	20	0	0
20 (7-8pm)	10	0	0	30	5	5	on	off	off	15	7	4	12	0	0
21 (8-9pm)	10	0	0	20	5	5	on	off	off	17	7	4	4	0	0
22 (9-10pm)	10	0	0	20	5	5	on	off	off	8	9	7	4	0	0
23 (10-11pm)	5	0	0	10	5	5	off	off	off	5	5	4	0	0	0
24 (11-12am)	5	0	0	5	5	5	off	off	off	5	5	4	0	0	0
Total/Day	920	200	60	1040	280	120	1600	1200	0	537	256	113	555	151	0
Total/Week		48.60	hours		56.00	hours		92.00	hours		30.54	hours		29.26	hours
Total/Year		2534	hours		2920	hours		4797	hours		1592	hours		1526	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2E
Office Occupancy¹

	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
Hour of Day	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
(time)	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
2 (1-2am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
3 (2-3am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
4 (3-4am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
5 (4-5am)	0	0	0	5	5	5	off	off	off	5	5	4	0	0	0
6 (5-6am)	0	0	0	10	5	5	off	off	off	8	8	7	0	0	0
7 (6-7am)	10	10	5	10	10	5	on	on	off	7	7	4	0	0	0
8 (7-8am)	20	10	5	30	10	5	on	on	off	19	11	4	35	16	0
9 (8-9am)	95	30	5	90	30	5	on	on	off	35	15	4	69	14	0
10 (9-10am)	95	30	5	90	30	5	on	on	off	38	21	4	43	21	0
11 (10-11am)	95	30	5	90	30	5	on	on	off	39	19	4	37	18	0
12 (11-12pm)	95	30	5	90	30	5	on	on	off	47	23	6	43	25	0
13 (12-1pm)	50	10	5	80	15	5	on	on	off	57	20	6	58	21	0
14 (1-2pm)	95	10	5	90	15	5	on	on	off	54	19	9	48	13	0
15 (2-3pm)	95	10	5	90	15	5	on	on	off	34	15	6	37	8	0
16 (3-4pm)	95	10	5	90	15	5	on	on	off	33	12	4	37	4	0
17 (4-5pm)	95	10	5	90	15	5	on	on	off	44	14	4	46	5	0
18 (5-6pm)	30	5	5	50	5	5	on	on	off	26	7	4	62	6	0
19 (6-7pm)	10	5	0	30	5	5	on	off	off	21	7	4	20	0	0
20 (7-8pm)	10	0	0	30	5	5	on	off	off	15	7	4	12	0	0
21 (8-9pm)	10	0	0	20	5	5	on	off	off	17	7	4	4	0	0
22 (9-10pm)	10	0	0	20	5	5	on	off	off	8	9	7	4	0	0
23 (10-11pm)	5	0	0	10	5	5	off	off	off	5	5	4	0	0	0
24 (11-12am)	5	0	0	5	5	5	off	off	off	5	5	4	0	0	0
Total/Day	920	200	60	1040	280	120	1600	1200	0	537	256	113	555	151	0
Total/Week		48.60	hours		56.00	hours		92.00	hours		30.54	hours		29.26	hours
Total/Year		2534	hours		2920	hours		4797	hours		1592	hours		1526	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2F
Parking Garage Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)				100	100	100									
2 (1-2am)				100	100	100									
3 (2-3am)				100	100	100									
4 (3-4am)				100	100	100									
5 (4-5am)				100	100	100									
6 (5-6am)				100	100	100									
7 (6-7am)				100	100	100									
8 (7-8am)				100	100	100									
9 (8-9am)				100	100	100									
10 (9-10am)				100	100	100									
11 (10-11am)				100	100	100									
12 (11-12pm)		N/A		100	100	100					N/A				
13 (12-1pm)				100	100	100									
14 (1-2pm)				100	100	100									
15 (2-3pm)				100	100	100									
16 (3-4pm)				100	100	100									
17 (4-5pm)				100	100	100									
18 (5-6pm)				100	100	100									
19 (6-7pm)				100	100	100									
20 (7-8pm)				100	100	100									
21 (8-9pm)				100	100	100									
22 (9-10pm)				100	100	100									
23 (10-11pm)				100	100	100									
24 (11-12am)				100	100	100									
Total/Day				2400	2400	2400									
Total/Week					168	hours									
Total/Year					8760	hours									

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2G
Restaurant Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	15	30	20	15	20	20	on	on	on	20	20	25	0	0	0
2 (1-2am)	15	25	20	15	15	15	on	on	on	15	15	20	0	0	0
3 (2-3am)	5	5	5	15	15	15	on	on	on	15	15	20	0	0	0
4 (3-4am)	0	0	0	15	15	15	off	off	off	0	0	0	0	0	0
5 (4-5am)	0	0	0	15	15	15	off	off	off	0	0	0	0	0	0
6 (5-6am)	0	0	0	20	15	15	off	off	off	0	0	0	0	0	0
7 (6-7am)	0	0	0	40	30	30	off	off	off	0	0	0	0	0	0
8 (7-8am)	5	0	0	40	30	30	on	off	off	60	0	0	0	0	0
9 (8-9am)	5	0	0	60	60	50	on	off	off	55	0	0	0	0	0
10 (9-10am)	5	5	0	60	60	50	on	on	off	45	50	0	0	0	0
11 (10-11am)	20	20	10	90	80	70	on	on	on	40	45	50	0	0	0
12 (11-12pm)	50	45	20	90	80	70	on	on	on	45	50	50	0	0	0
13 (12-1pm)	80	50	25	90	80	70	on	on	on	40	50	40	0	0	0
14 (1-2pm)	70	50	25	90	80	70	on	on	on	35	45	40	0	0	0
15 (2-3pm)	40	35	15	90	80	70	on	on	on	30	40	30	0	0	0
16 (3-4pm)	20	30	20	90	80	70	on	on	on	30	40	30	0	0	0
17 (4-5pm)	25	30	25	90	80	60	on	on	on	30	35	30	0	0	0
18 (5-6pm)	50	30	35	90	90	60	on	on	on	40	40	40	0	0	0
19 (6-7pm)	80	70	55	90	90	60	on	on	on	55	55	50	0	0	0
20 (7-8pm)	80	90	65	90	90	60	on	on	on	60	55	50	0	0	0
21 (8-9pm)	80	70	70	90	90	60	on	on	on	50	50	40	0	0	0
22 (9-10pm)	50	65	35	90	90	60	on	on	on	55	55	50	0	0	0
23 (10-11pm)	35	55	20	50	50	50	on	on	on	45	40	40	0	0	0
24 (11-12am)	20	35	20	30	30	30	on	on	on	25	30	20	0	0	0
Total/Day	750	740	485	1455	1365	1115	2000	1800	1700	790	730	625	0	0	0
Total/Week		49.75	hours		97.55	hours		135	hours		53.05	hours		0	hours
Total/Year		2594	hours		5086	hours		7039	hours		2766	hours		0	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2H
Retail Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	5	5	5	off	off	off	4	11	7	0	0	0
2 (1-2am)	0	0	0	5	5	5	off	off	off	5	10	7	0	0	0
3 (2-3am)	0	0	0	5	5	5	off	off	off	5	8	7	0	0	0
4 (3-4am)	0	0	0	5	5	5	off	off	off	4	6	6	0	0	0
5 (4-5am)	0	0	0	5	5	5	off	off	off	4	6	6	0	0	0
6 (5-6am)	0	0	0	5	5	5	off	off	off	4	6	6	0	0	0
7 (6-7am)	0	0	0	5	5	5	on	on	off	4	7	7	0	0	0
8 (7-8am)	10	10	0	20	10	5	on	on	off	15	20	10	12	9	0
9 (8-9am)	20	20	0	50	30	10	on	on	on	23	24	12	22	21	0
10 (9-10am)	50	50	10	90	60	10	on	on	on	32	27	14	64	56	11
11 (10-11am)	50	60	20	90	90	40	on	on	on	41	42	29	74	66	13
12 (11-12pm)	70	80	20	90	90	40	on	on	on	57	54	31	68	68	35
13 (12-1pm)	70	80	40	90	90	60	on	on	on	62	59	36	68	68	37
14 (1-2pm)	70	80	40	90	90	60	on	on	on	61	60	36	71	69	37
15 (2-3pm)	70	80	40	90	90	60	on	on	on	50	49	34	72	70	39
16 (3-4pm)	80	80	40	90	90	60	on	on	on	45	48	35	72	69	41
17 (4-5pm)	70	80	40	90	90	60	on	on	on	46	47	37	73	66	38
18 (5-6pm)	50	60	20	90	90	40	on	on	off	47	46	34	68	58	34

Hour of Day	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
19 (6-7pm)	50	20	10	60	50	20	on	on	off	42	44	25	68	47	3
20 (7-8pm)	30	20	0	60	30	5	on	on	off	34	36	27	58	43	0
21 (8-9pm)	30	20	0	50	30	5	on	on	off	33	29	21	54	43	0
22 (9-10pm)	0	10	0	20	10	5	off	on	off	23	22	16	0	8	0
23 (10-11pm)	0	0	0	5	5	5	off	off	off	13	16	10	0	0	0
24 (11-12am)	0	0	0	5	5	5	off	off	off	8	13	6	0	0	0
Total/Day	720	750	280	1115	985	525	1500	1600	900	662	690	459	844	761	288
Total/Week		46.30	hours		70.85	hours		100	hours		44.59	hours		52.69	hours
Total/Year		2414	hours		3694	hours		5214	hours		2325	hours		2747	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2I
School Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
2 (1-2am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
3 (2-3am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
4 (3-4am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
5 (4-5am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
6 (5-6am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
7 (6-7am)	0	0	0	5	5	5	off	off	off	5	3	3	0	0	0
8 (7-8am)	5	0	0	30	5	5	on	off	off	10	3	3	0	0	0
9 (8-9am)	75	10	0	85	15	5	on	on	off	34	3	5	30	0	0
10 (9-10am)	90	10	0	95	15	5	on	on	off	60	5	5	30	0	0
11 (10-11am)	90	10	0	95	15	5	on	on	off	63	5	5	30	0	0
12 (11-12pm)	80	10	0	95	15	5	on	on	off	72	5	5	30	0	0
13 (12-1pm)	80	10	0	80	15	5	on	on	off	79	5	5	30	0	0
14 (1-2pm)	80	0	0	80	5	5	on	off	off	83	3	5	30	0	0
15 (2-3pm)	80	0	0	80	5	5	on	off	off	61	3	3	30	0	0
16 (3-4pm)	45	0	0	70	5	5	on	off	off	65	3	3	15	0	0
17 (4-5pm)	15	0	0	50	5	5	on	off	off	10	3	3	0	0	0
18 (5-6pm)	5	0	0	50	5	5	on	off	off	10	3	3	0	0	0
19 (6-7pm)	15	0	0	35	5	5	on	off	off	19	3	3	0	0	0
20 (7-8pm)	20	0	0	35	5	5	on	off	off	25	3	3	0	0	0
21 (8-9pm)	20	0	0	35	5	5	on	off	off	22	3	3	0	0	0
22 (9-10pm)	10	0	0	30	5	5	on	off	off	22	3	3	0	0	0
23 (10-11pm)	0	0	0	5	5	5	off	off	off	12	3	3	0	0	0
24 (11-12am)	0	0	0	5	5	5	off	off	off	9	3	3	0	0	0
Total/Day	710	50	0	990	170	120	1500	500	0	691	80	84	285	0	0
Total/Week		36.00	hours		52.40	hours		80.00	hours		36.19	hours		14.25	hours
Total/Year		1877	hours		2732	hours		4171	hours		1887	hours		743	hours

Wk= Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-2J
Warehouse Occupancy¹

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1am)	0	0	0	5	5	5	off	off	off	2	2	2	0	0	0

Hour of Day (time)	Schedule for Occupancy			Schedule for Lighting Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
2 (1-2am)	0	0	0	5	5	5	off	off	off	2	2	2	0	0	0
3 (2-3am)	0	0	0	5	5	5	off	off	off	2	2	2	0	0	0
4 (3-4am)	0	0	0	5	5	5	off	off	off	2	2	2	0	0	0
5 (4-5am)	0	0	0	5	5	5	off	off	off	5	2	2	0	0	0
6 (5-6am)	0	0	0	5	5	5	off	off	off	7	2	2	0	0	0
7 (6-7am)	0	0	0	5	5	5	off	off	off	7	2	2	0	0	0
8 (7-8am)	15	0	0	40	5	5	on	off	off	10	2	2	0	0	0
9 (8-9am)	70	20	0	70	8	5	on	on	off	30	6	2	0	0	0
10 (9-10am)	90	20	0	90	24	5	on	on	off	36	12	2	0	0	0
11 (10-11am)	90	20	0	90	24	5	on	on	off	36	12	2	30	0	0
12 (11-12pm)	90	20	0	90	24	5	on	on	off	46	17	2	0	0	0
13 (12-1pm)	50	10	0	80	5	5	on	on	off	57	4	4	0	0	0
14 (1-2pm)	85	10	0	90	5	5	on	on	off	43	4	4	0	0	0
15 (2-3pm)	85	10	0	90	5	5	on	on	off	38	2	2	0	0	0
16 (3-4pm)	85	10	0	90	5	5	on	on	off	40	2	2	40	0	0
17 (4-5pm)	20	0	0	90	5	5	on	off	off	30	2	2	0	0	0
18 (5-6pm)	0	0	0	30	5	5	off	off	off	18	2	2	0	0	0
19 (6-7pm)	0	0	0	5	5	5	off	off	off	3	2	2	0	0	0
20 (7-8pm)	0	0	0	5	5	5	off	off	off	3	2	2	0	0	0
21 (8-9pm)	0	0	0	5	5	5	off	off	off	3	2	2	0	0	0
22 (9-10pm)	0	0	0	5	5	5	off	off	off	3	2	2	0	0	0
23 (10-11pm)	0	0	0	5	5	5	off	off	off	3	2	2	0	0	0
24 (11-12am)	0	0	0	5	5	5	off	off	off	3	2	2	0	0	0
Total/Day	680	120	0	915	180	120	1000	800	0	429	91	52	70	0	0
Total/Week		35.20	hours		48.75	hours		58.00	hours		22.88	hours		3.50	hours
Total/Year		1835	hours		2542	hours		3024	hours		1193	hours		182	hours

Wk= Weekday

- Schedules for occupancy, lighting, receptacle, HVAC system and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. THESE VALUES MAY BE USED ONLY IF ACTUAL SCHEDULES ARE NOT KNOWN.

TABLE 3-3
HVAC Systems of Prototype Buildings³

Use	System #	Remarks
1. Assembly		
a. Churches (any size)	1	
b. ≤ 50,000 ft ² or ≤ 3 floors	1 or 3	Note 2
c. > 50,000 ft ² or > 3 floors	3	
2. Health		
a. Nursing Home (any size)	2	
b. ≤ 15,000 ft ²	1	
c. > 15,000 ft ² and ≤ 50,000 ft ²	4	Note 3
d. > 50,000 ft ²	5	Note 3,4
3. Hotel/Motel		
a. ≤ 3 Stories	2	Note 6
b. > 3 Stories	6	Note 7
4. Light Manufacturing	1 or 3	
5. Office		
a. ≤ 20,000 ft ²	1	
b. > 20,000 ft ² and either ≤ 3 floors or ≤ 75,000 ft ²	4	
c. > 75,000 ft ² or > 3 floors	5	
6. Restaurant	1 or 3	Note 2
7. Retail		
a. ≤ 50,000 ft ²	1 or 3	Note 2
b. > 50,000 ft ²	4 or 5	Note 2
8. Schools		
a. ≤ 75,000 ft ² or ≤ 3 floors	1	
b. > 75,000 ft ² or > 3 floors	3	
9. Warehouse		Note 5

Footnote to TABLE 3-3: The system and energy types presented in this table are not intended as requirements or recommendations for the proposed design. Floors areas in the table are the total conditioned floor areas for the

listed use in the building. The number of floors indicated in the table is the total number of occupied floors for the listed use.

TABLE 3-3 (cont.)

HVAC System Descriptions for Prototype Buildings¹

HVAC Component	System #1	System #2
System Description	Packaged rooftop single zone, one unit per zone.	Packaged terminal air conditioner with space heater or heat pump, heating or cooling unit per zone.
Fan System		
Design Supply Circulation Rate	Note 10	Note 11
Supply Fan Control	Constant volume.	Fan cycles with call for heating or cooling.
Return Fan Control	N.A.	N.A.
Cooling System	Direct expansion air cooled	Direct expansion air cooled.
Heating System	Furnace, heat pump, or electric resistance.	Heat pump with electric resistance auxiliary or air conditioner with space heater.
Remarks	Drybulb economizer per Section 1433, heat recovery if required by Section 1436.	No economizer, if not required by Section 1433.

TABLE 3-3 (cont.)
HVAC Systems Descriptions for Prototype Buildings¹

HVAC Component	System #3	System #4
System Description	Air handler per zone with central plant.	Packaged rooftop VAV with perimeter reheat and fan-powered terminal units.
Fan System		
Design Supply Circulation Rate	Note 10	Note 10
Supply Fan Control	Constant volume.	VAV with forward curved centrifugal fan and variable inlet fans.
Return Fan Control	Constant volume.	VAV with forward curved centrifugal fan and discharge dampers.
Cooling System	Chilled water (Note 12)	Direct expansion air cooled.
Heating System	Hot water (Note 13)	Hot water (Note 13) or electric resistance.
Remarks	Drybulb economizer per Section 1433, heat recovery if required by Section 1436.	Drybulb economizer per Section 1433. Minimum VAV setting per Section 1435 Exception 1, Supply air reset by zone of greatest cooling demand, heat recovery if required by Section 1436.

TABLE 3-3 (cont.)
HVAC System Descriptions for Prototype Buildings¹

HVAC Component	System #5	System #6
System Description	Built-up central VAV with perimeter reheat and fan-powered terminal units	Four-pipe fan coil per zone with central plant.
Fan System		
Design Supply Circulation Rate	Note 10	Note 10
Supply Fan Control	VAV with air-foil centrifugal fan and AC frequency variable speed drive.	Fan cycles with call for heating or cooling.
Return Fan Control	VAV with air-foil centrifugal fan and AC frequency variable speed drive.	NA
Cooling System	Chilled water (Note 12)	Chilled water (Note 12)
Heating System	Hot water (Note 13) or electric resistance.	Hot water (Note 13) or electric resistance.
Remarks	Drybulb economizer per Section 1433. Minimum VAV setting per Section 1435 Exception 1, Supply air reset by zone of greatest cooling demand, heat recovery if required by Section 1436.	No economizer, if not required by Section 1433.

Numbered Footnotes for TABLE 3-3
HVAC System Descriptions for Prototype Buildings

1. The systems and energy types presented in this Table are not intended as requirements or recommendations for the proposed design.
2. For occupancies such as restaurants, assembly and retail that are part of a mixed use building which, according to Table 3-3, includes a central chilled water

plant (systems 3, 5, or 6), chilled water system type 3 or 5 shall be used as indicated in the table.

3. Constant volume may be used in zones where pressurization relationships must be maintained by code. Where constant volume is used, the system shall have heat recovery if required by Section 1436. VAV shall be used in all other areas, in accordance with Sections 1432 through 1439.
4. Provide run-around heat recovery systems for all fan systems with a minimum outside air intake greater than 70%. Recovery effectiveness shall be 0.50.
5. If a warehouse is not intended to be mechanically cooled, both the standard and proposed designs shall be calculated assuming no mechanical cooling.
6. The system listed is for guest rooms only. Areas such as public areas and back-of-house areas shall be served by system 4. Other areas such as offices and retail shall be served by systems listed in Table 3-3 for these occupancy types.
7. The system listed is for guest rooms only. Areas such as public areas and back-of-house areas shall be served by system 5. Other areas such as offices and retail shall be served by systems listed in Table 3-3 for these occupancy types.
8. Reserved.
9. Reserved.
10. Design supply air circulation rate shall be based on a supply-air-to-room air temperature difference of 20°F. A higher supply air temperature may be used if required to maintain a minimum circulation rate of 4.5 air changes per hour or 15 cfm per person to each zone served by the system, at design conditions. If return fans are specified, they shall be sized for the supply fan capacity less the required minimum ventilation with outside air, or 75% of the supply fan capacity, whichever is larger. Except where noted, supply and return fans shall be operated continuously during occupied hours.
11. Fan energy when included in the efficiency rating of the unit as defined in Section 1411, need not be modeled explicitly for this system. The fan shall cycle with calls for heating or cooling.
12. Chilled water systems shall be modeled using a reciprocating chiller for systems with total cooling capacities less than 175 tons, and centrifugal chillers for systems with cooling capacities of 175 tons or greater. For systems with cooling capacities of 600 tons or more, the standard design energy consumption shall be calculated using two centrifugal chillers, lead/lag controlled. Chilled water shall be assumed to be controlled at a constant 44°F. Chiller water pumps shall be sized using a 12°F temperature rise, from 44°F to 56°F, operating at 65% combined impeller and motor efficiency. Condenser water pumps shall be sized using a 10°F temperature rise, operating at 60% combined impeller and motor efficiency. The cooling tower shall be an open circuit, centrifugal blower type sized for the larger of 85°F leaving water temperature or 10°F approach to design wetbulb temperature. The tower shall be controlled to provide a 65°F leaving water temperature whenever weather conditions permit, floating up to design leaving water temperatures at design conditions. Chilled water supply temperature shall be reset in accordance with Section 1432.2.2.
13. Hot water system shall include a natural draft fossil fuel or electric boiler. The hot water pump shall be sized based on a 30°F temperature drop, from 180°F to

150°F, operating at a combined impeller and motor efficiency of 60%. Hot water supply temperature shall be reset in accordance with Section 1432.2.2.

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-99903, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-99903, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-99903, filed 10/18/93, effective 4/1/94.]

WAC 51-11-99904 Section 4—Suggested software for systems analysis approach.

Program Name	Source
Blast 3.0 (Level 334)	Blast Support Office University of Illinois Dept. of Mechanical and Industrial Engineering 1206 W. Green Street, Room 140, MEB Urbana, IL 61801 (217) 244-8182
DOE 2.1E	Energy Science and Technology Software Center (ESTSC) PO Box 1220 Oakridge, TN 37831-1020 423-576-2606
DOE 2.1E or DOE 2.2	James J. Hirsch & Associates Building Performance Analysis Software & Consulting 12185 Presilla Road Camarillo, CA 93012-9243 (805) 532-1045
EnergyPlus	Kathy Ellington Lawrence Berkeley National Laboratory (LBNL) Building 90, Room 3147 Berkeley, CA 94720-0001 (510) 486-5711
ESAS	Ross Meriweather Consulting, Engineering 3315 Outrider San Antonio, TX 78247-4405 210-490-7081
ESP-II	Automated Procedures for Engineering Consultants, Inc. 40 W. 4th Centre, Suite 2100 Dayton, OH 45402 937-228-2602
HAP 3.24	Carrier Building Systems and Services 3215 South 116th St., Suite 133 Tukwila, WA 98168 (206)-439-0097
Trace 600 Version 18.11 or Trace 700	The Trane Co. 3600 Pammel Creek Rd. Lacrosse, WI 54601 608-787-3926

[Statutory Authority: RCW 19.27A.025, 19.27A.045. 01-03-010, § 51-11-99904, filed 1/5/01, effective 7/1/01; 98-03-003, § 51-11-99904, filed 1/8/98, effective 7/1/98. Statutory Authority: RCW 19.27A.025. 93-21-052, § 51-11-99904, filed 10/18/93, effective 4/1/94.]

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Chapter 51-13 WAC

VENTILATION AND INDOOR AIR QUALITY

WAC

51-13-101	Scope and general requirements.
51-13-301	Compliance with this chapter.
51-13-302	Mechanical ventilation criteria using performance or design methods for Group R Occupancies four stories and less.
51-13-303	Mechanical ventilation criteria using prescriptive methods for Group R Occupancies four stories and less.
51-13-304	Mechanical ventilation criteria and minimum ventilation performance for all other occupancies not covered in sections 302 and 303.
51-13-503	Radon prescriptive requirements.

WAC 51-13-101 Scope and general requirements.

101.1 Title: This Code shall be known as the Washington State Ventilation and Indoor Air Quality Code. It is herein referred to as "this Code".

101.2 Intent: The purpose of this Code is to provide minimum standards for the design and installation of mechanical ventilation systems, the selection of structural materials used within the conditioned space, and the construction of radon mitigation systems for new construction.

It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques. These provisions are structured to permit compliance with the intent of this Code by demonstration of performance through on site testing or through engineered design. This Code is not intended to abridge any safety or health requirements required under any other applicable codes or ordinances.

101.3 Scope: This Code sets forth minimum requirements for ventilation in all occupancies, including the design of new construction.

101.3.1 Application to Existing Buildings

101.3.1.1 Additions to Existing Buildings: Additions to existing buildings or structures may be made without making the entire building comply, provided that the new addition shall conform to the provisions of this Code.

EXCEPTIONS	1. Additions with less than 500 square feet of conditioned floor area are exempt from the requirements in this code for Whole House Ventilation Systems, Section 302.2.2.
	2. Additions or alterations to existing buildings which do not require the construction of foundations, crawl-spaces, slabs, or basements shall not be required to meet the requirements for radon protection.

101.3.1.2 Alterations and Repairs: All alterations and repairs may be made to existing or moved buildings built or permitted prior to the enforcement of this Code without making the entire building comply with the provisions of this Code, provided the alterations or repairs comply with this Code.

EXCEPTION: Air handling/conditioning equipment, which is being replaced without alteration or repair of the associated air distribution system is exempt from the requirements of this Code.

101.3.1.3 Historic Buildings: Historic buildings are exempt from this Code only to the extent necessary to pre-

serve those features essential to their historical appearance or function.

101.4 Operating Instructions: Installers shall provide the manufacturer's installation, operating instructions, and a whole house ventilation system operation description.

[Statutory Authority: RCW 19.27.190, 19.27.020. 01-02-099, § 51-13-101, filed 1/3/01, effective 7/1/01. Statutory Authority: RCW 19.27.190(2) and 1992 c 132. 93-02-056, § 51-13-101, filed 1/6/93, effective 7/1/93. Statutory Authority: RCW 19.27.190. 91-01-102, § 51-13-101, filed 12/18/90, effective 7/1/91.]

WAC 51-13-301 Compliance with this chapter.

301.1 General: The criteria of this chapter establish the design conditions upon which the minimum ventilation systems are to be based for all occupancies. Group R Occupancies four (4) stories and less as defined by the Washington State Building Code shall comply with either Section 302 or 303. Section 304 applies to all other occupancies.

301.2 Testing: At the discretion of the building official, flow testing may be required to verify that the mechanical system(s) satisfies the requirements of this section. 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.

[Statutory Authority: RCW 19.27.190, 19.27.020. 01-02-099, § 51-13-301, filed 1/3/01, effective 7/1/01. Statutory Authority: RCW 19.27.190. 91-01-102, § 51-13-301, filed 12/18/90, effective 7/1/91.]

WAC 51-13-302 Mechanical ventilation criteria using performance or design methods for Group R Occupancies four stories and less.

302.1 Applicability: Group R Occupancies four (4) stories and less as defined by the Washington State Building Code shall comply with either this section or Section 303.

302.1.1 Compliance by Calculations or Testing: Compliance with this section shall be demonstrated through engineering calculation or performance testing. Documentation of calculations or performance test results shall be submitted to the building official. Performance testing shall be conducted in accordance with recognized test methods.

302.1.2 Minimum Ventilation Performance: Each dwelling unit or guest room shall be equipped with source specific and whole house ventilation systems designed and installed to satisfy the ventilation requirements of this section.

All public corridors shall meet the ventilation requirements in section 1203.3 of the Uniform Building Code.

302.2 Source Specific Ventilation Requirements.

302.2.1 Source Specific Ventilation: Source specific exhaust ventilation is required in each kitchen, bathroom, water closet, laundry room, indoor swimming pool, spa, and other rooms where excess water vapor or cooking odor is produced.

The minimum source specific ventilation effective exhaust capacity shall be not less than levels specified in Table 3-1.

302.2.2 Source Specific Ventilation Controls: Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means. Source specific ventilation system controls shall be readily accessible.

302.2.3 Source Specific Ventilation Ducts: Source specific ventilation ducts shall terminate outside the building. Exhaust ducts in systems which are designed to operate intermittently shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4. Terminal elements shall have at least the equivalent net free area of the duct work. Terminal elements for exhaust fan duct systems shall be screened or otherwise protected from entry by leaves or other material.

302.3 Requirements for Whole House Ventilation Systems.

302.3.1 Whole House Ventilation Systems: Each dwelling unit shall be equipped with a whole house ventilation system which shall be capable of providing the volume of outdoor air specified in Table 3-2 under normal operating conditions.

EXCEPTION: Maximum flow rates listed in Table 3-2 do not apply to heat recovery ventilation systems.

302.3.2 Whole House Ventilation System Controls: All ventilation system controls shall be readily accessible. Controls for whole house ventilation systems shall be capable of operating the ventilation system without energizing other energy-consuming appliances.

Intermittently operated whole house ventilation systems shall be constructed to have the capability for continuous operation, and shall have a manual control and an automatic control, such as a clock timer. At the time of final inspection, the automatic control timer shall be set to operate the whole house fan for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

302.3.3 Fan Noise: Whole house fans located four feet or less from the interior grille shall have a sone rating of 1.5 or less measured at 0.1 inches water gauge. Manufacturer's noise ratings shall be determined as per HVI 915 (October 1995). Remotely mounted fans shall be acoustically isolated from the structural elements of the building and from attached duct work using insulated flexible duct or other approved material.

EXCEPTION: Whole house ventilation systems which are integrated with forced-air heating systems or heat-recovery ventilation systems are exempt from the sone rating requirements of this section.

302.3.4 Whole House Ventilation Ducts: All ducts shall terminate outside the building. Exhaust ducts in systems which are designed to operate intermittently shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.

All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

302.3.5 Outdoor Air.

302.3.5.1 Outdoor Air Supply: A mechanical system shall supply outdoor air as required in Section 302.3.1. The mechanical system may consist of exhaust fans, supply fans, or both.

302.3.5.2 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- a) Closer than ten feet from an appliance vent outlet, unless such vent outlet is three feet above the outdoor air inlet.
- b) Where it will pick up objectionable odors, fumes, or flammable vapors.
- c) A hazardous or unsanitary location.
- d) A room or space having any fuel-burning appliances therein.
- e) Closer than ten feet from a vent opening of a plumbing drainage system unless the vent opening is at least three feet above the air inlet.
- f) Attic, crawl spaces, garages.

302.3.5.3 Outdoor Air Distribution: Outdoor air shall be distributed to each habitable room by means such as individual inlets, separate duct systems, or a forced-air system. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means where permitted by the Uniform Building Code. Doors shall be undercut to a minimum of one-half inch above the surface of the finish floor covering.

302.3.5.4 Doors and operable lites in windows are deemed not to meet the outdoor air supply intake requirements.

302.3.5.5 Individual Room Outdoor Air Inlets: Where provided, individual room outdoor air inlets shall:

- a) Have controllable and secure openings;
- b) Be sleeved or otherwise designed so as not to compromise the thermal properties of the wall or window in which they are placed.

302.3.5.6 Ventilation Integrated with Forced-Air Systems: Where outdoor air is provided by a forced-air system, the outdoor air connection to the return air stream shall be located upstream of the forced-air system blower and shall not be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger.

[Statutory Authority: RCW 19.27.190, 19.27.020, 01-02-099, § 51-13-302, filed 1/3/01, effective 7/1/01. Statutory Authority: RCW 19.27.190, 95-01-128, § 51-13-302, filed 12/21/94, effective 6/30/95. Statutory Authority: RCW 19.27.190(2) and 1992 c 132, 93-02-056, § 51-13-302, filed 1/6/93, effective 7/1/93. Statutory Authority: RCW 19.27.190, 91-01-102, § 51-13-302, filed 12/18/90, effective 7/1/91.]

WAC 51-13-303 Mechanical ventilation criteria using prescriptive methods for Group R Occupancies four stories and less.

303.1 Applicability: Group R Occupancies 4 stories or less shall comply with this section or Section 302. This section establishes minimum prescriptive design requirements for intermittently operated systems. Continuously operated systems shall comply with Section 302. A system which meets the requirements of this section shall be deemed to satisfy the requirements of this chapter.

303.2 Minimum Ventilation Performance: Each dwelling unit or guest room shall be equipped with source specific and whole house ventilation systems designed and installed to satisfy the ventilation requirements of this section. All public corridors shall meet the ventilation requirements in Section 1203.3 of the Uniform Building Code.

303.3 Source Specific Exhaust Ventilation Requirements.

303.3.1 Source Specific Ventilation: Source specific exhaust ventilation is required in each kitchen, bathroom, water closet, laundry room, indoor swimming pool, spa, and other rooms where excess water vapor or cooking odor is produced. The minimum source specific ventilation effective exhaust capacity shall be not less than levels specified in Table 3-1.

303.3.2 Source Specific Exhaust Fans: Exhaust fans providing source specific ventilation shall have a minimum fan flow rating not less than 50 cfm at 0.25 inches water gauge for bathrooms, laundries, or similar rooms and 100 cfm at 0.25 inches water gauge for kitchens. Manufacturers' fan flow ratings shall be determined as per HVI 916 (April 1995) or AMCA 210.

EXCEPTION: Where a range hood or down draft exhaust fan is used to satisfy the source specific ventilation requirements for kitchens, the range hood or down draft exhaust shall not be less than 100 cfm at 0.10 inches water gauge.

303.3.3 Source Specific Ventilation Controls: Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means. Source specific ventilation system controls shall be readily accessible.

303.3.4 Source Specific Ventilation Ducts: Source specific ventilation ducts shall terminate outside the building. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4. Terminal elements shall have at least the equivalent net free area of the duct work. Terminal elements for exhaust fan duct systems shall be screened or otherwise protected from entry by leaves or other material.

303.4 Prescriptive Whole House Ventilation Systems: Whole house ventilation shall be provided by a system that meets the requirements of either Section 303.3.1, 303.3.2, 303.3.3, or 303.3.4. A system which meets all of the requirements of one of these sections shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.1 Intermittent Whole House Ventilation Using Exhaust Fans: This section establishes minimum prescriptive requirements for intermittent whole house ventilation systems using exhaust fans. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.1.1 Whole House Ventilation Fans: Exhaust fans providing whole house ventilation shall have a flow rating at 0.25 inches water gauge as specified in Table 3-2. Manufacturers' fan flow ratings shall be determined according to HVI 916 (April 1995) or AMCA 210.

303.4.1.2 Fan Noise: Whole house fans located four feet or less from the interior grille shall have a sone rating of 1.5 or less measured at 0.1 inches water gauge. Manufacturer's noise ratings shall be determined as per HVI 915 (October 1995). Remotely mounted fans shall be acoustically isolated from the structural elements of the building and from attached duct work using insulated flexible duct or other approved material.

303.4.1.3 Fan Controls: The whole house ventilation fan shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation fan without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house fan for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.1.4 Exhaust Ducts: All exhaust ducts shall terminate outside the building. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.

303.4.1.5 Outdoor Air Inlets: Outdoor air shall be distributed to each habitable room by individual outdoor air inlets. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means where permitted by the Uniform Building Code. Doors shall be undercut to a minimum of one-half inch above the surface of the finish floor covering.

Individual room outdoor air inlets shall:

- a. Have controllable and secure openings;
- b. Be sleeved or otherwise designed so as not to compromise the thermal properties of the wall or window in which they are placed;
- c. Provide not less than four square inches of net free area of opening for each habitable space. Any inlet or combination of inlets which provide 10 cfm at 10 Pascals as determined by the Home Ventilating Institute Air Flow Test Standard (HVI 901 (November 1996)) are deemed equivalent to four square inches net free area.

Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
- b. Where it will pick up objectionable odors, fumes or flammable vapors.
- c. A hazardous or unsanitary location.
- d. A room or space having any fuel-burning appliances therein.
- e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
- f. Attic, crawl spaces, or garages.

EXCEPTION: Exhaust only ventilation systems do not require outdoor air inlets if the home has a ducted forced air heating system that communicates with all habitable rooms and the interior doors are undercut to a minimum of one-half inch above the surface of the finish floor covering.

303.4.2 Prescriptive Requirements for Intermittent Whole House Ventilation Integrated with a Forced-Air System: This section establishes minimum prescriptive requirements for intermittent whole house ventilation systems integrated with forced-air ventilation systems. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.2.1 Integrated Whole House Ventilation Systems: Integrated Whole House Ventilation Systems shall provide outdoor air at the rates specified in Table 3-2. Integrated Forced-Air Ventilation Systems shall distribute outdoor air to each habitable room through the forced-air system ducts. Integrated Forced-Air Ventilation Systems shall have an outdoor air inlet duct connecting a terminal element on the outside of the building to the return air plenum of the forced-air system, at a point within four (4) feet upstream of the air handler. The outdoor air inlet duct connection to the return air stream shall be located upstream of the forced-air system blower and shall not be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger. The outdoor air inlet duct shall be prescriptively sized in accordance with Table 3-5. The system will be equipped with one of the following:

1. A motorized damper connected to the automatic ventilation control as specified in Section 303.3.2.2; or
2. A damper installed and set to meet minimum flow rates as specified in Table 3-2, by either field testing or following manufacturer's installation instructions based on site conditions; or
3. An automatic flow regulated device with field measured or field calculated minimum negative pressure of 0.07 inches water gauge at the point where the outside air duct is connected to the return air plenum.

303.4.2.2 Ventilation Controls: The whole house ventilation system shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the forced air system blower and if applicable the automatic damper. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation system

without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.2.3 Ventilation Duct Insulation: All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

303.4.2.4 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
- b. Where it will pick up objectionable odors, fumes or flammable vapors.
- c. A hazardous or unsanitary location.
- d. A room or space having any fuel-burning appliances therein.
- e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
- f. Attic, crawl spaces, or garages.

303.4.3 Prescriptive Requirements for Intermittent Whole House Ventilation Using a Supply Fan: This section establishes minimum prescriptive requirements for intermittent whole house ventilation systems using an inline supply fan. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.3.1 Outdoor Air: Supply Fan Ventilation Systems shall distribute outdoor air to each habitable room through the forced-air system ducts or through dedicated ducts to each habitable room. Supply fans shall have the capacity to provide the amount of outdoor air specified in Table 3-2 at 0.4 inches water gauge as per HVI 916 (April 1995). The outdoor air must be filtered before it is delivered to habitable rooms. The filter may be located at the intake device, inline with the fan, or, in the case of a connection to the return plenum of the airhandler, using the furnace filter. An outdoor air inlet shall be connected to either the supply or return air stream.

303.4.3.2 Ducts: An outdoor air inlet duct connection to the supply air stream shall be located downstream of the forced-air system blower. An outdoor air inlet duct connection to the return air stream shall be located at least four feet upstream of the forced-air system blower and its filter. Neither type of duct shall be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger. The outdoor air inlet duct shall be prescriptively sized in accordance with Table 3-6. The terminal element on the outside of the building shall be sized two inches in diameter larger than the outdoor air inlet duct.

303.4.3.3 Dampers: The system shall be equipped with a back-draft damper and one of the following:

1. A calibrated manual volume damper installed and set to meet the measured flow rates specified in Table 3-2 by

field testing with a pressure gauge and/or following manufacturer's installation instructions, or

2. A manual volume damper installed and set to meet the measured flow rates specified in Table 3-2 by field testing with a flow hood or a flow measuring station; or

3. An automatic flow-regulating device sized to the specified flow rates in Table 3-2 which provides constant flow over a pressure range of 0.2 to 0.6 inches water gauge.

303.4.3.4 Ventilation Controls: The whole house ventilation system shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the inline supply fan. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.3.5 Ventilation Duct Insulation: All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

303.4.3.6 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
- b. Where it will pick up objectionable odors, fumes or flammable vapors.
- c. A hazardous or unsanitary location.
- d. A room or space having any fuel-burning appliances therein.
- e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
- f. Attic, crawl spaces, or garages.

303.4.4 Prescriptive Requirements for Intermittent Whole House Ventilation Using a Heat Recovery Ventilation System: This section establishes minimum prescriptive requirements for intermittent whole house ventilation using a heat recovery ventilation system.

303.4.4.1 Heat Recovery Ventilation Systems: All duct work in heat recovery ventilation systems shall be not less than six inch diameter. Balancing dampers shall be installed on the inlet and exhaust side. Flow measurement grids shall be installed on the supply and return. System minimum flow rating shall be not less than that specified in Table 3-2. Maximum flow rates in Table 3-2 do not apply to heat recovery ventilation systems.

303.4.4.2 Ventilation Controls: The whole house ventilation system shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the inline supply fan. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventila-

tion system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.4.3 Ventilation Duct Insulation: All supply ducts in the conditioned space installed upstream of the heat exchanger shall be insulated to a minimum of R-4.

303.4.4.4 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
- Where it will pick up objectionable odors, fumes or flammable vapors.
- A hazardous or unsanitary location.
- A room or space having any fuel-burning appliances therein.
- Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
- Attic, crawl spaces, or garages.

[Statutory Authority: RCW 19.27.190, 19.27.020, 01-02-099, § 51-13-303, filed 1/3/01, effective 7/1/01. Statutory Authority: RCW 19.27.190(2) and 1992 c 132, 93-02-056, § 51-13-303, filed 1/6/93, effective 7/1/93. Statutory Authority: RCW 19.27.190, 91-01-102, § 51-13-303, filed 12/18/90, effective 7/1/91.]

WAC 51-13-304 Mechanical ventilation criteria and minimum ventilation performance for all other occupancies not covered in sections 302 and 303.

304.1 Ventilation: The minimum requirements for operable area to provide natural ventilation are specified in the Uniform Building Code (UBC) as adopted by the state of Washington.

Where a mechanical ventilation system is installed, the mechanical ventilation system shall be capable of supplying ventilation air to each zone with the minimum outdoor air quantities specified in Table 3-4.

EXCEPTION: 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 3-4 estimated maximum occupancy values.

The outdoor air shall be ducted in a fully enclosed path directly to every air handling unit in each zone not provided with sufficient operable area for natural ventilation.

EXCEPTION: Ducts may terminate within 12 inches of the intake to an HVAC unit provided they are physically fastened so that the outside air duct is directed into the unit intake.

In all parking garages, other than open parking garages as defined in UBC 311.9, used for storing or handling of automobiles operating under their own power and on all loading platforms in bus terminals, ventilation shall be provided at 1.5 cfm per square foot of gross floor area. The building official may approve an alternate ventilation system designed to exhaust a minimum fourteen thousand cfm for each operating vehicle. Such system shall be based on the anticipated instantaneous movement rate of vehicles but not less than 2.5 percent (or one vehicle) of the garage capacity. Automatic carbon monoxide sensing systems may be submitted for approval.

In all buildings used for the repair of automobiles, each repair stall shall be equipped with an exhaust extension duct, extending to the outside of the building, which if over ten feet in length, shall mechanically exhaust three hundred cfm. Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

Combustion air requirements shall conform to the requirements of Chapter 7 of the UMC.

Mechanical refrigerating equipment and rooms storing refrigerants shall conform to the requirements of Chapter 11 of the UMC.

304.2 Alternate Systems: Alternate systems designed in accordance with ASHRAE Standard 62.1.1999 shall be permitted.

TABLE 3-1
Minimum Source Specific Ventilation Capacity
Requirements

	Bathrooms	Kitchens
Intermittently operating	50 cfm	100 cfm
Continuous operation	20 cfm	25 cfm

TABLE 3-2
Ventilation Rates For All Group R Occupancies four (4) stories and less*
Minimum and Maximum Ventilation Rates: Cubic Feet Per Minute (CFM)

Floor Area, ft²	Bedrooms													
	2 or less		3		4		5		6		7		8	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<500	50	75	65	98	80	120	95	143	110	165	125	188	140	210
501-1000	55	83	70	105	85	128	100	150	115	173	130	195	145	218
1001-1500	60	90	75	113	90	135	105	158	120	180	135	203	150	225
1501-2000	65	98	80	120	95	143	110	165	125	188	140	210	155	233
2001-2500	70	105	85	128	100	150	115	173	130	195	145	218	160	240
2501-3000	75	113	90	135	105	158	120	180	135	203	150	225	165	248
3001-3500	80	120	95	143	110	165	125	188	140	210	155	233	170	255
3501-4000	85	128	100	150	115	173	130	195	145	218	160	240	175	263
4001-5000	95	143	110	165	125	188	140	210	155	233	170	255	185	278
5001-6000	105	158	120	180	135	203	150	225	165	248	180	270	195	293
6001-7000	115	173	130	195	145	218	160	240	175	263	190	285	205	308

Floor Area, ft ²	Bedrooms													
	2 or less		3		4		5		6		7		8	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
7001-8000	125	188	140	210	155	233	170	255	185	278	200	300	215	323
8001-9000	135	203	150	225	165	248	180	270	195	293	210	315	225	338
>9000	145	218	160	240	175	263	190	285	205	308	220	330	235	353

*For residences that exceed 8 bedrooms, increase the minimum requirement listed for 8 bedrooms by an additional 15 CFM per bedroom. The maximum CFM is equal to 1.5 times the minimum.

TABLE 3-3
Prescriptive Exhaust Duct Sizing

Fan Tested CFM @ 0.25 W.G.	Minimum Flex Diameter	Maximum Length Feet	Minimum Smooth Diameter	Maximum Length Feet	Maximum Elbows ¹
50	4 inch	25	4 inch	70	3
50	5 inch	90	5 inch	100	3
50	6 inch	No Limit	6 inch	No Limit	3
80	4 inch ²	NA	4 inch	20	3
80	5 inch	15	5 inch	100	3
80	6 inch	90	6 inch	No Limit	3
100	5 inch ²	NA	5 inch	50	3
100	6 inch	45	6 inch	No Limit	3
125	6 inch	15	6 inch	No Limit	3
125	7 inch	70	7 inch	No Limit	3

- For each additional elbow subtract 10 feet from length.
- Flex ducts of this diameter are not permitted with fans of this size.

TABLE 3-4
Outdoor air requirements for ventilation¹
Occupancies not subject to sections 302 and 303

Application	Estimated Maximum ² Occupancy P/1000 ft ² or 100 m ²	Outdoor Air Requirements cfm/person
Dry Cleaners, Laundries³		
Commercial laundry	10	25
Commercial dry cleaner	30	30
Storage, pick up	30	35
Coin-operated laundries	20	15
Coin-operated dry cleaner	20	15
Dwelling Units In Buildings Greater Than Four Stories or Attached to I-Occupancy Facilities		
Bedroom & living area ²⁴		15
Food and Beverage Service		
Dining rooms	70	20
Cafeteria, fast food	100	20
Bars, cocktail lounges ⁴	100	30
Kitchens (cooking) ²³	20	15
Garages, Repair, Service Stations		
Enclosed parking garage ⁵		1.50 cfm/ft.sq.
Auto repair rooms		1.50 cfm/ft.sq.
Hotels, Motels, Resorts, Congregate Residences with More Than Four Stories⁶		
Bedrooms		30 cfm/room
Living Rooms		30 cfm/room
Bath ⁷		35 cfm/room
Lobbies	30	15
Conference rooms	50	20
Assembly rooms	120	15
Gambling casinos ⁴	120	30
Offices		
Office space ⁹	7	20
Reception area	60	15
Telecommunication centers and data entry areas	60	20
Conference rooms	50	20
Public Spaces		
Corridors and utilities		0.05 cfm/ft.sq.

Application	Estimated Maximum ² Occupancy P/1000 ft ² or 100 m ²	Outdoor Air Requirements cfm/person
Public restroom, cfm/wc or urinal ¹⁰		50
Lockers and dressing rooms		0.50 cfm/ft.sq.
Smoking lounge ¹¹	70	60
Elevators ¹²		1.0 cfm/ft.sq.
Retail Stores, Sales Floors, and Show Room Floors		
Basement and street	30	0.30 cfm/ft.sq.
Upper floors	20	0.20 cfm/ft.sq.
Storage rooms	15	0.15 cfm/ft.sq.
Dressing rooms		0.20 cfm/ft.sq.
Malls and arcades	20	0.20 cfm/ft.sq.
Shipping and receiving	10	0.15 cfm/ft.sq.
Smoking lounge ¹¹	70	60
Warehouses	5	0.05 cfm/ft.sq.
Specialty Shops		
Barber	25	15
Beauty	25	25
Reducing salons	20	15
Florists ¹³	8	15
Clothiers, furniture		0.30 cfm/ft.sq.
Hardware, drugs, fabric	8	15
Supermarkets	8	15
Pet shops		1.00 cfm/ft.sq.
Sports and Amusement¹⁴		
Spectator areas	150	15
Game rooms	70	25
Ice arenas (playing areas)		0.50 cfm/ft.sq.
Swimming Pools (pool and deck area) ¹⁵		0.50 cfm/ft.sq.
Playing floor (gymnasium)	30	20
Ballrooms and discos	100	25
Bowling alleys (seating areas)	70	25
Theaters¹⁶		
Ticket booths	60	20
Lobbies	150	20
Auditorium	150	20
Stages, studios	70	15
Transportation¹⁷		
Waiting rooms	100	15
Platforms	100	15
Vehicles	150	15
Workrooms		
Meat processing ¹⁸	10	15
Photo studios	10	15
Darkrooms	10	0.50 cfm/ft.sq.
Pharmacy	20	15
Bank vaults	5	15
Duplicating, printing ¹⁹		0.50 cfm/ft.sq.
INSTITUTIONAL FACILITIES		
Education		
Classroom	50	15
Laboratories ²⁰	30	20
Training shop	30	20
Music rooms	50	15
Libraries	20	15
Locker rooms		0.50 cfm/ft.sq.
Corridors		0.10 cfm/ft.sq.
Auditoriums	150	15
Smoking lounges ¹¹	70	60

Application	Estimated Maximum ² Occupancy P/1000 ft ² or 100 m ²	Outdoor Air Requirements cfm/person
Hospitals, Nursing and Convalescent Homes		
Patient rooms ²¹	10	25
Medical procedure	20	15
Operating rooms	20	30
Recovery and ICU	20	15
Autopsy rooms ²²		0.50 cfm/ft.sq.
Physical Therapy	20	15
Correctional Facilities		
Cells	20	20
Dining halls	100	15
Guard station	40	15

- Derived from ASHRAE Standard 62-1989.
- Net occupiable space.
- Dry-cleaning process may require more air.
- Supplementary smoke-removal equipment may be required.
- Distribution among people must consider worker location and concentration of running engine; stands where engines are run must incorporate systems for positive engine exhaust withdrawal. Contaminant sensors may be used to control ventilation.
- Independent of room size.
- Installed capacity for intermittent use.
- See also food and beverage service, merchandising, barber and beauty shops, garages.
- Some office equipment may require local exhaust.
- Mechanical exhaust with no recirculation is recommended.
- Normally supplied by transfer air, local mechanical exhaust; with no recirculation recommended.
- Normally supplied by transfer air.
- Ventilation to optimize plant growth may dictate requirements.
- When internal combustion engines are operated for maintenance of playing surfaces, increased ventilation rates may be required.
- Higher values may be required for humidity control.
- Special ventilation will be needed to eliminate special stage effects.
- Ventilation within vehicles may require special considerations.
- Spaces maintained at low temperatures (-10°F. to + 50°F.) are not covered by these requirements unless the occupancy is continuous. Ventilation from adjoining spaces is permissible. When the occupancy is intermittent, infiltration will normally exceed the ventilation requirements.
- Installed equipment must incorporate positive exhaust and control of undesirable contaminants.
- Special contamination control systems may be required for processes or functions including laboratory animal occupancy.
- Special requirements or codes and pressure relationships may determine minimum ventilation rates and filter efficiency. Procedures generating contaminants may require higher rates.
- Air shall not be recirculated into other spaces.
- Makeup air for hood exhaust may require more ventilating air.
- Occupant loading shall be based on the number of bedrooms as follows: first bedroom, two persons; each additional bedroom, one person. Where higher occupant loadings are known, they shall be used.

TABLE 3-5
Prescriptive Integrated Forced Air Supply Duct Sizing

Required Flow (CFM) Per Table 3-2	Minimum Smooth Duct Diameter	Minimum Flexible Duct Diameter	Maximum Length ¹	Maximum Number of Elbows ²
50-80	6"	7"	20'	3
80-125	7"	8"	20'	3
115-175	8"	10"	20'	3
170-240	9"	11"	20'	3

- For lengths over 20 feet increase duct diameter 1 inch.
- For elbows numbering more than 3 increase duct diameter 1 inch.

TABLE 3-6
Prescriptive Supply Fan Duct Sizing

Supply Fan Tested CFM At 0.4" WG		
Specified volume from Table 3-2	Minimum Smooth Duct Diameter	Minimum Flexible Duct Diameter
50-90 CFM	4 inch	5 inch
90-150 CFM	5 inch	6 inch
150-250 CFM	6 inch	7 inch
250-400 CFM	7 inch	8 inch

[Statutory Authority: RCW 19.27.190, 19.27.020, 01-02-099, § 51-13-304, filed 1/3/01, effective 7/1/01. Statutory Authority: RCW 19.27.190, 95-01-128, § 51-13-304, filed 12/21/94, effective 6/30/95. Statutory Authority: RCW 19.27.190(2) and 1992 c 132, 93-02-056, § 51-13-304, filed 1/6/93, effective 7/1/93. Statutory Authority: RCW 19.27.190, 91-01-102, § 51-13-304, filed 12/18/90, effective 7/1/91.]

WAC 51-13-503 Radon prescriptive requirements.

503.1 Scope: This section applies to those counties specified in section 501.2.2. This section establishes prescriptive construction requirements for reducing the potential for radon entry into all Group R Occupancies, and for preparing the building for future mitigation if desired.

In all crawlspaces, except crawlspace plenums used for providing supply air for an HVAC system, a continuous air barrier shall be installed between the crawlspace area and the occupied area to limit air transport between the areas. If a wood sheet subfloor or other material is utilized as an air barrier, in addition to the requirements of section 502.1.6.2 of the Washington state energy code, all joints between sheets shall be sealed.

503.2 Floors in Contact with the Earth

503.2.1 General: Concrete slabs that are in direct contact with the building envelope shall comply with the requirements of this section.

EXCEPTION: Concrete slabs located under garages or other than Group R Occupancies need not comply with this chapter.

503.2.2 Aggregate: A layer of aggregate of four inch minimum thickness shall be placed beneath concrete slabs. The aggregate shall be continuous to the extent practical.

503.2.3 Gradation: Aggregate shall:

a) 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

b) 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

c) Be screened, washed pea gravel free of deleterious substances in a manner consistent with ASTM Standard C-33 with one hundred percent (100%) passing a one-half (1/2) inch sieve and less than five percent (5%) 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.

503.2.4 Soil-Gas Retarder Membrane: A soil-gas retarder membrane, consisting of at least one layer of virgin polyethylene with a thickness of at least six 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 two inches (2") 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 twelve 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.

503.2.5 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.

503.2.6 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 five feet of perforated drain pipe of three 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 five feet horizontally from the exterior perimeter of the aggregate area.

The continuous sealed pipe shall terminate no less than twelve inches above the eave, and more than ten 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 three 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 sub-slab 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 forced sub-slab depressurization system includes:

- 1) Soil-gas retarder membrane as specified in section 503.2.4;
- 2) Sealing of penetrations and joints as specified in section 503.2.5;
- 3) A three-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 may be gas tight, and may be of either PVC schedule 40 or ABS schedule of equivalent in wall thickness;
- 5) A label of "radon vent" shall be placed on the pipe so as to remain visible to the occupant;
- 6) Fan circuit and wiring as specified in section 503.2.7 and a fan.

If the sub-slab depressurization system is exhausted through the concrete foundation wall or rim joist, the exhaust terminus shall be a minimum of six 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 re-entrainment.

503.2.7 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 in-line fan on the radon vent pipe without the need to place new wiring. A one hundred ten volt power supply shall be provided at a junction box near the fan location.

503.2.8 Separate Aggregate Areas: If the four-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 three-inch diameter connection joining the separate areas is provided for every thirty feet of barrier separating those areas.

503.2.9 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.

[Statutory Authority: RCW 19.27.190, 19.27.020, 01-02-099, § 51-13-503, filed 1/3/01, effective 7/1/01. Statutory Authority: RCW 19.27.190(2) and 1992 c 132, 93-02-056, § 51-13-503, filed 1/6/93, effective 7/1/93. Statutory Authority: RCW 19.27.190, 91-01-102, § 51-13-503, filed 12/18/90, effective 7/1/91.]

Chapter 51-40 WAC**STATE BUILDING CODE ADOPTION AND
AMENDMENT OF THE 1997 EDITION OF THE
UNIFORM BUILDING CODE****WAC**

51-40-0200	Chapter 2—Definitions and abbreviations.
51-40-0310	Section 310—Requirements for Group R Occupancies.
51-40-0313	Section 313—Requirements for Group LC Occupancies.
51-40-0902	Section 902—Standards of quality.
51-40-1003	General egress requirements.
51-40-1004	The exit access.
51-40-1104	Section 1104—Egress and areas of evacuation assistance.
51-40-1105	Section 1105—Facility accessibility.
51-40-1106	Section 1106—Accessible design and standards.
51-40-1202	Section 1202—Light and ventilation in Groups A, B, E, F, H, I, M and S Occupancies.
51-40-1203	Section 1203—Light and ventilation in Group R Occupancies.
51-40-2900	Chapter 29—Plumbing systems.
51-40-3102	Section 3102—Chimneys, fireplaces and barbecues.
51-40-31200	Section 31-2—Standard test method for particulate emissions from fireplaces.

WAC 51-40-0200 Chapter 2—Definitions and abbreviations.**SECTION 202 - A.**

ADULT FAMILY HOME means a family abode 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.

SECTION 204 - C.

CHILD DAY CARE, shall, for the purposes of these regulations, mean the care of children during any period of a 24 hour day.

CHILD DAY CARE HOME, FAMILY is a child day care facility, licensed by the state, located in the family abode of the person or persons under whose direct care and supervision the child is placed, for the care of twelve or fewer children, including children who reside at the home.

SECTION 207 - F.

FAMILY ABODE means a single dwelling unit and accessory buildings occupied for living purposes by a family which provides permanent provisions for living, sleeping, eating, cooking, and sanitation.

FLOOR AREA is the area included within the surrounding exterior walls of a building or portion thereof, exclusive of vent shafts, courts, and gridirons. The floor area of a building, or portion thereof, not provided with surrounding exterior wall shall be the usable area under the horizontal projection of the roof or floor above.

SECTION 217 - P.

PORTABLE SCHOOL CLASSROOM is a structure, transportable in one or more sections, which requires a chassis to be transported, and is designed to be used as an educational space with or without a permanent foundation. The structure

shall be trailerable and capable of being demounted and relocated to other locations as needs arise.

SECTION 220 - S.

STRUCTURAL OBSERVATION means the visual observation of the structural system, for general conformance to the approved plans and specifications. Structural observation does not include or waive the responsibility for the inspections required by Sections 108 and 1701 or other sections of the code.

SURGICAL AREA is the preoperating, operating, recovery and similar rooms within an outpatient health-care center where the patients are incapable of unassisted self-preservation.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-0200, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-0200, filed 1/6/98, effective 7/1/98.]

WAC 51-40-0310 Section 310—Requirements for Group R Occupancies.

310.1 Group R Occupancies Defined. Group R Occupancies shall be:

Division 1. Hotels and apartment houses.

Congregate residences (each accommodating more than 10 persons).

Division 2. Not used.

Division 3. Dwellings, family child day care homes, adult family homes and lodging houses.

Congregate residences (each accommodating 10 persons or less).

Foster Family Care Homes licensed by the Washington State Department of Social and Health Services shall be permitted, as an accessory use to a dwelling unit, for six or fewer children including those of the resident family.

For occupancy separations, see Table 3-B.

A complete code for construction of detached one- and two-family dwellings is in Appendix Chapter 3, Division III, of this code. When adopted, as set forth in Section 101.3, it will take precedence over the other requirements set forth in this code.

310.2.2 Special provisions. Walls and floors separating dwelling units in the same building, or guest rooms in Group R, Division 1 hotel occupancies, shall not be of less than one-hour fire-resistive construction.

Group R, Division 1 Occupancies more than two stories in height or having more than 3,000 square feet (279 m²) of floor area above the first story shall not be of less than one-hour fire-resistive construction throughout, except as provided in Section 601.5.2.2.

Storage or laundry rooms that are within Group R, Division 1 Occupancies that are used in common by tenants shall be separated from the rest of the building by not less than

one-hour fire-resistive occupancy separation. The separation between individual storage lockers may be nonrated in rooms of 500 square feet (46.4 m²) or less in area and in sprinklered rooms of any size.

For Group R, Division 1 Occupancies with a Group S, Division 3 parking garage in the basement or first story, see Section 311.2.2.

For attic space partitions and draft stops, see Section 708.

310.5 Light, Ventilation and Sanitation. In Group R Occupancies, light, ventilation and sanitation shall be as specified in Chapters 12 and 29.

310.6 Room Dimensions.

310.6.1 Ceiling heights. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than 7 feet (2134 mm). The required height shall be measured from the finished floor to the lowest projection from the ceiling.

EXCEPTIONS:

1. Beams and girders spaced not less than 4 feet (1219 mm) on center may project not more than 6 inches (153 mm) below the required ceiling height.
2. Ceilings in basements without habitable spaces may project to within 6 feet 8 inches (2032 mm) of the finished floor, and beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.
3. Not more than 50 percent of the required floor area of a room or space is permitted to have a sloped ceiling less than 7 feet (2134 mm) in height, with no portion of the required floor area less than 5 feet (1524 mm) in height.

310.6.2 Floor area. Dwelling units and congregate residences shall have at least one room that shall have not less than 120 square feet (11.2 m²) of floor area. Other habitable rooms except kitchens shall have an area of not less than 70 square feet (6.5 m²). Efficiency dwelling units shall comply with the requirements of Section 310.7.

Portions of a room with a sloped ceiling measuring less than 5 feet (1524 mm) or a flat 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 habitable area for that room.

310.6.3 Width. Habitable rooms other than a kitchen shall not be less than 7 feet (2134 mm) in any dimension.

310.9.1.6. Location within family child day care homes. In family child day care homes operable detectors shall be located in all sleeping and napping areas. When the family child day care home has more than one story, and in family child day care homes with basements, an operable detector shall be installed on each story and in the basement. In family child day care homes where a story or basement is split into two or more levels, the smoke detector shall be installed in the upper level, except that when the lower level contains a sleeping or napping area, an operable detector shall be located on each level. When sleeping rooms are on an upper level, the detector shall be placed at the ceiling of the upper level in close proximity to the stairway. In family child day care homes where the ceiling height of a room open to the

hallway serving the bedrooms exceeds that of the hallway by 24 inches or more, smoke detectors shall be installed in the hallway and the adjacent room. Detectors shall sound an alarm audible in all areas of the building.

310.13 Family Child Day Care Homes. For family child day care homes with more than six children, each floor level used for family child day 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 four feet below grade level shall not be used for family child day care homes unless one of 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. A residential sprinkler system is provided throughout the entire building in accordance with National Fire Protection Association Standard 13d.

Floors located more than 4 feet above grade level shall not be occupied by children in family day care homes.

EXCEPTIONS:

1. Use of toilet facilities while under supervision of an adult staff person.
2. Family child day care homes 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 A residential sprinkler system is provided throughout the entire building in accordance with National Fire Protection Association Standard 13d.

Every sleeping or napping room in a family child day care home 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, woodworking shop, flammable or combustible storage, or painting operation shall be separated from the family child day care area by at least one-hour fire-resistive construction.

EXCEPTION: A fire-resistive separation shall not be required where the food preparation kitchen contains only a domestic cooking range, and preparation of food does not result in the production of smoke or grease laden vapors.

310.14 Adult Family Homes.

310.14.1 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.

310.14.2 Submittal Standards. In addition to those requirements in Section 106.3, the submittal shall identify the project as a Group R, Division 3 Adult Family Home Occupancy. A floor plan shall be submitted identifying the means of egress and the components in the means of egress such as stairs, ramps, platform lifts and elevators. The plans shall indicate the rooms used for clients and the sleeping room classification of each room.

310.14.3 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 to grade is provided which is constructed in accordance with 1106.8.
3. Type NS2 - where two means of egress are at grade level or ramps to grade are provided which are constructed in accordance with 1106.8.

310.14.4 Types of Locking Devices. All bedroom and bathroom doors shall be openable from the outside when locked.

Every closet shall be readily openable from the inside.

310.14.5 Smoke Alarm Requirements. All adult family homes shall be equipped with smoke alarms installed as required in Section 310.9.1. Alarms shall be installed in such a manner so that the fire warning may be audible in all parts of the dwelling upon activation of a single device.

310.14.6 Escape Windows and Doors. Every sleeping room shall be provided with emergency escape and rescue windows as required by Section 310.4.

310.14.7 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 Article 9 of the Fire Code for new construction.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-0310, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-0310, filed 1/6/98, effective 7/1/98.]

WAC 51-40-0313 Section 313—Requirements for Group LC Occupancies.

313.1 Group LC Occupancies Defined. Group LC Occupancies shall include buildings, structures, or portions thereof, used for the business of providing licensed care to clients in one of the following categories regulated by either the Washington Department of Health or the Department of Social and Health Services:

1. Adult residential rehabilitation facility.
2. Alcoholism intensive inpatient treatment service.
3. Alcoholism detoxification service.
4. Alcoholism long term treatment service.
5. Alcoholism recovery house service.
6. Boarding home.
7. Group care facility.
8. Group care facility for severely and multiple handicapped children.
9. Residential treatment facility for psychiatrically impaired children and youth.

EXCEPTION:

Where the care provided at an alcoholism detoxification service is acute care similar to that provided in a hospital, the facility shall be classified as a Group I, Division 1.1 hospital.

313.2 Construction, Height and Allowable Area.

313.2.1 General. Buildings or parts of buildings classed in Group LC because of the use or character of the occupancy shall be limited to the types of construction set forth in this section.

313.2.1.1 Type of construction. Except as provided herein, LC Occupancy buildings may be of any construction type allowed in this code and shall not exceed the limits specified in Sections 504, 505 and 506.

Group LC Occupancies which are licensed for more than six clients and which are more than two stories in height or which have more than 3,000 square feet (279 m²) above the first story shall not be less than one-hour fire-resistive construction throughout.

EXCEPTION:

Buildings which are licensed for not more than 16 clients may be of Type V-N construction provided:

1. The entire building has an interior wall and ceiling covering consisting of 1/2 inch gypsum wall board or an approved equal installed in accordance with Section 2511; and,
2. An approved smoke-detection system, supervised by an approved central, proprietary or remote station service, is installed throughout the entire structure and is interconnected with any required sprinkler system.

For attic space partitions and draft stops, see Section 708.

313.2.1.2 Area and height. Buildings classified as Group LC Occupancy shall not exceed, in area or height, the limitations set forth in Table 5-B for Group R, Division 1 Occupancies.

EXCEPTION:

LC Occupancies licensed for six or fewer clients may be of unlimited area provided they are limited to 3 stories or less.

313.2.1.3 Mixed Occupancies. Group LC Occupancies shall be separated from Group H Occupancies by a four-hour fire-resistive occupancy separation and shall be separated from all other occupancies by a one-hour fire-resistive assembly.

EXCEPTIONS:

1. An occupancy separation need not be provided between a Group LC Occupancy licensed for 16 or fewer clients and a carport having no enclosed use above, provided the carport is entirely open on two or more sides.

2. In a Group LC Occupancy licensed for 16 or fewer clients, the one-hour occupancy separation between a Group LC Occupancy and a Group U, Division 1 Occupancy, may be limited to the installation of materials approved for one-hour fire-resistive construction on the garage side and a self-closing, tight-fitting solid-wood door 1 3/8 inches (35 mm) in thickness, or a self-closing tight-fitting door having a fire-protection rating of not less than 20 minutes when tested in accordance with Part II of UBC Standard 7-2, which is a part of this code, is permitted in lieu of a one-hour fire assembly. Fire dampers need not be installed in air ducts passing through the wall, floor or ceiling separating a Group LC Occupancy from a Group U Occupancy, provided such ducts within the Group U Occupancy are constructed of steel having a thickness not less than 0.019 inch (0.48 mm) (No. 26 galvanized sheet gage) and having no openings into the Group U Occupancy.

3. An occupancy separation need not be provided between a Group LC, Boarding Home Occupancy and a Group R, Division 1 Occupancy.

313.3 Location on Property. For fire-resistive protection of exterior walls and openings, as determined by location on property, see Section 503 and Chapter 6. For the purpose of this determination, LC Occupancies licensed for six or fewer clients shall comply with provisions for Group R, Division 3 Occupancies; and all other LC Occupancies shall comply with provisions for Group R, Division 1 Occupancies.

313.4 Access, Means of Egress, and Emergency Escape.

313.4.1 Evacuation capability. Evacuation capability is the ability of the clients of a licensed care facility to respond to an emergency situation and either evacuate a building or move to a point of safety. Clients shall be classified in one of the following levels:

- I - persons physically and mentally capable of walking or traversing a normal path to safety, including the ascent and descent of stairs, and capable of self-preservation, without the physical assistance of another person.
- II - persons physically and mentally capable of traversing a normal path to safety with the use of mobility aids, but unable to ascend or descend stairs without the physical assistance of another person.
- III - persons physically or mentally unable to walk or traverse a normal path to safety without the physical assistance of another person.

313.4.2 Means of egress. Means of egress shall be provided as specified in Chapter 10. For the purpose of determining egress requirements, Group LC Occupancies shall be considered to have an occupant load factor of 300. At least two means of egress shall be required when the number of occupants (clients and staff) is 10 or more. For all other requirements of Chapter 10, Group LC Occupancies licensed for six or fewer clients shall comply with provisions for Group R, Division 3 Occupancies; and all other Group LC Occupancies shall comply with provisions for Group R, Division 1 Occupancies.

EXCEPTIONS:

- 1. Means of egress illumination required by Section 1003.2.9.1 need not be provided in any Group LC Occupancy licensed for six or fewer clients.
- 2. In LC Occupancies with an approved automatic fire sprinkler system and approved automatic fire alarm system, waiting and resting areas may be open to the corridor provided:

2.1 Each rest area does not exceed 150 square feet, excluding the corridor width; and

2.2 Walls defining the space shall continue the construction of the corridor's wall; and

2.3 The floor on which the rest area or areas are located is divided into at least two compartments by smoke barrier walls of not less than one-hour fire-resistive construction meeting the requirements of Section 308.2.2.1 and Section 905.2.3; and

2.4 Combustible furnishings located within the rest area are flame resistant as defined by Uniform Fire Code Section 207; and

2.5 Emergency means of egress lighting is provided as required by Section 1003.2.9.1 to illuminate the area.

313.4.3 Accessibility. In new construction, Group LC Occupancies regardless of the number of clients shall comply with accessibility standards for Group R, Division 1 apartment buildings or congregate residences as specified in Chapter 11.

Where a Group LC Occupancy is being established by change of occupancy in an existing building, the building shall be altered to comply with apartment building or congregate residence provisions of Chapter 11 if any client is a person with disability. The alterations shall provide the minimum necessary access appropriate for the disabilities of clients. Any alteration, whether to accommodate a client with disability or for another purpose, shall comply with Part III of Chapter 11.

313.4.4 Emergency escape.

313.4.4.1 Location of sleeping rooms. In every licensed care facility, all sleeping rooms occupied by clients with an evacuation capability of II or III shall be located on a grade level floor which provides not less than two means of egress which do not require clients to use stairs, elevator, or platform lift to exit the facility.

EXCEPTIONS:

1. In a Group LC Occupancy licensed to provide care to two or fewer clients with an evacuation capability of II or III and six or fewer total clients, only one means of egress which does not require clients to use stairs, elevator or platform lift to exit the facility need be provided.

2. Sleeping rooms for clients with an evacuation capability of II or III may be located on floors other than at grade level, provided the facility is divided into at least two compartments by smoke barriers of not less than one-hour fire-resistance meeting the requirements of Sections 308.2.2.1 and 905.2.3.

313.4.4.2 Escape windows and doors. Every sleeping room below the fourth story (including basements) shall have at least one operable window or door approved for emergency escape or rescue which shall open directly into a public street, public alley, yard or exit court. The emergency window shall be operable from the inside to provide a full, clear opening without the use of separate tools.

EXCEPTION:

The window or door may open into an atrium complying with Section 402 provided the window or door opens onto an exit-access balcony and the sleeping room has an exit or exit-access doorway which does not open into the atrium.

Escape or rescue windows shall have a minimum net clear openable area of 5.7 square feet (0.53 m²). The minimum net clear openable height dimension shall be 24 inches (610 mm). The minimum net clear openable width dimension shall be 20 inches (508 mm). When windows are provided as

a means of escape or rescue, they shall have a finished sill height not more than 44 inches (1118 mm) above the floor.

Escape and rescue windows with a finished sill height below the adjacent ground elevation shall have a window well. Window wells at escape and rescue windows shall comply with the following:

1. The clear horizontal dimension shall allow the window to be fully opened and provide a minimum accessible net clear opening of 9 square feet (0.84 m²), with a minimum dimension of 36 inches (914 mm).

2. Window wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or stairs that are accessible with the window in the fully open position. The ladder or stairs shall not encroach into the required dimensions of the window well by more than 6 inches (152 mm).

Bars, grilles, grates or similar devices may be installed on emergency escape windows, doors or window wells, provided:

1. The devices are equipped with approved release mechanisms which are operable from the inside without the use of a key or special knowledge or effort; and

2. The building is equipped with smoke detectors installed in accordance with Section 313.8.

313.5 Light, Ventilation and Sanitation.

313.5.1 General. For the purpose of determining the light and ventilation for Group LC Occupancies required by this section, any room may be considered as a portion of an adjoining room when 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 (2.3 m²), whichever is greater.

Exterior openings for natural light or ventilation required by this section shall open directly onto a public way or a yard or court as set for in Section 313.5.4.

EXCEPTIONS:

1. Required exterior openings may open into a roofed porch where the porch:
 - 1.1 Abuts a public way, yard or court; and
 - 1.2 Has a ceiling height of not less than 7 feet (2134 mm); and
 - 1.3 Has a longer side at least 65 percent open and unobstructed.
2. Skylights.

313.5.2 Light. Sleeping rooms and habitable rooms within the licensed care facility shall be provided with natural light by means of exterior glazed openings with an area not less than one tenth of the floor area of such rooms with a minimum of 10 square feet (0.93 m²).

EXCEPTION: Kitchens may be provided with artificial light.

313.5.3 Ventilation. Group LC Occupancies shall comply with provisions for Group R Occupancies as provided in the Washington State Ventilation and Indoor Air Quality Code (WAC 51-13).

313.5.4 Yards and Courts.

313.5.4.1 General. This section shall apply to yards and courts adjacent to exterior openings that provide required light or ventilation. Such yards and courts shall be on the same property as the building.

313.5.4.2 Yards. Yards shall not be less than 3 feet (914 mm) in width for one-story and two-story buildings. For buildings more than two stories in height, 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 in height, the required width of the yard shall be computed on the basis of 14 stories.

313.5.4.3 Courts. Courts shall not be less than 3 feet (914 mm) in width. Courts having windows opening on opposite sides shall not be less than 6 feet (1829 mm) in width. Courts bounded on three or more sides by the walls of the building shall not be 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 in height, 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 in height, the required dimensions shall be computed on the basis of 14 stories.

Adequate access shall be provided to the bottom of all courts for cleaning purposes. Every court 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 m²) in area and leading to the exterior of the building unless abutting a yard or a public way. The construction of the air intake shall be as required for the court walls of the building but in no case less than one-hour fire resistive.

313.5.4.4 Eaves. Eaves over required windows shall extend no closer than 30 inches (762 mm) from the side and rear property lines. See also Sections 503.2 and 705.

313.5.5 Sanitation.

313.5.5.1 General. Sanitation facilities shall comply with Chapter 29 and the provisions of this section. Any room in which a water closet is located shall be separated from food preparation or storage rooms by a self-closing tight-fitting door.

313.5.5.2 Group LC Occupancies with six or fewer clients. Group LC Occupancies licensed for six or fewer clients shall be provided with not less than one water closet, one lavatory and one bathtub or shower.

313.5.5.3 Group LC Occupancies with more than six clients. Group LC Occupancies licensed for more than six clients shall provide not less than one water closet for each 10 male clients, or fractional part thereof, and not less than one water closet for each 8 female clients, or fractional part thereof.

In addition, not less than one lavatory shall be provided for each 12 male clients, or fractional part thereof, and not less than one lavatory for each 12 female clients, or fractional part thereof. Where the number of clients of either sex

exceeds 12, one lavatory shall be added for each additional 20 males, or fractional part thereof, and one lavatory shall be added for each additional 15 females, or fractional part thereof.

In addition, not less than one bathtub or shower shall be provided for every eight clients, or fractional part thereof. Where there are female clients, one additional bathtub or shower shall be provided for each 30 female clients, or fractional part thereof. Where the number of total clients exceeds 150, one bathtub or shower shall be provided for each 20 clients, or fractional part thereof, over 150 clients.

313.6 Room Dimensions.

313.6.1 Ceiling Heights. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than 7 feet (2134 mm). The required height shall be measured from the finished floor to the lowest projection from the ceiling.

- EXCEPTIONS:
1. Beams and girders spaced not less than 4 feet (1219 mm) on center may project not more than 6 inches (153 mm) below the required ceiling height.
 2. Ceilings in basements without habitable spaces may project to within 6 feet 8 inches (2032 mm) of the finished floor, and beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.
 3. Not more than 50 percent of the required floor area of a room or space is permitted to have a sloped ceiling less than 7 feet (2134 mm) in height, with no portion of the required floor area less than 5 feet (1524 mm) in height.

313.6.2 Floor area. Group LC Occupancies shall have at least one room which shall have not less than 120 square feet (11.2 m²) of floor area. Other habitable rooms except kitchens shall have an area of not less than 70 square feet (6.5 m²).

Portions of a room with a sloped ceiling measuring less than 5 feet (1524 mm) or a flat 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 habitable area for that room.

313.6.3 Width. Habitable rooms other than kitchens shall not be less than 7 feet (2134 mm) in any dimension.

313.7 Shaft and Exit Enclosures. Exits shall be enclosed as specified in Chapter 10.

Elevator shafts, vent shafts, dumbwaiter shafts, clothes chutes and other vertical openings shall be enclosed and the enclosure shall be as specified in Section 711.

313.8 Smoke Detectors and Sprinkler Systems.

313.8.1 Smoke detectors.

313.8.1.1 General. Rooms within licensed care facilities that are used for sleeping purposes shall be provided with smoke detectors. Detectors shall be installed in accordance with the approved manufacturer's instructions.

313.8.1.2 Additions, alterations or repairs. When the valuation of an addition, alteration or repair to a Group LC Occupancy exceeds \$1,000 and a permit is required, or when one or more sleeping rooms is added or created in an existing

Group LC Occupancy, smoke detectors shall be installed in accordance with Sections 313.8.1.3 and 313.8.1.4 of this section.

EXCEPTION: Repairs to the exterior surfaces are exempt from the requirements of this section.

313.8.1.3 Power source. In new construction, required smoke detectors shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup. The detector shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke detectors may be solely battery operated when installed in existing buildings; or in buildings without commercial power; or in buildings which undergo alterations, repairs or additions regulated by Section 313.8.1.2.

313.8.1.4 Location. A detector shall be installed in each sleeping room and at a point centrally located in the corridor or area giving access to each separate sleeping area. When the licensed care facility has more than one story or in facilities with basements, a detector shall be installed on each story and in the basement. Where a story or basement is split into two or more levels, the smoke detector shall be installed on the upper level, except that when the lower level contains a sleeping area, a detector shall be installed on each level. When sleeping rooms are on an upper level, the detector shall be placed at the ceiling of the upper level in close proximity to the stairway. Where the ceiling height of a room open to a hallway serving the bedrooms exceeds that of the hallway by 24 inches (610 mm) or more, smoke detectors shall be installed in the hallway and in the adjacent room. Detectors shall sound an alarm audible in all sleeping areas of the licensed care facility in which they are located.

313.8.2 Sprinkler and standpipe systems.

313.8.2.1 Sprinkler Systems. An automatic sprinkler system shall be installed throughout every licensed care facility three or more stories in height or licensed for more than 16 clients. Licensed care facilities with 16 or fewer clients, licensed to provide care for more than two clients who have an evacuation capability of II or III, shall be provided with an automatic sprinkler system throughout the facility.

EXCEPTION: An automatic sprinkler system need not be installed in any licensed care facility licensed for six or fewer clients regardless of the level of evacuation capability.

Where a sprinkler system is required, a system complying with UBC Standard 9-1 shall be installed.

- EXCEPTIONS:
1. An automatic sprinkler system complying with UBC Standard 9-3 may be installed in buildings of four stories or less.
 2. Where a Group LC Occupancy is being established by change of occupancy in an existing building not protected by a sprinkler system as is required above for buildings of new construction, an automatic sprinkler system complying with NFPA Standard 13d may be installed provided the care facility is licensed for not more than 16 clients.

Residential or quick-response heads shall be used in all sprinkler systems.

313.8.2.2 Standpipe systems. Standpipe systems shall be provided where required by Section 904.5.

313.9 Fire Alarm Systems. Group LC Occupancies licensed for more than 16 clients shall be provided with an approved manual and automatic fire alarm system. The local alarm shall provide an alarm signal with a sound pressure level of 15 dBA above the average ambient sound level in every occupied space within the building. The minimum sound pressure level shall be 70 dBA. The maximum sound pressure level shall not exceed 110 dBA at the minimum hearing distance from the audible appliance.

313.10 Heating. Licensed care facilities shall be provided with heating facilities capable of maintaining a room temperature of 70°F (21°C) at a point 3 feet (914 mm) above the floor in all habitable rooms.

313.11 Special Hazards. Chimneys and heating apparatus shall conform to the requirements of Chapter 31 and the Mechanical Code.

In Group LC Occupancies licensed for more than six clients, the storage, use and handling of flammable and combustible liquids shall be in accordance with the Fire Code. In such facilities, doors leading into rooms in which Class I flammable liquids are stored or used shall be protected by a fire assembly having a one-hour fire-protection rating. Such fire assembly shall be self-closing and shall be posted with a sign on each side of the door in 1-inch (25.4 mm) block letters stating: FIRE DOOR—KEEP CLOSED.

In Group LC Occupancies licensed for more than 16 clients, rooms containing a boiler, central heating plant or hot-water supply boiler shall be separated from the rest of the building by not less than a one-hour occupancy separation.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-0313, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-0313, filed 1/6/98, effective 7/1/98.]

WAC 51-40-0902 Section 902—Standards of quality.

Fire-extinguishing systems, including automatic sprinkler systems, Class I, Class II and Class III standpipe systems, special automatic extinguishing systems, basement pipe inlets, smoke-control systems, and smoke and heat vents shall be approved and shall be subject to such periodic tests as may be required.

The standards listed below labeled a "UBC Standard" are also listed in Chapter 35, Part II, and are part of this code. The other standards listed below are recognized standards (see Sections 3503 and 3504).

1. Fire-extinguishing system.

- 1.1 UBC Standard 9-1, Installation of Sprinkler Systems
- 1.2 UBC Standard 9-3, Installation of Sprinkler Systems in Group R Occupancies Four Stories or Less
- 1.3 NFPA Standard 13D, as published by the National Fire Protection Association, 1999 edition

2. Standpipe systems.

UBC Standard 9-2, Standpipe Systems

3 Smoke control.

- 3.1 UBC Standard 7-2, Fire Test of Door Assemblies
- 3.2 UL 555, Fire Dampers
- 3.3 UL 555C, Ceiling Dampers
- 3.4 UL 555S, Leakage Rated Dampers for Use in Smoke Control Systems
- 3.5 UL 33, Heat Response Links for Fire Protection Service
- 3.6 UL 353, Limit Controls

4. Smoke and heat vents.

UBC Standard 15-7, Automatic Smoke and Heat Vents

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-0902, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-0902, filed 1/6/98, effective 7/1/98.]

WAC 51-40-1003 General egress requirements.

1003.3.1.1 General (Doors). For the purposes of Section 1003.3.1, the term "exit door" shall mean all of those doors or doorways along the path of exit travel anywhere in a means of egress system.

Exit doors serving the means of egress system shall comply with the requirements of Section 1003.3.1. Where additional doors are installed for egress purposes, they shall conform to all requirements of this section. Buildings or structures used for human occupancy shall have at least one exterior exit door that meets the requirements of Section 1003.3.1.3. Section 1003.3.1.5 shall apply to all exit doors within an accessible route, regardless of occupant load.

Exit doors shall be readily distinguishable from the adjacent construction and shall be easily recognizable as exit doors. Mirrors or similar reflecting materials shall not be used on exit doors, and exit doors shall not be concealed by curtains, drapes, decorations and similar materials.

1003.3.1.2 Special Doors. Revolving, sliding and overhead doors serving an occupant load of 10 or more shall not be used as required exit doors. Where revolving or overhead doors or turnstiles are used, an adjacent accessible gate or door shall be provided where an accessible route is required by Chapter 11.

EXCEPTIONS:

1. Approved revolving doors having leaves that will collapse under opposing pressures may be used, provided
 - 1.1 Such doors have a minimum width of 6 feet 6 inches (1981 mm).
 - 1.2 At least one conforming exit door is located adjacent to each revolving door.
 - 1.3 The revolving door shall not be considered to provide any required width when computing means of egress width in accordance with Section 1003.2.3.
2. Horizontal sliding doors complying with UBC Standard 7-8 may be used
 - 2.1 In elevator lobby separations.
 - 2.2 In other than Groups A and H Occupancies, where smoke barriers are required.
 - 2.3 In other than Group H Occupancies, where serving an occupant load of less than 50.

Power-operated doors complying with UBC Standard 10-1 may be used for egress purposes. Such doors, where swinging, shall have two guide rails installed on the swing side projecting out from the face of the door jambs for a distance not less than the widest door leaf. Guide rails shall not be less than 30 inches (762 mm) in height with solid or mesh

panels to prevent penetration into door swing and shall be capable of resisting a horizontal load at top of rail of not less than 50 pounds per lineal foot (730 N/m).

EXCEPTIONS:

1. Walls or other types of separators may be used in lieu of the above guide rail, provided all the criteria are met.
2. Guide rails in industrial or commercial occupancies not accessible to the public may comply with the exception to Section 509.3.
3. Doors swinging toward flow of traffic shall not be permitted unless actuating devices start to function at least 8 feet 11 inches (2718 mm) beyond the door in an open position and guide rails extend 6 feet 5 inches (1956 mm) beyond the door in an open position.

Clearances for guide rails shall be as follows:

1. Six inches (152 mm) maximum between rails and leading edge of door at the closest point in its arc of travel.
2. Six inches (152 mm) maximum between rails and the door in an open position.
3. Two inches (51 mm) minimum between rail at hinge side and door in an open position.
4. Two inches (51 mm) maximum between freestanding rails and jamb or other adjacent surface.

1003.3.1.5 Swing and Opening Force. Exit doors serving an occupant load of 10 or more shall be of the pivoted, balanced or side-hinged swinging type. Exit doors shall swing in the direction of the path of exit travel where the area served has an occupant load of 50 or more. The door shall swing to the fully open position when an opening force not to exceed 30 pounds (133.45 N) is applied to the latch side. Within an accessible route, such force shall not exceed 8.5 pounds (37.8 N) at exterior doors; and shall not exceed 5 pounds (22.24 N) at sliding and folding doors and interior swinging doors. At exterior doors where environmental conditions require greater closing pressure, power-operated doors shall be used within the accessible route. For other door-opening forces, see Chapter 11 and Section 905.3. See Section 3207 for doors swinging over public property.

EXCEPTIONS:

1. Group I, Division 3 Occupancy used as a place of detention.
2. In other than accessible dwelling units, doors within or serving an individual dwelling unit.
3. Special door conforming with Section 1003.3.1.2.
4. The opening force at required fire doors within an accessible route may be not greater than 30 pounds (133.45 N).

Double-acting doors shall not be used as exits where any of the following conditions exist:

1. The occupant load served by the door is 100 or more.
2. The door is part of a fire assembly.
3. The door is part of a smoke- and draft-control assembly.
4. Panic hardware is required or provided on the door.

A double-acting door shall be provided with a view panel of not less than 200 square inches (0.129 m²).

1003.3.1.6 Floor Level at Doors. Regardless of the occupant load served, there shall be a floor or a landing on each side of a door. Where access for persons with disabilities is required

by Chapter 11, the floor or landing shall not be more than 1/2 inch (13 mm) lower than the threshold of the doorway. Where such access is not required, the threshold shall not exceed 1 inch (25 mm). Landings shall be level except that exterior landings, may have a slope not to exceed 1/4 unit vertical in 12 units horizontal (2% slope).

EXCEPTIONS:

1. In Group R, Division 3, and Group U Occupancies and within individual units of Group R, Division 1 Occupancies:
 - 1.1. A door may open at the top of an interior flight of stairs, provided the door does not swing over the top step.
 - 1.2. A door may open at a landing which is not more than 8 inches (203 mm) lower than the floor level, provided the door does not swing over the landing.
 - 1.3. Screen doors and storm doors may swing over stairs, steps or landings.
2. Doors serving building equipment rooms which are not normally occupied.
3. At exterior sliding doors within accessible dwelling units, the floor or landing may be no more than 3/4 inch (19 mm) lower than the threshold of the doorway, including the sliding door tracks, provided that an additional accessible entrance door is provided into the dwelling unit.

1003.3.1.10 Special Egress-control Devices. When approved by the building official, exit doors in Group B; Group F; Group I, Divisions 1.1, 1.2 and 2; Group M, Group LC Occupancies, and Group S Occupancies may be equipped with approved listed special egress-control devices, provided the building is protected throughout by an approved automatic sprinkler system and an approved automatic smoke-detection system. Such devices shall conform to all of the following:

1. The egress-control device shall automatically deactivate upon activation of either the sprinkler system or the smoke-detection system.
2. The egress-control device shall automatically deactivate upon loss of electrical power to any one of the following:
 - 2.1 The egress-control device itself.
 - 2.2 The smoke-detection system.
 - 2.3 Means of egress illumination as required by Section 1003.2.9.
3. The egress-control device shall be capable of being deactivated by a signal from a switch located in an approved location.
4. An irreversible process which will deactivate the egress-control device shall be initiated whenever a manual force of not more than 15 pounds (66.72 N) is applied for two seconds to the panic bar or other door-latching hardware. The egress-control device shall deactivate within an approved time period not to exceed a total of 15 seconds. The time delay established for each egress-control device shall not be field adjustable.
5. Actuation of the panic bar or other door-latching hardware shall activate an audible signal at the door.
6. The unlatching shall not require more than one operation.

A sign shall be provided on the door located above and within 12 inches (305 mm) of the panic bar or other door-latching hardware reading:

**KEEP PUSHING. THE DOOR WILL OPEN IN
SECONDS. ALARM WILL SOUND.**

Sign letter shall be at least 1 inch (25 mm) in height and shall have a stroke of not less than 1/8 inch (3.2 mm).

Regardless of the means of deactivation, relocking of the egress-control device shall be by manual means only at the door.

EXCEPTION: Subject to the approval of the building official, special units for the care of dementia patients in nursing homes which are identified and approved by the state agency licensing such units, may use special egress-control devices where a panic bar is not part of the egress-control mechanism.

1003.3.3.1 General (Stairways).

Every stairway having two or more risers serving any building or portion thereof shall conform to the requirements of Section 1003.3.3. For the purposes of Section 1003.3.3, the term "stairway" shall include stairs, landings, handrails and guardrails as applicable. Where aisles in assembly rooms have steps, they shall conform with the requirements in Section 1004.3.2.

For the purpose of this chapter, the term "step" shall mean those portions of the means of egress achieving a change in elevation by means of a single riser. Individual steps shall comply with the detailed requirements of this chapter which specify applicability to steps.

EXCEPTIONS:

1. Stairs or ladders used only to attend equipment or window wells are exempt from the requirements of this section.
2. Stairs or ladders within an individual dwelling unit used to gain access to areas of 200 square feet (18.6 m²) or less, and not containing the primary bathroom or kitchen, are exempt from the requirements of this section.

Stairways located in a building required to be accessible shall also comply with Chapter 11.

1003.3.3.3 Rise and Run. The rise of steps and stairs shall not be less than 4 inches (102 mm) nor more than 7-1/2 inches (190 mm). The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Except as permitted in Sections 1003.3.3.8.1, 1003.3.3.8.2 and 1003.3.3.8.3, the run shall not be less than 10 inches (254 mm), as measured horizontally between the vertical planes of the furthest projections of adjacent treads or nosings. Stair treads shall be of uniform size and shape, except the largest tread run within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

EXCEPTIONS:

1. Private steps and stairways serving an occupant load of less than 10 and stairways to unoccupied roofs may be constructed with an 8-inch-maximum (203 mm) rise and a 9-inch-minimum (229 mm) run.
2. Where the bottom or top riser adjoins a sloping public way, walk or driveway having an established grade and serving as a landing, the bottom or top riser may be reduced along the slope.

Where Exception 2 to Section 1103.2.2 is used in a building design, the run of stair treads shall not be less than

11 inches (279 mm), as measured horizontally between the vertical planes of the furthest projections of adjacent tread. The largest tread run within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

1003.3.3.6 Handrails. Stairways shall have handrails on each side, and every stairway required to be more than 88 inches (2235 mm) in width shall be provided with not less than one intermediate handrail for each 88 inches (2235 mm) of required width. Intermediate handrails shall be spaced approximately equally across the entire width of the stairway.

EXCEPTIONS:

1. Stairways less than 44 inches (1118 mm) in width or stairways serving one individual dwelling unit in Group R, Division 1 or 3 Occupancies or a Group R, Division 3 congregate residence may have one handrail. This exception shall not be used concurrently with the second exception to the first paragraph of Section 1103.2.2.
2. Private stairways 30 inches (762 mm) or less in height may have handrails on one side only. This exception shall not be used concurrently with the second exception to the first paragraph of Section 1103.2.2.
3. Stairways having less than four risers and serving one individual dwelling unit in Group R, Division 1 or 3, or a Group R, Division 3 congregate residence or Group U Occupancies need not have handrails.

The top of handrails and handrail extensions shall be placed not less than 34 inches (864 mm) or more than 38 inches (965 mm) above landings and the nosing of treads. Handrails shall be continuous the full length of the stairs and, except for private stairways, at least one handrail shall extend in the direction of the stair run not less than 12 inches (305 mm) beyond the top riser nor less than a length equal to one tread depth plus 12 inches (305 mm) beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.

EXCEPTIONS:

1. Private stairways do not require handrail extensions.
2. Handrails may have starting newel posts within the first tread on stairways in Group R, Division 3 Occupancies and within individual dwelling units of Group R, Division 1 Occupancies.

The handgrip portion of handrails shall not be less than 1 1/4 inches (32 mm) nor more than 2 inches (51 mm) in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. Handrails projecting from a wall shall have a space of not less than 1 1/2 inches (38 mm) between the wall and the handrail.

1003.3.3.13 Stairway Identification. Stairway identification signs shall be located at each floor level in all enclosed stairways in buildings four or more stories in height. The sign shall identify the stairway, indicate whether or not there is roof access, the floor level, and the upper and lower terminus of the stairway. The sign shall be located approximately 5 feet (1524 mm) above the landing floor in a position that is readily visible when the door is in either the open or closed position. Signs shall comply with requirements of U.B.C. Standard 10-2. Each door to a floor level also shall have a tactile sign, including raised letters and Braille, identifying the floor level and shall comply with Part II of Chapter 11.

1003.3.4.4 Landings (Ramps). Ramps having slopes steeper than 1 unit vertical in 15 units horizontal (6.7% slope)

shall have landings at the top and bottom, and at least one intermediate landing shall be provided for each 5 feet (1524 mm) of vertical rise measured between the horizontal planes of adjacent landings. Landing shall have a dimension measured in the direction of ramp run of not less than 5 feet (1524 mm). Landings shall provide maneuvering clearances at doors as required in Chapter 11.

1003.3.4.5 Handrails (Ramps). Ramps having slopes steeper than 1 unit vertical in 15 units horizontal (6.7% slope) shall have handrails as required for stairways, except that intermediate handrails shall not be required. At least one handrail shall extend in the direction of ramp run not less than 12 inches (305 mm) horizontally beyond the top and bottom of the ramp runs. Ramped aisles serving fixed seating shall have handrails as required in Section 1004.3.2.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1003, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-1003, filed 1/6/98, effective 7/1/98.]

WAC 51-40-1004 The exit access.

1004.3.2.3.1 Width. The clear width of aisles shall be based on the number of fixed seats served by the aisle. The required width of aisles serving fixed seats shall not be used for any other purpose.

The clear width of an aisle in inches shall not be less than the occupant load served by the aisle multiplied by 0.3 for aisles with slopes greater than 1 unit vertical to 8 units horizontal (12.5% slope) and not less than 0.2 for aisles with a slope of 1 unit vertical to 8 units horizontal (12.5% slope) or less. In addition, when the rise of steps in aisles exceeds 7 inches (178 mm), the aisle clear width shall be increased by 1 1/4 inches (32 mm) for each 100 occupants or fraction thereof served for each 1/4 inch (6.35 mm) of riser height above 7 inches (178 mm).

EXCEPTION: For buildings with smoke-protected assembly seating and for which an approved life-safety evaluation is conducted, the minimum clear width of aisles and other means of egress may be in accordance with Table 10-D. For Table 10-D, the number of seats specified must be within a single assembly area, and interpolation shall be permitted between the specified values shown. If Table 10-D is used the minimum clear widths shown shall be modified in accordance with the following:

1. Where risers exceed 7 inches (178 mm) in height, multiply the stairway width in the tables by factor A, where:

$$A = 1 + \frac{(\text{riser height} - 7.0 \text{ inches})}{5} \quad (4-1)$$

For SI:
$$A = 1 + \frac{(\text{riser height} - 178 \text{ mm})}{127}$$

Where risers do not exceed 7 inches (178 mm) in height, A = 1.

2. Stairways not having a handrail within a 30-inch (762 mm) horizontal distance shall be 25 percent wider than otherwise calculated, i.e., multiply by B = 1.25. For all other stairs, B = 1.

3. Ramps steeper than 1 unit vertical in 10 units horizontal (10% slope) where used in ascent shall have their width increased by 10 percent, i.e., multiply by C = 1.10. For ramps not steeper than 1 unit vertical in 10 units horizontal (10% slope), C = 1. Where fixed seats are arranged in rows, the clear width of aisles

shall not be less than set forth above or less than the following minimum widths:

3.1 Forty-eight inches (1219 mm) for stairways having seating on both sides.

3.2 Thirty-six inches (914 mm) for stairways having seating on one side.

3.3 Twenty-three inches (584 mm) between a stairway handrail and seating where the aisles are subdivided by the handrail.

3.4 Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

3.5 Thirty-six inches (914 mm) for level or ramped aisles having seating on one side.

3.6 Twenty-three inches (584 mm) between a stairway handrail and seating where an aisle does not serve more than five rows on one side.

Where exit access is possible in two directions, the width of such aisles shall be uniform throughout their length. Where aisles converge to form a single path of exit travel, the aisle width shall not be less than the combined required width of the converging aisles.

1004.3.2.5.2 Where required. Aisles with a slope steeper than 1 unit vertical in 8 units horizontal (12.5% slope) shall consist of a series of risers and treads extending across the entire width of the aisle, except as provided in Section 1004.3.2.6.

The height of risers shall not be more than 8 inches (203 mm) nor less than 4 inches (102 mm) and the tread run shall not be less than 11 inches (279 mm). The riser height shall be uniform within each flight and the tread run shall be uniform throughout the aisle. Variations in run or height between adjacent treads or risers shall not exceed 3/16 inch (4.8 mm).

EXCEPTION:

Where the slope of aisle steps and the adjoining seating area is the same, the riser heights may be increased to a maximum of 9 inches (229 mm) and may be non-uniform, but only to the extent necessitated by changes in the slope of the adjoining seating area to maintain adequate sight lines. Variations may exceed 3/16 inch (4.8 mm) between adjacent risers, provided the exact location of such variations is identified with a marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform riser. The marking stripe shall be distinctively different from the contrasting marking stripe.

A contrasting marking stripe or other approved marking shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be a minimum of 1 inch (25 mm) wide and a maximum of 2 inches (51 mm) wide.

EXCEPTION:

The marking stripe may be omitted where tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

1004.3.2.6 Ramp Slope. The slope of ramped aisles shall not be more than 1 unit vertical in 8 units horizontal (12.5% slope). Ramped aisles shall have a slip-resistant surface.

EXCEPTION:

When provided with fixed seating, theaters may have a slope not steeper than 1 unit vertical in 5 units horizontal (20% slope).

1004.3.2.7 Handrails. Handrails shall comply with the height, size and shape dimensions set forth in Section 1003.3.3.6, and ends shall be returned or shall have rounded terminations or bends. Ramped aisles having a slope steeper than 1 unit vertical in 15 units horizontal (6.7% slope) and aisle stairs (two or more adjacent steps) shall have handrails located either at the side or within the aisle width. Handrails

may project into the required aisle width a distance of 3 1/2 inches (89 mm).

EXCEPTIONS:

1. Handrails may be omitted on ramped aisles having a slope not steeper than 1 unit vertical in 5 units horizontal (20% slope) and having fixed seats on both sides of the aisle.
2. Handrails may be omitted where a guardrail is at the side of an aisle that conforms to the size and shape requirements for handrails.

Handrails located within the aisle width shall be discontinuous with gaps or breaks at intervals not to exceed five rows. These gaps or breaks shall have a clear width of not less than 22 inches (559 mm) not more than 36 inches (914 mm) measured horizontally.

1004.3.4.5 Elevators. Elevators opening into a corridor shall be provided with an elevator lobby at each floor containing such a corridor. The lobby shall completely separate the elevators from the corridor by construction conforming to Section 1004.3.4.3.1 and all openings into the lobby wall contiguous with the corridor shall be protected as required by Section 1004.3.4.3.2.

EXCEPTIONS:

1. In office buildings, separations need not be provided from a street floor lobby, provided the entire street floor is protected with an automatic sprinkler system.
2. Elevators not required to meet the shaft enclosure requirements of Section 711.
3. When additional doors are provided in accordance with Section 3007.
4. Where elevator shafts are pressurized in accordance with Section 905, elevator lobbies need not be provided.

Elevator lobbies shall comply with Section 3002.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1004, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-1004, filed 1/6/98, effective 7/1/98.]

WAC 51-40-1104 Section 1104—Egress and areas of evacuation assistance.

Section 1104.1 General. In buildings or portions of buildings required to be accessible, accessible means of egress shall be provided in the same number as required for exits by Chapter 10. When an exit required by Chapter 10 is not accessible, an area for evacuation assistance shall be provided.

EXCEPTIONS:

1. Areas of evacuation assistance are not required in buildings where an approved, automatic fire-extinguishing system is installed in accordance with UBC Standard 9-1, provided that quick-response sprinkler heads are used where allowed by the standard; and that a written fire- and life-safety emergency plan, which specifically addresses the evacuation of persons with disabilities, is approved by the building official and the fire chief.
2. Areas for evacuation assistance are not required in open parking garages.

Every area for evacuation assistance shall comply with the requirements of this code and shall adjoin an accessible route of travel which shall comply with Section 1106.

1104.2 Areas for Evacuation Assistance.

1104.2.1 Location and construction. An area for evacuation assistance shall be one of the following:

1. A portion of a landing within a smokeproof enclosure, complying with Section 1005.3.3.

2. A portion of an exterior exit balcony, located immediately adjacent to an exit stairway, when the exterior exit balcony complies with Section 1006.3.2. Openings to the interior of the building located within 20 feet (6096 mm) of the area for evacuation assistance shall be protected with fire assemblies having a three-fourths-hour fire-protection rating.

3. A portion of a one-hour fire-resistive corridor complying with Sections 1004.3.4.3, 1004.3.4.3.1 and 1004.3.4.3.2 located immediately adjacent to an exit enclosure.

4. A vestibule located immediately adjacent to an exit enclosure and constructed to the same fire-resistive standards as required by Section 1004.3.4.3, 1004.3.4.3.1 and 1004.3.4.3.2.

5. A portion of a stairway landing within an exit enclosure which is vented to the exterior and is separated from the interior of the building by not less than one-hour fire-resistive door assemblies.

6. When approved by the building official, an area or room which is separated from other portions of the building by a smoke barrier. Smoke barriers shall have a fire-resistive rating of not less than one hour and shall completely enclose the area or room. Doors in the smoke barrier shall be tight-fitting smoke-and draft-control assemblies having a fire-protection rating of not less than 20 minutes and shall be self-closing or automatic closing. The area or room shall be provided with an exit directly to an exit enclosure. When the room or area exits into an exit enclosure which is required to be of more than one-hour fire-resistive construction, the room or area shall have the same fire-resistive construction, including the same opening protection, as required for the adjacent exit enclosure.

7. An elevator lobby complying with Section 1104.4.

1104.2.2 Size. Each area for evacuation assistance shall provide at least two wheelchair spaces not smaller than 30 inches by 48 inches (760 mm by 1220 mm) for each space. The area for evacuation assistance shall not encroach on any required exit width. The total number of such wheelchair spaces per story shall not be less than 1 for every 200 persons of calculated occupant load served by the area for evacuation assistance.

EXCEPTION: The building official may reduce the minimum number of 30-inch (760 mm) by 48-inch (1220 mm) areas to one for each area for evacuation assistance on floors where the occupant load is less than 200.

1104.2.3 Stairway width. Each stairway adjacent to an area for evacuation assistance shall have a minimum clear width of 48 inches (1220 mm) between handrails.

1104.2.4 Two-way communication. A telephone with controlled access to a public telephone system or another method of two-way communication shall be provided between each area for evacuation assistance and the primary entrance. The telephone or other two-way communication system shall be located with the reach ranges specified in Section 1106.2.4. The fire department may approve location other than the pri-

mary entrance. The communication system shall not require voice communication.

1104.2.5 Identification. Each area for evacuation assistance shall be identified by a sign which states: **AREA FOR EVACUATION ASSISTANCE** and the International Symbol of Access. The sign shall be illuminated when exit sign illumination is required. The sign shall comply with Sections 1003.2.8.4 and 1003.2.8.5. In each area for evacuation assistance, instructions on the use of the area under emergency conditions shall be posted adjoining the two-way communication system.

1104.3 Accessible Exits. All exterior exits which are located adjacent to accessible areas and within 6 inches (152 mm) of grade shall be accessible.

1104.4 Area for Evacuation Assistance, High-Rise Alternative. Within a building of any height or occupancy, constructed in accordance with the requirements of Section 403, an area for evacuation assistance may be located in the elevator lobby, or adjacent to the elevator where no lobby is required, when:

1. The area for evacuation assistance complies with the requirements for size, two-way communication and identification as specified in Section 1104.2; and,

2. Elevator shafts are pressurized as required for smokeproof enclosures in Section 1005.3.3. Such pressurization system shall be activated by smoke detectors on each floor located in a manner approved by the building official. Pressurization equipment and its ductwork within the building shall be separated from other portions of the building by a minimum of two-hour fire-resistive construction.

3. The manager of the building has established and maintains a written fire- and life-safety emergency plan which, in addition to other provisions, shall specifically address the evacuation of persons with disabilities. Such plan shall be approved by the building official and the fire chief.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1104, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-1104, filed 1/6/98, effective 7/1/98.]

WAC 51-40-1105 Section 1105—Facility accessibility.

Section 1105.1 General. Where buildings are required to be accessible, building facilities shall be accessible to persons with disabilities as provided in this section. For Group R, Division 1 apartment buildings, where specific floors of a building are required to be accessible, the requirements shall apply only to the facilities located on accessible floors.

All building facilities or elements required by this section to be accessible shall be designed and constructed in accordance with Section 1106.

1105.2 Bathing and Toilet Facilities.

1105.2.1 Bathing facilities. When bathing facilities are provided, at least 2 percent, but not less than 1, bathtub or shower shall be accessible. In dwelling units where a separate

bathtub and shower are provided in the same room, at least one shall be accessible.

1105.2.2 Toilet facilities. Toilet facilities located within accessible dwelling units, guest rooms, and congregate residences shall comply with Sections 1106.11 and 1106.27.

EXCEPTION: Within accessible dwelling units, only one toilet facility need be accessible.

In each toilet facility in other occupancies, at least one wheelchair accessible toilet stall with an accessible water closet shall be provided. In addition, when there are 6 or more water closets within a toilet facility, at least one ambulatory accessible toilet stall complying with Section 1106.11.4 shall also be installed.

Where urinals are provided, at least one urinal shall be accessible.

1105.2.3 Lavatories, mirrors and towel fixtures. At least one accessible lavatory shall be provided within any toilet facility. Where mirrors, towel fixtures and other toilet and bathroom accessories are provided, at least one of each shall be accessible.

1105.2.4 Adaptable fixtures in dwelling units. See Section 1106.27.2 for adaptable fixtures in dwelling units.

1105.3 Elevators, Platform Lifts and Stairways.

1105.3.1 Elevators.

1105.3.1.1 Where required. In multi-story buildings or portions thereof required to be accessible by Section 1103, at least one elevator shall serve each level, including mezzanines. Other than within an individual dwelling unit, where an elevator is provided but not required, it shall be accessible.

EXCEPTIONS:

1. In Group R, Division 1 apartment occupancies, an elevator is not required where accessible dwelling units and guest rooms are accessible by ramp or by grade level route of travel.
2. In a building of fewer than three stories, an elevator is not required where ramps, grade-level entrances or accessible horizontal exits from an adjacent building, are provided to each floor.
3. In multi-story parking garages, an elevator is not required where an accessible route of travel is provided from accessible parking spaces on levels with accessible horizontal connections to the primary building served.
4. In Group R, Division 1 hotels and lodging houses, less than 3 stories in height, an elevator is not required, provided that all accessible guest rooms are located on the ground floor.

1105.3.1.2 Design. All elevators shall be accessible.

EXCEPTIONS:

1. Private elevators serving only one dwelling unit.
2. Where more than one elevator is provided in the building, elevators used exclusively for movement of freight.

Elevators required to be accessible shall be designed and constructed to comply with Chapter 296-81 of the Washington Administrative Code.

1105.3.2 Platform lifts. Platform lifts may be used in lieu of an elevator under one of the following conditions subject to approval by the building official:

1. To provide an accessible route of travel to a performing area in a Group A Occupancy; or,

2. To provide unobstructed sight lines and distribution for wheelchair viewing positions in Group A Occupancies; or

3. To provide access to spaces with an occupant load of less than 5 that are not open to the public; or,

4. To provide access where existing site or other constraints make use of a ramp or elevator infeasible.

All platform lifts used in lieu of an elevator shall be capable of independent operation and shall comply with Chapter 296-81 of the Washington Administrative Code.

1105.3.3 Stairways. Stairways shall comply with Section 1106.9.

1105.4 Other Building Facilities.

1105.4.1 Water fountains. On any floor where water fountains are provided, at least 50 percent, but in no case less than one fountain, shall be accessible complying with Section 1106.13 and at least one fountain shall be mounted at a standard height.

1105.4.2 Telephones. On any floor where public telephones are provided at least one telephone shall be accessible. On any floor where 2 or more banks of multiple telephones are provided, at least one telephone in each bank shall be accessible and at least one telephone per floor shall be designed to allow forward reach complying with Section 1106.2.4.5.

Where any bank of public telephones consists of 3 or more telephones, at least one telephone in each bank shall be equipped with a shelf and electrical outlet complying with Section 1106.14.7.

All accessible telephones and at least 25 percent of all other public telephones, but in no case less than one, shall be provided with volume controls in accordance with Section 1106.14.3 and shall be dispersed among the public telephones provided in the building.

Where four or more public telephones are provided at a building site, and at least one is in an interior location, at least one interior telephone shall be a text telephone in accordance with Section 1106.14.

Where interior public pay phones are provided in transportation facilities; assembly and similar areas including stadiums and arenas; convention centers; hotels with convention facilities; or covered malls; or in or adjacent to hospital emergency, recovery, or waiting rooms; at least one interior text telephone shall be provided.

1105.4.3 Kitchens. Kitchens within accessible dwelling units shall be designed in accordance with Sections 1106.12 and 1106.27.

EXCEPTION: Kitchens in Type B dwelling units need not comply with Section 1106.12.1 (See Section 1106.27.1).

Kitchens, kitchenettes, or wet bars in other than dwelling units, which are provided accessory to a sleeping room, guest room, or suite, shall be designed in accordance with Section

1106. Countertops and sinks shall be no more than 34 inches (865 mm) above the finished floor. At least 50 percent of shelf space in cabinets and appliances shall be within the reach ranges of Section 1106.2.4.

1105.4.4 Recreation facilities. Where common- or public-use recreational facilities, swimming pools, hot tubs, spas, and similar facilities are provided, they shall be accessible. Swimming pools shall be accessible by transfer tier, hydraulic chair, ramp, or other means. Hot tubs and spas need be accessible only to the edge of the facility.

EXCEPTION: For Group R, Division 1 apartment occupancies, common- or public-use facilities accessory to buildings not required to contain either Type A or Type B dwelling units in accordance with Section 1103.1.8.2.

1105.4.5 Fixed or built-in seating or tables. Where fixed or built-in seating or tables are provided, at least 5 percent, but no fewer than one, shall be accessible. Accessible fixed or built-in seating or tables shall comply with Section 1106.19. In eating and drinking establishments, such seating or tables shall be distributed throughout the facility.

1105.4.6 Storage facilities. In other than Group R, Division 1 apartment buildings, where fixed or built-in storage facilities such as cabinets, shelves, closets, and drawers are provided in accessible spaces, at least one of each type provided shall contain storage space complying with Section 1106.18.

1105.4.7 Customer service facilities.

1105.4.7.1 Dressing and fitting rooms. Where dressing or fitting rooms are provided for use by the general public, patients, customers or employees, 5 percent, but not less than one, in each group of rooms serving distinct and different functions shall be accessible in accordance with Section 1106.24.

1105.4.7.2 Counters and windows. Where customer sales and service counters or windows are provided, a portion of the counter, or at least one window, shall be accessible in accordance with Section 1106.24.2.

1105.4.7.3 Shelving and display. Self-service shelves or display units in retail occupancies shall be located on an accessible route of travel in accordance with Section 1103.2.2. Not all self-service shelves and display units need be located within reach ranges required by Section 1106.2.4.

1105.4.7.4 Check-out aisles. Accessible check-out aisles shall be installed in accordance with Table No. 11-E and Section 1106.24.3.

1105.4.7.5 Food service lines. Where self-service shelves are provided in dining and drinking establishments, at least 50 percent of each type shall comply with Sections 1106.2 and 1106.22.

1105.4.8 Controls, operating mechanisms, and hardware. Controls, operating mechanisms, and hardware, including; switches that control lighting, ventilation or electrical outlets; in accessible spaces, along accessible routes or as parts of accessible elements, shall comply with Section 1106.3.

1105.4.9 Alarms. Where provided, alarm systems shall include both audible and visible alarms. Visible alarm devices shall be located in all assembly areas; common-use areas, including toilet rooms and bathing facilities; hallways and lobbies; and hotel guest rooms as required by Section 1103.1.8.3.

EXCEPTIONS:

1. Alarm systems in Group I, Division 1.1 and 2 Occupancies may be modified to suit standard health care design practice.
2. Visible alarms are not required in Group R, Division 1 apartment buildings.
3. Visible alarms are not required in employee assigned work areas, whether they are single or multiple work stations.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1105, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-1105, filed 1/6/98, effective 7/1/98.]

WAC 51-40-1106 Section 1106—Accessible design and standards.

Section 1106.1 General. Where accessibility is required by this chapter, buildings and facilities shall be designed and constructed in accordance with this section, unless otherwise specified in this chapter.

1106.2 Space Allowance and Reach Ranges.

1106.2.1 Wheelchair passage width. The minimum clear width for single wheelchair passage shall be 36 inches (915 mm). The minimum width for two wheelchairs to pass is 60 inches (1525 mm).

EXCEPTION: The minimum width for single wheelchair passage may be 32 inches (815 mm) for a maximum distance of 24 inches (610 mm).

1106.2.2 Wheelchair turning spaces. Wheelchair turning spaces shall be designed and constructed to satisfy one of the following requirements:

1. A turning space not less than 60 inches (1525 mm) in diameter; or,
2. A turning space at T-shaped intersections or within a room, where the minimum width is not less than 36 inches (915 mm). Each segment of the T shall be clear of obstructions not less than 24 inches (610 mm) in each direction.

Wheelchair turning space may include knee and toe clearance in accordance with Section 1106.2.4.3.

1106.2.3 Unobstructed floor space. A floor space, including the vertical space above such floor space, which is free of any physical obstruction including door swings, to a height of 29 inches (737 mm). Where a pair of doors occurs, the swing of the inactive leaf may be considered to be unobstructed floor space. Unobstructed floor space may include toe spaces that are a minimum of 9 inches (230 mm) in height and not more than 6 inches (152 mm) in depth.

1106.2.4 Clear floor or ground spaces and maneuvering clearance space for wheelchairs.

1106.2.4.1 Size. The minimum clear floor or ground space required to accommodate a single, stationary wheelchair

occupant shall be not less than 30 inches (760 mm) by 48 inches (1220 mm).

1106.2.4.2 Approach. Wheelchair spaces shall be designed to allow for forward or parallel approach to an accessible feature.

1106.2.4.3 Knee and toe clearances. Spaces under obstructions, work surfaces or fixtures may be included in the clear floor or ground space provided that they are at least 30 inches (760 mm) in width, a minimum of 27 inches (685 mm) in height, and not greater than 25 inches (635 mm) in depth. Toe spaces under obstructions, work surfaces or fixtures which comply with the requirements for unobstructed floor space may be included in the clear floor or ground space.

1106.2.4.4 Approach to wheelchair spaces. One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin or overlap an accessible route of travel, or shall adjoin another wheelchair clear space. Clear space located in an alcove or otherwise confined on all or part of three sides shall be not less than 36 inches (915 mm) in width where forward approach is provided, or 60 inches (1525 mm) in width where parallel approach is provided.

1106.2.4.5 Forward reach. Where the clear floor space allows only forward approach to an object, the maximum forward reach allowed shall not be higher than 48 inches (1220 mm). Reach obstructions 20 inches (510 mm) or less in depth may project into the clear space provided that knee clearance is maintained in accordance with Section 1106.2.4.3. Reach obstructions greater than 20 inches (510 mm) in depth may project into the clear space provided that the reach obstruction shall not exceed 25 inches (635 mm) in depth and the maximum forward reach shall not exceed 44 inches (1118 mm) in height. The minimum low forward reach shall not be lower than 15 inches (380 mm).

1106.2.4.6 Side reach. Where the clear floor space allows parallel approach by a person in a wheelchair, the maximum high side reach allowed shall not be higher than 48 inches (1219 mm). Obstructions no greater than 34 inches (865 mm) in height and no more than 24 inches (610 mm) in depth may be located in the side reach area provided that when such obstructions are present, the side reach shall not exceed 46 inches (1170 mm) in height. The minimum low side reach shall not be lower than 9 inches (230 mm).

1106.3 Controls and Hardware.

1106.3.1 Operation. Handles, pulls, latches, locks, and other operating devices on doors, windows, cabinets, plumbing fixtures, and storage facilities, shall have a lever or other shape which will permit operation by wrist or arm pressure and which does not require tight grasping, pinching or twisting to operate. Doors shall comply with Section 1003.3.1.5.

The force to activate controls on lavatories and water fountains and flush valves on water closets and urinals shall not be greater than 5 pounds (22.2 N).

1106.3.2 Mounting heights. The highest operable part of environmental and other controls, dispensers, receptacles,

and other operable equipment shall be within at least one of the reach ranges specified in Section 1106.2.4, and not less than 36 inches (915 mm) above the floor. Electrical and communications system receptacles on walls shall be mounted a minimum of 15 inches (380 mm) above the floor. Door hardware shall be mounted at not less than 36 inches (915 mm) and not more than 48 inches (1220 mm) above the floor.

1106.3.3 Clear floor space. Clear floor space that allows a forward or a side approach shall be provided at all controls or hardware.

1106.4 Accessible Route of Travel.

1106.4.1 Width. The minimum clear width of an accessible route of travel shall be 36 inches (915 mm) except at doors (see Section 1106.10.2). Where an accessible route includes a 180 degree turn around an obstruction which is less than 48 inches (1220 mm) in width, the clear width of the accessible route of travel around the obstruction shall be 42 inches (1065 mm) minimum. For exterior accessible routes of travel, the minimum clear width shall be 44 inches (1118 mm).

EXCEPTION: The minimum width for single wheelchair passage may be 32 inches (815 mm) for a maximum distance of 24 inches (610 mm).

Where an accessible route of travel is less than 60 inches (1525 mm) in width, passing spaces at least 60 inches (1525 mm) by 60 inches (1525 mm) shall be located at intervals not to exceed 200 feet (61 m). A T-shaped intersection of two corridors or walks may be used as a passing space.

1106.4.2 Height. Accessible routes shall have a clear height of not less than 79 inches (2007 mm). Where the vertical clearance of an area adjoining an accessible route of travel is less than 79 inches (2007 mm) but more than 27 inches (685 mm), a continuous permanent barrier shall be installed to prevent traffic into such areas of reduced clearance.

1106.4.3 Slope. An accessible route of travel shall have a running slope not greater than 1 vertical in 12 horizontal. An accessible route of travel with a running slope greater than 1 vertical in 20 horizontal shall comply with Section 1106.8. Cross slopes of an accessible route of travel shall not exceed 1 vertical in 48 horizontal.

1106.4.4 Changes in level. Changes in level along an accessible route of travel shall comply with Section 1106.6. Stairs or escalators shall not be part of an accessible route of travel. Any raised area within an accessible route of travel shall be cut through to maintain a level route or shall have curb ramps at both sides and a level area not less than 48 inches (1220 mm) long connecting the ramps.

1106.4.5 Surfaces.

1106.4.5.1 General. All floor and ground surfaces in an accessible route of travel shall comply with Section 1106.7.

1106.4.5.2 Detectable warnings. Curb ramps shall have detectable warnings complying with Section 1106.17. Detectable warnings shall extend the full width and depth of the curb ramp.

1106.4.6 Illumination. Illumination shall be provided along an exterior accessible route of travel at any time the building is occupied, with an intensity of not less than one footcandle (10.76 lx) on the surface of the route.

1106.4.7 Curb ramps.

1106.4.7.1 Slope. Slopes of curb ramps shall comply with Section 1106.8. Transitions from ramps to walks, gutters, or vehicular ways shall be flush and free of abrupt changes in height. Maximum slopes of adjoining gutters and road surfaces immediately adjacent to the curb ramp or accessible route of travel shall not exceed 1 vertical in 20 horizontal.

1106.4.7.2 Width. Curb ramps shall be not less than 36 inches (915 mm) in width, exclusive of the required side slopes.

1106.4.7.3 Side slopes of curb ramps. Curb ramps located where pedestrians must walk across the ramp, or where not protected by handrails or guardrails, shall have sloped sides. The maximum side slope shall be 1 vertical in 10 horizontal. Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp.

EXCEPTION: Where the width of the walking surface at the top of the ramp and parallel to the run of the ramp is less than 48 inches (1220 mm), the maximum side slope shall be 1 vertical in 12 horizontal.

1106.4.7.4 Location. Built-up curb ramps shall be located so as not to project into vehicular ways nor be located within accessible parking spaces.

1106.4.7.5 Obstructions. Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

1106.4.7.6 Location at marked cross walks. Curb ramps at marked cross walks shall be wholly contained within the markings, excluding any sloped sides.

1106.4.7.7 Orientation. Curb ramps shall be oriented in the same direction as pedestrian flow of crosswalks; diagonally oriented curb ramps are prohibited.

1106.4.8 Vehicular areas. Where an accessible route of travel crosses or adjoins a vehicular way, and where there are no curbs, railings or other elements which separate the pedestrian and vehicular areas, and which are detectable by a person who has a severe vision impairment, the boundary between the areas shall be defined by a continuous detectable warning not less than 36 inches (915 mm) wide, complying with Section 1106.17.

1106.5 Protruding Objects. Protruding objects shall not reduce the clear width of a route of travel or maneuvering space. Any wall- or post-mounted object with its leading edge between 27 inches (685 mm) and 79 inches (2007 mm) above the floor may project not more than 4 inches (102 mm) into a route of travel, corridor, passageway, or aisle. Any wall- or post-mounted projection greater than 4 inches (102 mm) shall extend to the floor.

1106.6 Changes in Level. Accessible routes of travel and accessible spaces within buildings shall have continuous common floor or ramp surfaces. Abrupt change in height

greater than 1/4 inch (6 mm) shall be beveled to 1 vertical in 2 horizontal. Changes in level greater than 1/2 inch (13 mm) shall be accomplished by means of a ramp meeting the requirements of Section 1106.8, a curb ramp meeting the requirements of Section 1106.4.7, or an elevator or platform lift meeting the requirements of Section 1105.3. For Type B dwelling units, see also Section 1106.27.

1106.7 Floor Coverings and Surface Treatments.

1106.7.1 General. All surfaces shall be firm and stable.

1106.7.2 Carpeting. Carpeting and floor mats in accessible areas shall be securely fastened to the underlying surface, and shall provide a firm, stable, continuous, and relatively smooth surface.

1106.7.3 Slip-resistant surfaces. Showers; locker rooms; swimming pool, spa, and hot tub decks; toilet rooms; and other areas subject to wet conditions shall have slip-resistant floors.

Exterior accessible routes of travel shall have slip-resistant surfaces.

1106.7.4 Grates. Within an accessible route of travel, grates shall have openings not more than 1/2 inch (13 mm) in one direction. Where grates have elongated openings, they shall be placed so that the long dimension is perpendicular to the dominant direction of travel. The maximum vertical surface change shall be 1/8 inch (3 mm).

1106.7.5 Expansion and construction joints. Expansion and construction joints in exterior routes of travel shall have a width of not more than 1/2 inch (13 mm), shall be filled with a firm, compressible, elastic material, and shall be substantially level with the surface of the accessible route of travel.

1106.8 Ramps.

1106.8.1 General. Ramps required to be accessible shall comply with Section 1003.3.4 and the provisions of this section. No ramp shall change direction between landings, except ramps with an inside radius of 30 feet (9144 mm) or greater.

1106.8.2 Slope and rise. The maximum slope of a ramp shall be 1 vertical in 12 horizontal. The maximum rise for any run shall be 30 inches (760 mm).

1106.8.3 Width. The minimum width of a ramp shall be not less than 36 inches (915 mm) for interior ramps and 44 inches (1118 mm) for exterior ramps.

1106.8.4 Landings. Ramps within the accessible route of travel shall have landings at the top and bottom, and at least one intermediate landing shall be provided for each 30 inches (760 mm) of rise. Landings shall be level and have a minimum dimension measured in the direction of ramp run of not less than 60 inches (1525 mm). Where the ramp changes direction at a landing, the landing shall be not less than 60 inches (1525 mm) by 60 inches (1525 mm). The width of any landing shall be not less than the width of the ramp.

1106.8.5 Handrails. Ramps having slopes steeper than 1 vertical to 20 horizontal shall have handrails as required for stairways, except that intermediate handrails as required in Section 1003.3.3.6 are not required. Handrails shall be continuous provided that they shall not be required at any point of access along the ramp, nor at any curb ramp. Handrails shall extend at least 12 inches (305 mm) beyond the top and bottom of any ramp run.

EXCEPTION: Ramps having a rise less than or equal to 6 inches (152 mm), or a run less than or equal to 72 inches (1830 mm), need not have handrails.

1106.8.6 Exterior ramps. Exposed ramps and their approaches shall be constructed to prevent the accumulation of water on walking surfaces.

1106.8.7 Edge protection. Any portion of the edge of a ramp with a slope greater than 1 vertical in 20 horizontal, or landing which is more than 1/2 inch (13 mm) above the adjacent grade or floor, shall be provided with edge protection in accordance with the following:

1. **Walls and Curbs.** When used, walls or curbs shall be not less than 2 inches (51 mm) in height above the surface of the accessible route of travel.

2. **Railings.** When used, railings shall comply with Section 1106.8.5 and also shall have one of the following features:

2.1. An intermediate rail mounted 17 to 19 inches (430 to 485 mm) above the ramp or landing surface, or

2.2. A guardrail complying with Section 509.

1106.9 Stairways.

1106.9.1 General. Stairways required to be accessible shall comply with Section 1003.3.3 and provisions of this section.

1106.9.2 Open risers. Open risers shall not be permitted.

EXCEPTION: Stairways in Group R, Division 1 apartment buildings may have open risers.

1106.9.3 Nosings. Stair nosings shall be flush, slip-resistant, and rounded to a radius of 1/2 inch (13 mm) maximum. Risers shall be sloped, or the underside of the nosing shall have an angle of not less than 60 degrees from the horizontal. Nosings shall project no more than 1-1/2 inches (38 mm).

1106.9.4 Exterior stairways. Exposed stairways and their approaches shall be constructed to prevent the accumulation of water on walking surfaces.

1106.10 Doors.

1106.10.1 General. Doors required to be accessible shall comply with Section 1003.3.1 and with provisions of this section. For the purpose of this section, gates shall be considered to be doors. An accessible gate or door shall be provided adjacent to any turnstile or revolving door. Where doorways have two independently operated door leaves, then at least one leaf shall comply with this section.

1106.10.2 Clear width. Doors shall be capable of being opened so that the clear width of the opening is not less than 32 inches (815 mm).

EXCEPTION: Doors not requiring full user passage, such as shallow closets, may have a clear opening of not less than 20 inches (510 mm).

1106.10.3 Maneuvering clearances at doors. Except as provided in Section 1106.27, all doors shall have minimum maneuvering clearances as follows:

1. For a forward approach, where a door must be pulled to be opened, an unobstructed floor space shall extend at least 18 inches (455 mm) beyond the strike jamb and extend at least 60 inches (1525 mm) perpendicular to the doorway.

2. For a forward approach, where a door must be pushed to be opened and is equipped with a closer and a latch, an unobstructed floor space shall extend at least 12 inches (305 mm) beyond the strike jamb and extend at least 48 inches (1220 mm) perpendicular to the doorway.

3. For a forward approach, where a door must be pushed to be opened and is not equipped with a closer and a latch, an unobstructed floor space shall be at least the width of the doorway and extend at least 48 inches (1220 mm) perpendicular to the doorway.

4. For a hinge side approach, where a door must be pulled to be opened, an unobstructed floor space shall extend at least 36 inches (915 mm) beyond the latch side of the door and at least 60 inches (1525 mm) perpendicular to the doorway, or shall have an unobstructed floor space that extends at least 42 inches (1065 mm) beyond the latch side of the door and at least 54 inches (1370 mm) perpendicular to the doorway.

5. For a hinge side approach, where a door must be pushed to be opened and is not equipped with both a closer and a latch, an unobstructed floor space, measured from the latch side, shall extend across the width of the doorway and beyond the hinge side of the door for a total width of not less than 54 inches (1370 mm); and at least 42 inches (1065 mm) perpendicular to the doorway.

6. For a hinge side approach, where a door must be pushed to be opened and is equipped with both latch and closer, an unobstructed floor space, measured from the latch side, shall extend across the width of the doorway and beyond the hinge side of the door for a total width of not less than 54 inches (1370 mm); and at least 48 inches (1220 mm) perpendicular to the doorway.

7. For a latch side approach, where a door must be pulled to be opened and is equipped with a closer, an unobstructed floor space shall extend at least 24 inches (610 mm) beyond the latch side of the door and at least 54 inches (1370 mm) perpendicular to the doorway.

8. For a latch side approach, where a door must be pulled to be opened and is not equipped with a closer, an unobstructed floor space shall extend at least 24 inches (610 mm) beyond the latch side of the door and at least 48 inches (1220 mm) perpendicular to the doorway.

9. For a latch side approach, where a door must be pushed to be opened and is equipped with a closer, an unobstructed floor space shall extend at least 24 inches (610 mm) beyond the latch side of the door and at least 48 inches (1370 mm) perpendicular to the doorway.

10. For a latch side approach, where a door must be pushed to be opened and is not equipped with a closer, an unobstructed floor space shall extend at least 24 inches (610 mm) parallel to the doorway, beyond the latch side of the door and at least 42 inches (1065 mm) perpendicular to the doorway.

11. For a forward approach, to a sliding or folding door, an unobstructed floor space shall extend the same width as the door opening and at least 48 inches (1220 mm) perpendicular to the doorway.

12. For a slide side approach to a sliding or folding door, an unobstructed floor space, measured from the latch side, shall extend across the width of the doorway and beyond the slide side of the door for a total width of not less than 54 inches (1370 mm); and at least 42 inches (1065 mm) perpendicular to the doorway.

13. For a latch side approach to a sliding or folding door, an unobstructed floor space shall extend at least 24 inches (610 mm) beyond the latch side of the door and at least 42 inches (1065 mm) perpendicular to the doorway.

14. Where two doors are in series, the minimum distance between two hinged or pivoted doors shall be 48 inches (1220 mm), in addition to any area needed for door swing. Doors in series shall swing either in the same direction, or away from the space between the doors.

15. All doors in alcoves shall comply with the requirement for a forward approach.

1106.10.4 Thresholds at doors. Thresholds at doors shall comply with Section 1106.6.

EXCEPTION: In dwelling units, exterior doors other than the accessible entrance to a dwelling unit, may be sliding doors with thresholds not exceeding 3/4 inch (19 mm).

1106.10.5 Automatic and power-assisted doors. Door-closers or power-operators shall be operable as required by Section 1003.3.1.2.

EXCEPTION: Floor pad or electric eye actuated power-operators.

All power-operated doors shall remain in the fully open position for not less than 6 seconds before closing. Touch switches shall be mounted 36 inches (915 mm) above the floor and not less than 18 inches (455 mm), nor more than 36 inches (915 mm), horizontally from the nearest point of travel of the moving door. Other power-operated doors must be actuated from a location not less than 36 inches (915 mm) from the nearest point of travel of the moving door. Power-operated doors shall automatically reopen when they encounter an obstruction other than the strike jamb.

1106.10.6 Door closers. Where provided, door closers shall be adjusted to close from an open position of 70 degrees to a point 3 inches (76 mm) from the latch, in not less than 3 seconds, when measured to the leading edge of the door.

1106.10.7 Vision panels. Where a door contains one or more vision panels, the bottom of the glass of at least one panel, shall be not more than 43 inches (1091 mm) above the floor.

1106.11 Bathrooms, Toilet Rooms, Bathing Facilities, and Shower Rooms.

1106.11.1 General. Bathrooms, toilet rooms, bathing facilities, and shower rooms shall be designed in accordance with this section. For dwelling units, see also Section 1106.27.

1106.11.2 Unobstructed floor space. An unobstructed floor space shall be provided within bathrooms, toilet rooms, bathing facilities, and shower rooms of sufficient size to inscribe a circle with a diameter not less than 60 inches (1525 mm). Doors in any position may encroach into this space by not more than 12 inches (305 mm). The clear floor spaces at fixtures, the accessible route of travel, and the unobstructed floor space may overlap.

1106.11.3 Wheelchair accessible toilet stalls.

1106.11.3.1 Dimensions. Wheelchair accessible toilet stalls shall be at least 60 inches (1525 mm) in width. Where wall-hung water closets are installed, the depth of the stall shall be not less than 56 inches (1420 mm). Where floor-mounted water closets are installed, the depth of the stall shall be not less than 59 inches (1500 mm). Entry to the compartment shall have a clear width of 32 inches (815 mm). Toilet stall doors shall not swing into the clear floor space required for any fixture. Except for door swing, a clear unobstructed access not less than 48 inches (1220 mm) in width shall be provided to toilet stalls.

EXCEPTION: Partitions may project not more than one inch (25 mm), in the aggregate, into the required width of the stall.

1106.11.3.2 Toe clearances. In any toilet stall, the front partition and at least one side partition shall provide a toe clearance of at least 9 inches (230 mm) above the floor.

EXCEPTION: Toe clearance is not required in a stall with a depth greater than 60 inches (1525 mm).

1106.11.3.3 Door hardware. Doors of accessible toilet stalls shall comply with Section 1106.3.

1106.11.4 Ambulatory accessible toilet stalls. Ambulatory accessible toilet stalls shall be at least 36 inches (915 mm) in width, with an outward swinging, self-closing door. Grab bars shall be installed on each side of the toilet stall and shall comply with Sections 1106.11.5.3 and 1106.11.11.

1106.11.5 Water closets.

1106.11.5.1 Clear floor space. The lateral distance from the center line of the water closet to the nearest obstruction, excluding grab bars, shall be 18 inches (455 mm) on one side and not less than 42 inches (1065 mm) on the other side. In other than stalls, a clear floor space of not less than 32 inches (815 mm), measured perpendicular to the wall on which the water closet is mounted, shall be provided in front of the water closet.

EXCEPTION: In other than a toilet stall, a lavatory may be located within the clear floor space required for a water closet

provided that knee and toe clearances for the lavatory comply with Section 1106.11.7, below, and:

1. In Type B dwelling units the edge of the lavatory shall be located not less than 15 inches (380 mm) from the centerline of the water closet; or,
2. In all other occupancies the edge of the lavatory shall be located not less than 18 inches (455 mm) from the centerline of the water closet.

1106.11.5.2 Height. The height of water closets shall be a minimum of 17 inches (430 mm) and a maximum of 19 inches (485 mm) measured to the top of the seat. Seats shall not be sprung to return to a lifted position.

1106.11.5.3 Grab bars. Grab bars shall be installed at one side and at the back of the water closet. The top of grab bars shall be not less than 33 inches (840 mm) and not more than 36 inches (915 mm) above and parallel to the floor. Grab bars located at the side shall be a minimum 42 inches (1065 mm) in length located not more than 12 inches (305 mm) from the rear wall and extending at least 54 inches (1370 mm) from the rear wall. Grab bars located at the back shall be a minimum of 36 inches (915 mm) in length and shall extend at least 12 inches (305 mm) beyond the center of the water closet toward the side wall and at least 24 inches (610 mm) toward the open side of the water closet. Grab bars located at the back shall be mounted not more than 9 inches (230 mm) behind the water closet seat. See also Section 1106.11.11.

1106.11.5.4 Flush controls. Flush controls shall be mounted for use from the wide side of the water closet area and not more than 44 inches (1118 mm) above the floor. Flush valves shall comply with Section 1106.3.

1106.11.5.5 Dispensers and receptacles. Toilet paper and other dispensers or receptacles shall be installed within easy reach of the water closet, and shall not interfere with unobstructed floor space or grab bar utilization.

1106.11.6 Urinals. A clear floor space measuring 30 inches (760 mm) in width by 48 inches (1220 mm) in depth shall be provided in front of urinals to allow for forward approach. Urinal shields shall have a clear space between them of not less than 29 inches (737 mm) and shall not extend farther than the front edge of the urinal rim. Urinals shall be stall-type or wall-hung with an elongated rim at a maximum of 17 inches (430 mm) above the floor. Flush controls shall be mounted not more than 44 inches (1118 mm) above the floor. Flush valves shall comply with Section 1106.3.

1106.11.7 Lavatories and sinks.

1106.11.7.1 Clear floor space. A clear floor space not less than 30 inches (760 mm) in width by 48 inches (1220 mm) in depth shall be provided in front of lavatories and sinks to allow a forward approach. The clear floor space may include knee and toe clearances not to exceed 19 inches (485 mm) extending under the lavatory or sink.

1106.11.7.2 Height. Lavatories and sinks shall be mounted with the rim or counter surface no higher than 34 inches (865 mm) above the finished floor.

1106.11.7.3 Knee and toe clearances.

1106.11.7.3.1 Lavatories. The total depth of the clear space beneath a lavatory shall be not less than 17 inches (430 mm), of which toe clearance shall be not more than 6 inches (152 mm) of the total depth. Knee clearance shall be not less than 29 inches (237 mm) in height and 30 inches (760 mm) in width.

1106.11.7.3.2 Sinks. Knee clearance not less than 27 inches (685 mm) in height, 30 inches (760 mm) in width, and 19 inches (485 mm) in depth shall be provided underneath sinks.

1106.11.7.4 Exposed pipes and surfaces. Hot water and drain pipes exposed under lavatories and sinks shall be insulated or otherwise covered. There shall be no sharp or abrasive surfaces under lavatories or sinks.

1106.11.7.5 Faucets. Faucet control handles shall be located not more than 17 inches (430 mm) from the front edge of the lavatory, sink or counter, and shall comply with Section 1106.3. Self-closing valves shall remain open for at least 10 seconds per operation.

1106.11.7.6 Sink depth. Sinks shall be not more than 6-1/2 inches (165 mm) in vertical depth.

1106.11.8 Mirrors, dispensers, and other fixtures. Mirrors or shelves shall be installed so that the bottom of the mirror or the top of the shelf is within 40 inches (1015 mm) of the floor.

Drying equipment, towel or other dispensers, and disposal fixtures shall be mounted so as to not exceed 40 inches (1015 mm) above the finished floor to any rack, operating controls, receptacle or dispenser.

1106.11.9 Bathtubs.

1106.11.9.1 Clear floor space. A clear floor space not less than 60 inches (1525 mm) in length shall be provided along the tub. Where the required seat is located at the end of the tub, the clear floor space shall be not less than 75 inches (1905 mm) in length. The clear floor space shall be not less than 30 inches (760 mm) in width where access to the space is parallel to the tub and not less than 48 inches (1220 mm) in width where access to the space is at right angles to the tub.

A lavatory which complies with Section 1106.11.7, above, may be located in the clear floor space for the tub.

Where a seat is provided and a lavatory is located in the clear floor space for the tub, the lavatory shall be located at the end of the tub adjacent to the controls.

1106.11.9.2 Seats. An in-tub seat or a seat at the end of the tub shall be provided. In-tub seats shall be portable and removable, not less than 12 inches (305 mm) in width, and extend the full width of the tub. Seats at the end of the tub shall be constructed flush with the top of the tub and shall extend not less than 15 inches (380 mm) from the end of the tub. Seats shall be mounted securely and shall not slip during use.

1106.11.9.3 Grab bars. All required grab bars shall be installed parallel to the floor. Lower grab bars shall be

installed centered 9 inches (230 mm) above the tub rim. Upper or single grab bars shall be installed centered not less than 33 inches (840 mm) and not more than 36 inches (915 mm) above the floor of the clear space.

Where a tub has a seat at the end, two grab bars not less than 48 inches (1220 mm) in length shall be installed on the wall opposite the clear floor space. One end of each grab bar shall terminate where the tub abuts the seat.

Where a tub has an in-tub seat, two grab bars, not less than 24 inches (610 mm) in length, shall be installed on the wall opposite the clear floor space. The grab bars shall extend to not less than 24 inches (610 mm) from one end of the tub and not less than 12 inches (305 mm) from the other end. One grab bar shall be installed on the wall at the end of the tub opposite the drain, extending at least 12 inches (305 mm) from the clear floor space.

For all bathtubs, one grab bar shall be installed on the wall at the end of the tub nearest the drain, extending at least 24 inches (610 mm) from the clear floor space.

1106.11.9.4 Controls and fixtures. Faucets and other controls shall be located above the tub rim and below the grab bars, shall be offset laterally from the clear floor space between the open edge of the tub and the mid-point of the tub and shall comply with Section 1106.3.

A shower spray unit, with a hose at least 60 inches (1525 mm) long, that can be used as a fixed shower head or as a hand-held shower, shall be provided.

1106.11.9.5 Bathtub enclosures. Where provided, enclosures for bathtubs shall not obstruct controls or obstruct transfer from wheelchairs onto bathtub seats or into tubs. Bathtub enclosures shall not have tracks mounted on the tub rim.

1106.11.10 Shower stalls.

1106.11.10.1 Configuration. Shower stalls shall have one of the following configurations:

1. Transfer shower stalls shall be 36 inches by 36 inches (915 by 915 mm), nominal, and shall have a seat; or,

2. Roll-in shower stalls shall be not less than 30 inches (760 mm) in depth by 60 inches (1525 mm) in length.

1106.11.10.2 Clear floor space. A clear floor space shall be provided adjacent to shower stalls.

1. For transfer shower stalls, a clear floor space not less than 48 inches (1220 mm) in length, parallel to the open side of the shower stall, and not less than 36 inches (915 mm) in width, perpendicular to the open edge of the shower stall, shall be located so as to extend at least 12 inches (305 mm) beyond the wall on which the seat is mounted.

2. For roll-in shower stalls, a clear floor space not less than 60 inches (1525 mm) in length, parallel to the open edge of the shower stall, and not less than 36 inches (915 mm) in width, perpendicular to the open edge of the shower stall, shall be provided. A lavatory which complies with Section 1106.11.7, above, may be located within one end of the clear

floor space. Where a seat is provided in the shower, a lavatory may be located only at the opposite end of the clear space.

1106.11.10.3 Seats. Transfer shower stalls shall be provided with a folding or nonfolding seat located on the wall opposite the shower controls.

Roll-in shower stalls shall be provided with a folding seat located on the wall adjacent to the shower controls.

EXCEPTION: Roll-in shower stalls located in occupancies other than hotels, lodging houses and congregate residences need not be provided with a seat.

The seat shall be mounted not less than 17 inches (430 mm) and not more than 19 inches (485 mm) above the floor. The seat shall be mounted not more than 1-1/2 inches (38 mm) from the shower walls. The leading edge of the seat may be set back not more than 1-1/2 inches (38 mm) from the leading edge of the shower stall.

The seat shall be L-shaped and shall extend the full depth of the stall. The section of the seat adjacent to the wall opposite the clear floor space shall be at least 22 inches (560 mm) and not more than 23 inches (585 mm) wide, measured from the wall on which the seat is mounted. That section of the seat shall extend not less than 14 inches (355 mm) but not more than 15 inches (380 mm), measured from the wall opposite the clear floor space. The remaining portion of the seat shall be not less than 15 inches (380 mm) and not more than 16 inches (405 mm) wide, measured from the wall on which the seat is mounted, and shall extend the remaining depth of the stall.

1106.11.10.4 Grab bars. All required grab bars shall be installed parallel to the floor. All grab bars shall be installed not less than 33 inches (840 mm) and not more than 36 inches (915 mm) above the floor of the adjacent clear space.

For transfer shower stalls, a grab bar, not less than 18 inches (455 mm) in length, shall be installed on the wall opposite the clear floor space. One end of the grab bar shall terminate at the wall opposite the seat. A grab bar not less than 27 inches (685 mm) in length shall also be installed on the wall opposite the seat.

For roll-in shower stalls, grab bars shall be provided on all permanent stall walls. Grab bars located on either end of the stall shall be not less than 27 inches (685 mm) in length. The grab bar located opposite the clear space shall be not less than 48 inches (1220 mm) in length.

1106.11.10.5 Controls and fixtures. Faucets and other controls shall be located on the same wall as the shower spray unit, and shall be installed not less than 38 inches (965 mm) or more than 48 inches (1220 mm) above the shower floor and shall comply with Section 1106.3. In addition:

1. For transfer shower stalls, the controls shall be located on the wall opposite the shower seat. The controls shall be located within 18 inches (455 mm) of the open side of the shower stall.

2. For roll-in shower stalls equipped with seats, the controls shall be mounted on the wall adjacent to the seat not

more than 27 inches (685 mm) from the wall where the seat is mounted. For roll-in shower stalls without seats, the controls may be located on any wall. Where the controls are located on the back wall, they shall be located not more than 27 inches (685 mm) from a side wall.

A shower spray unit, with a hose at least 60 inches (1525 mm) long, that can be used as a fixed shower head or as a hand-held shower, shall be provided.

EXCEPTION: In unmonitored facilities where vandalism is a consideration, a fixed shower head may be installed not more than 48 inches (1220 mm) above the stall floor.

1106.11.10.6 Thresholds. In transfer shower stalls, thresholds shall be flush or beveled with a maximum edge height of 1/2 inch (13 mm), and a maximum slope of not more than 1 vertical in 2 horizontal.

Thresholds in roll-in shower stalls shall be level with the adjacent clear space.

1106.11.10.7 Shower enclosures. Where provided, enclosures for shower stalls shall not obstruct controls or obstruct transfer from wheelchairs onto shower seats.

1106.11.11 Structural requirements for grab bars, and tub and shower seats.

1106.11.11.1 General. All grab bars, and tub and shower seats required to be accessible, shall comply with this section.

1106.11.11.2 Size and spacing of grab bars. Grab bars shall have an outside diameter of not less than 1-1/4 inch (32 mm) nor more than 1-1/2 inches (38 mm) and shall provide a clearance of 1-1/2 inches (38 mm) between the grab bar and the wall.

1106.11.11.3 Structural strength. The structural strength of grab bars, tub and shower seats, fasteners and mounting devices shall meet the following specification:

1. Bending stress in a grab bar or seat induced by the maximum bending moment from the application of 300 pounds (1334 N) shall be less than the allowable stress for the material of the grab bar or seat.

2. Shear stress induced in a grab bar or seat by the application of 300 pounds (1334 N) shall be less than the allowable shear stress for the material of the grab bar or seat. If the connection between the grab bar or seat and its mounting bracket or other support is considered to be fully restrained, then direct and torsional shear stresses shall be totaled for the combined shear stress, which shall not exceed the allowable shear stress.

3. Shear force induced in a fastener or mounting device from the application of 300 pounds (1334 N) shall be less than the allowable lateral load of either the fastener or mounting device or the supporting structure, whichever is the smaller allowable load.

4. Tensile force induced in a fastener by a direct tension force of 300 pounds (1334 N) plus the maximum moment from the application of 300 pounds (1334 N) shall be less

than the allowable withdrawal load between the fastener and the supporting structure.

1106.11.11.4 Special hazards. A grab bar and any wall or other surface adjacent to it shall be free of any sharp or abrasive elements. Edges shall have a minimum radius of 1/8 inch (3 mm).

1106.12 Kitchens.

1106.12.1 Clear floor space. An unobstructed floor space shall be provided within kitchens of sufficient size to inscribe a circle with a diameter not less than 60 inches (1525 mm). Doors in any position may encroach into this space by not more than 12 inches (305 mm). The clear floor spaces at fixtures, the accessible route of travel, and the unobstructed floor space may overlap.

1106.12.2 Counter surfaces and shelving. Within Type A dwelling units, a counter surface, a minimum of 30 inches (760 mm) wide by 24 inches (610 mm) deep, shall be provided at a maximum height of 34 inches (865 mm), with a knee space beneath at least 27 inches (685 mm) in height.

In other than dwelling units, at least 50 percent of shelf space in cabinets, refrigerators and freezers shall be within the reach ranges specified in Section 1106.2.4.

1106.13 Water Fountains.

1106.13.1 Clear floor space. Wall- and post-mounted cantilevered units shall have a minimum clear floor space in front of the unit, of 30 inches (760 mm) in width by 48 inches (1220 mm) in depth to allow a forward approach.

Free-standing or built-in units not having a clear space beneath them shall have an adjacent clear floor space at least 30 inches (760 mm) in depth by 48 inches (1220 mm) in width in order to allow a person in a wheelchair to make a parallel approach to the unit.

1106.13.2 Knee space. Wall- and post-mounted cantilevered units shall have knee space in accordance with Section 1106.2.4.3. The knee space shall be not less than 17 inches (430 mm) nor more than 19 inches (485 mm) in depth.

1106.13.3 Spout location. Spouts shall be located not more than 36 inches (915 mm) above the floor or ground surface. Spouts shall be located at the front of the unit and shall direct a water flow not less than 4 inches (102 mm) in height, in a trajectory parallel to the front of the unit. Recessed units shall be installed such that the spout is not recessed beyond the plane of the wall.

1106.13.4 Controls. Controls shall be located not more than 6 inches (152 mm) from the front of the unit and shall comply with Section 1106.3. The force required to activate the control shall not exceed 5 pounds (22.2 N).

1106.13.5 Water fountains in alcoves. Where a unit is installed in an alcove greater than 8 inches (205 mm) in depth, the alcove shall be not less than 48 inches (1220 mm) in width. A minimum 24 inches (610 mm) of clear space shall be provided from the spout to the nearest side wall of the alcove.

1106.14 Telephones.

1106.14.1 Clear floor or ground space. A clear floor or ground space, not less than 30 inches (760 mm) by 48 inches (1220 mm), that allows either a forward or parallel approach, shall be provided in front of telephones. Bases, enclosures and fixed seats shall not project into the clear floor space.

Where parallel approach is provided, any shelf or enclosure shall not project farther than 10 inches (255 mm) beyond the face of the telephone.

Where a forward approach is provided, any shelf shall not project farther than 20 inches (510 mm) beyond the face of the telephone; any enclosure panels shall be a minimum 30 inches (760 mm) apart, and where less than 36 inches (915 mm) apart, shall project no more than 24 inches (610 mm) beyond the face of the phone.

1106.14.2 Height. The highest operable part of a telephone shall be within the reach ranges specified in Section 1106.2.4.

1106.14.3 Equipment for persons with hearing impairments. Telephones shall be equipped with volume controls and shall be hearing aid compatible. Volume controls shall be capable of increasing volume not less than 12 dbA nor more than 18 dbA above normal.

EXCEPTION: Where an automatic reset is provided, 18 dbA may be exceeded.

1106.14.4 Controls. Telephones shall have push-button controls where service for such equipment is available.

1106.14.5 Cord length. The cord from the telephone to the handset shall be not less than 29 inches (737 mm) in length.

1106.14.6 Text telephones. Text telephones shall be permanently affixed within, or adjacent to, the telephone enclosure. Where an acoustic coupler is used, the telephone cord shall be sufficiently long to allow connection of the text telephone and the telephone receiver.

1106.14.7 Shelf and electrical outlet. Shelves and an electrical outlet shall be located within or adjacent to the telephone enclosure. The shelf shall be not less than 10 inches by 10 inches (255 mm by 255 mm) in dimension, with a vertical clearance above the shelf of not less than 6 inches (152 mm). The telephone handset shall be capable of being placed flush on the surface of the shelf.

1106.15 Alarms.

1106.15.1 Audible alarms. Audible alarms shall produce a sound in accordance with the Fire Code.

1106.15.2 Visible alarms. Visible alarm signal appliances shall be integrated into the building or facility alarm system. Where single-station audible alarms are provided, single-station visible alarm signals shall be provided.

EXCEPTION: Visible alarms are not required in Group R, Division 1 apartment buildings.

Visible alarm system designs shall comply with the requirements in ANSI A117.1, 1998 edition, or NFPA 72, 1999 edition.

1106.15.3 Access to manual fire alarm systems. Manual fire alarm devices shall be mounted not more than 54 inches (1370 mm) above the floor where a parallel approach is provided.

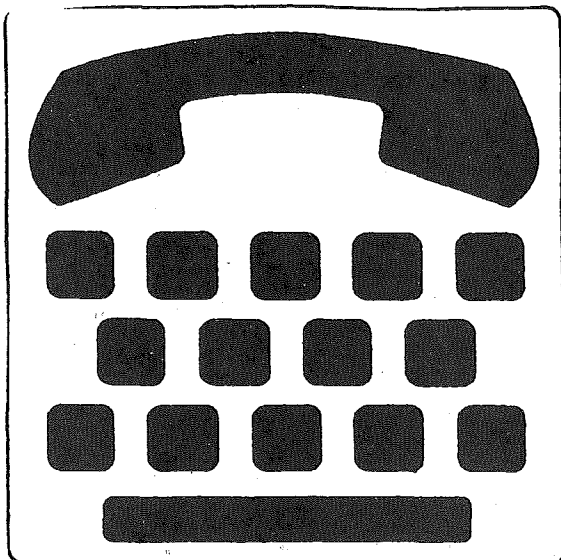
1106.16 Signage.

1106.16.1 Symbols.

1106.16.1.1 International Symbol of Access. The International Symbol of Access shall be as shown below:



1106.16.1.2 Text telephones. Text telephones required by Section 1105.4.2 shall be identified by the International Text Telephone Symbol as shown below:



1106.16.1.3 Assistive listening systems. Permanently installed assistive listening systems that are required by Section 1103.1.2.2 shall be identified by the International Symbol of Access for Hearing Loss as shown below:



1106.16.1.4 Volume control telephones. Telephones required by Section 1105.4.2 to have volume controls shall be identified by a handset containing a depiction of a telephone handset with radiating sound waves.

1106.16.2 Mounting location and height. Signs shall be installed on the wall adjacent to the latch side of the door. Signs shall be centered at 60 inches (1525 mm) above the finished floor. Mounting location for such signage shall be such that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of a door.

1106.16.3 Finish and color. Characters and symbols shall have a high contrast with their background. The character and background of interior signs shall be eggshell, matte, or other nonglare finish.

All interior and exterior signs depicting the International Symbol of Access shall be white on a blue background.

1106.16.4 Character proportion and height. Letters and numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10.

Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum character height for signs that are suspended or projected overhead is 3 inches (76 mm) for upper case letters. Lower case letters are permitted.

1106.16.5 Raised and Braille characters and pictorial symbol signs (pictograms).

1106.16.5.1 Raised characters and symbols. Characters and symbols on tactile signs shall be raised at least 1/32 inch (.8 mm). Raised characters and symbols shall be simple type face upper case characters. Raised characters and symbols shall be between 5/8 inch (16 mm) and 2 inches (51 mm) in height. Raised characters shall be accompanied by Braille in accordance with this section.

1106.16.5.2 Braille. Braille shall be separated from the corresponding raised characters or symbols. Braille shall be Grade 2.

1106.16.5.3 Pictograms. Where provided, pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be not less than 6 inches (152 mm) in height.

1106.17 Detectable Warnings. Detectable warnings on walking surfaces shall consist of raised truncated domes having a diameter of 0.9 inches (23 mm) nominal, a height of 0.2 inches (5 mm) nominal, and a center-to-center spacing of 2.35 inches (60 mm) nominal, or be an approved alternate, and shall contrast visually and tactilely with adjoining surfaces.

1106.18 Storage, Shelving and Display Units.

1106.18.1 Clear floor space. Storage, shelving and display units shall have a clear floor space, not less than 30 inches (760 mm) by 48 inches (1220 mm), that allows for either a forward or parallel approach.

1106.18.2 Height. Accessible storage, shelving and display units shall be within the reach ranges specified in Section 1106.2.4. Clothes rods shall be not more than 54 inches (1370 mm) above the floor.

1106.19 Seating, Tables, and Sinks.

1106.19.1 Clear floor space. Sinks and seating spaces at tables shall have a clear floor space of not less than 30 inches (760 mm) by 48 inches (1220 mm), that allows forward approach. The clear floor space shall not overlap knee space by more than 19 inches (483 mm).

1106.19.2 Knee clearances. Knee spaces at tables, counters, and sinks shall be provided in accordance with Section 1106.2.4.3. In addition, the depth of the knee space shall be not less than 19 inches (483 mm). No projection which might obstruct the arm of a wheelchair may intrude into this clearance, within 24 inches (610 mm) horizontally from the table edge.

1106.19.3 Height. The tops of tables and sinks shall be not less than 28 inches (710 mm) nor more than 34 inches (865 mm) in height above the floor or ground.

1106.20 Aisles. All aisles required to be accessible, including check out aisles, food service lines, and aisles between fixed tables, shall be not less than 36 inches (915 mm) in width.

1106.21 Assembly Areas.

1106.21.1 Wheelchair spaces.

1106.21.1.1 Location. Wheelchair spaces shall be an integral part of any fixed seating plan and shall be dispersed throughout the seating area. Spaces shall adjoin an accessible route of travel that also serves as a means of egress and shall be located to provide lines of sight comparable to those for all viewing areas.

EXCEPTION: Accessible viewing positions may be clustered for bleachers, balconies and other areas having sight lines that require slopes of greater than 5 percent. Equivalent accessible viewing positions may be located on levels having accessible egress.

1106.21.1.2 Size. Wheelchair spaces shall be not less than 33 inches (840 mm) in width. Where forward or rear approach is provided, wheelchair spaces shall be not less than 48 inches (1220 mm) in depth. Where only side approach is provided, wheelchair spaces shall be not less than 60 inches (1525 mm) in depth.

1106.21.1.3 Surfaces. The ground or floor surfaces at wheelchair locations shall be level and shall comply with Section 1106.7.

1106.21.2 Placement of assistive listening systems. Where an assistive listening system serves individual fixed seats, such seats shall have a clear line of sight and shall be located not more than 50 feet (15 m) from the stage or performance area.

1106.22 Restaurants and Cafeterias.

1106.22.1 Aisles. Aisles to fixed tables required to be accessible shall comply with Section 1106.20.

1106.22.2 Food service lines.

1106.22.2.1 Clear floor space. Food service lines shall comply with Section 1106.20.

1106.22.2.2 Height. Tray slides shall be mounted not more than 34 inches (865 mm) in height above the floor.

1106.22.2.3 Counters and bars. Where service of food or drink is provided at counters more than 34 inches (865 mm) in height, to customers seated on stools or standing, a portion of the main counter shall be provided in compliance with Section 1106.19, or service shall be available at accessible tables within the same area.

1106.22.2.4 Tableware and condiment areas. Self-service shelves and dispensing devices for tableware, dishware, condiments, food, and beverages shall be installed to comply with Section 1106.18.

1106.23 Patient bedrooms. Each patient bedroom shall be designed and constructed to provide space for a 180-degree turn that complies with Section 1106.2.2. Each patient room shall have a minimum clear floor space not less than 36 inches (915 mm) on each side of any bed.

1106.24 Customer Service Facilities.

1106.24.1 Dressing and fitting rooms.

1106.24.1.1 Clear floor space. Each dressing and fitting room shall have a clear floor space complying with Section 1106.2.

EXCEPTION: Dressing and fitting rooms that are entered through a curtained opening need not comply with Section 1106.2.2.

1106.24.1.2 Doors. All doors to accessible dressing and fitting rooms shall comply with Section 1106.10.

1106.24.1.3 Benches. Every accessible dressing or fitting room shall have a bench installed adjacent to the longest wall in the room. The bench shall be not less than 24 inches (610 mm) in width and 48 inches (1220 mm) in length, and shall be mounted not less than 17 inches (430 mm) nor more than 19 inches (483 mm) above the finished floor.

Clear floor space shall be provided adjacent to the bench to allow for parallel transfer, and the structural strength of the bench shall comply with Section 1106.11.11.3.

Where benches are installed in dressing and fitting rooms adjacent to showers, swimming pools, or other wet locations, water shall not accumulate upon the surface of the bench and the bench shall have a slip-resistant surface.

1106.24.1.4 Mirrors. Where provided, mirrors in accessible dressing and fitting rooms shall be not less than 18 inches (455 mm) in width by 54 inches (1370 mm) in height and shall be mounted opposite the bench.

1106.24.2 Counters and windows. Where counters are required to be accessible, the accessible portion shall be not less than 36 inches (915 mm) in length and not more than 36 inches (915 mm) in height above the finished floor.

Where accessible windows are required, they shall be no more than 36 inches (915 mm) in height above the finished floor.

EXCEPTION: An auxiliary counter with a maximum height of 36 inches (915 mm) is installed in close proximity to the main counter.

1106.24.3 Check-out aisles. The width of accessible check-out aisles shall comply with Section 1106.20. Counters in accessible check-out aisles shall be not more than 38 inches (965 mm) in height, and the top of the raised edge of the counter shall not exceed 40 inches (1015 mm) in height above the finished floor.

Accessible check-out aisles shall be identified by the International Symbol of Access in accordance with Section 1106.16.1.1.

1106.25 Libraries.

1106.25.1 Reading and study areas. At least 5 percent, or a minimum of one, of each element of fixed seating, tables, or study carrels shall comply with Section 1106.19. Clearances between fixed accessible tables and study carrels shall comply with Section 1106.20.

1106.25.2 Check-out areas. At least one lane at each check-out area shall comply with Section 1106.20. Any traffic control or book security gates or turnstiles shall comply with Section 1106.10.

1106.25.3 Card catalogs, magazine displays and stacks.

1106.25.3.1 Aisles. Aisles between card catalogs, magazine displays or stacks shall comply with Section 1106.20.

1106.25.3.2 Height. Card catalogs or magazine displays shall have a reach height of not more than 54 inches (1370 mm) for side approach and not more than 48 inches (1220 mm) for forward approach.

Not all shelves in library stacks need be located within reach ranges required by Section 1106.2.4.

1106.26 Hotels and Congregate Residences.

1106.26.1 Clear floor space. Each sleeping room shall have a space complying with Section 1106.4.1, along both sides of each bed.

EXCEPTION: In rooms with two beds, only one 36 inch (915 mm) wide maneuvering space need be provided between the two beds.

1106.26.2 Accessible route of travel. An accessible route of travel complying with Section 1103.2.2 shall connect all accessible spaces and elements; including telephones, patios, terraces, balconies, carports, garages or parking spaces; with all accessible sleeping rooms.

1106.26.3 Doors. Doors within all sleeping rooms, suites or other covered units shall comply with Section 1106.10.

1106.26.4 Storage. Where fixed or built-in storage is provided in accessible units, sleeping rooms, or suites; including cabinets, shelves, closets, and drawers; at least one of each type shall comply with Section 1106.18.

1106.26.5 Controls. All controls in accessible units, sleeping rooms, and suites shall comply with Section 1106.3.

1106.27 Dwelling Units.

1106.27.1 Type A and B dwelling units. Type A and B dwelling units shall comply with Section 1106.

EXCEPTIONS:

1. In a Type A accessible dwelling unit with two or more stories, access to other levels is not required if the accessible level complies with all requirements for Type A accessible dwelling units and that kitchen, toilet and bathing facilities, and at least one bedroom are provided on the accessible level.
2. Kitchens in Type B dwelling units need not comply with Section 1106.12.1, provided that:
 - 2.1. A clear space at least 30 inches by 48 inches (760 mm by 1220 mm) that allows parallel approach by a person in a wheelchair is provided at the range or cook top and sink, and either a parallel or forward approach is provided at all other appliances; and,
 - 2.2. In all other kitchens, clearance between all opposing counters, base cabinets, countertops, appliances, and walls shall be not less than 40 inches (1015 mm); and,
 - 2.3. In "U" shaped kitchens with a sink, range, or cooktop at the base of the "U", an unobstructed floor space of sufficient size to inscribe a circle with a diameter of not less than 60 inches (1525 mm) shall be provided.
3. Bathrooms in Type B dwelling units need not comply with Section 1106.11.2, provided that sufficient maneuvering space which is not less than 30 inches by 48 inches (760 by 1220 mm) is provided within the bathroom. Doors may swing into the clear floor space provided at any fixture, but shall not encroach on the required maneuvering space.

4. Doors in Type B dwelling units, other than the primary entry door, need not comply with Section 1106.10.3.
5. Mezzanines in Type A or B dwelling units need not be accessible.
6. Raised or sunken floors in Type B dwelling units need not be accessible, provided that they do not interfere with the accessible route of travel through the unit, and are not located in the kitchen or bathroom.
7. Counter surfaces in Type B dwelling units need not comply with Section 1106.12.2.
8. Within an individual dwelling unit in a building with an elevator, access to other levels is not required if the accessible level complies with all requirements for accessible dwelling units.
9. In Type B dwelling units, exterior deck, patio, or balcony surfaces may be no more than 4 inches (100 mm) below the floor level of the interior surface where the exterior surface is constructed of an impervious material such as concrete, brick, or flagstone.
10. Vanities or lavatories in Type A and B dwelling units may be located in the clear floor spaces as permitted in Section 1106.11.5.1.
11. Seats for bathtubs or showers are not required in Type B dwelling units.
12. In Type B dwelling units, the clear floor space for bathtubs or showers may be reduced to not less than 30 inches (760 mm) in width by 48 inches (1220 mm) in length.
13. Showers in Type B dwelling units shall be nominal 36 inches (915 mm) minimum by 36 inches (915 mm) minimum.

1106.27.2 Adaptable fixtures for dwelling units.

1106.27.2.1 Grab bars. Grab bars may be omitted in bathing and toilet facilities within Type A or B dwelling units, provided that all structural reinforcements for grab bar installation are provided in the appropriate locations in the adjoining walls.

1106.27.2.2 Kitchen counters. Cabinets or shelving may be installed beneath the counter space required by Section 1106.12.2, provided that such cabinetry or shelving is not permanent, and is easily removable.

1106.27.2.3 Lavatories. Cabinets or shelving may be installed beneath bathroom lavatories provided that such cabinetry or shelving is not permanent, and is easily removable.

1106.27.2.4 Signage. Parking signage required by Section 1107.3 need not be installed in spaces designated for accessible dwelling units.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1106, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-1106, filed 1/6/98, effective 7/1/98.]

WAC 51-40-1202 Section 1202—Light and ventilation in Groups A, B, E, F, H, I, M and S Occupancies.

1202.2 Ventilation.

1202.2.1 General. All enclosed portions of Groups A, B, E, F, H, I, M and S Occupancies customarily occupied by human beings shall be provided with natural ventilation by means of openable exterior openings with an area not less than 1/20 of the total floor area or shall be provided with a mechanically operated ventilation system which complies with Ventilation and Indoor Air Quality Code Section 304. Such exterior openings shall open directly onto a public way or a yard or court as set forth in Section 1203.4.

Toilet rooms shall be provided with a fully openable exterior window with an area not less than 3 square feet (0.279 m²), or a vertical duct not less than 100 square inches (64 516 mm²) in area for the first water closet plus 50 square inches (32 258 mm²) additional of area for each additional water closet, or a mechanically operated exhaust system which complies with Ventilation and Indoor Air Quality Code Section 304. Such mechanically operated exhaust systems shall be connected directly to the outside, and the point of discharge shall be at least 3 feet (914 mm) from any opening that allows air entry into occupied portions of the building.

For ventilation of hazardous vapors or fumes in Group H Occupancies, see Sections 307.5.2 and 1202.2.3. For Group S, Division 3 Occupancies, see Section 1202.2.7.

1202.2.4 Group H, Division 4 Occupancies. In all buildings classified as Group H, Division 4 Occupancies used for the repair or handling of motor vehicles operating under their own power, mechanical ventilation shall be provided capable of exhausting a minimum of 1.5 cubic feet per minute per square foot (0.044 L/s/m²) of floor area. Each engine repair stall shall be equipped with an exhaust pipe extension duct, extending to the outside of the building, which, if over 10 feet (3048 mm) in length, shall mechanically exhaust 300 cubic feet per minute (141.6 L/s). Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

EXCEPTION:

When approved, ventilating equipment may be omitted in repair garages, enclosed heliports and aircraft hangars when well-distributed unobstructed openings to the outer air of sufficient size to supply necessary ventilation are furnished.

1202.2.7 Group S parking garages. In Group S, Division 3 parking garages, other than open parking garages, used for storing or handling automobiles operating under their own power and on loading platforms in bus terminals, ventilation shall be provided which complies with Ventilation and Indoor Air Quality Code Section 304. The building official may approve an alternate ventilation system designed to exhaust a minimum of 14,000 cfm (6608 L/s) for each operating vehicle. Such system shall be based on the anticipated instantaneous movement rate of vehicles, but not less than 2.5 percent (or one vehicle) of the garage capacity. Automatic carbon monoxide-sensing devices may be employed to modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during any eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour. Connecting offices, waiting rooms, ticket booths and similar uses shall be supplied with conditioned air under positive pressure.

EXCEPTION:

Mechanical ventilation need not be provided within a Group S, Division 3 parking garage when openings complying with Section 311.9.2.2 are provided.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1202, filed 1/3/01, effective 7/1/01.]

WAC 51-40-1203 Section 1203—Light and ventilation in Group R Occupancies.

1203.3 Ventilation. Group R Occupancies shall be provided with ventilation systems which comply with Ventilation and Indoor Air Quality Code Section 302 and 303. Public corridors in Group R Occupancies shall be provided with natural ventilation by means of openable exterior openings with an area of not less than one twentieth of the floor area of such corridors with a minimum of 5 square feet (0.46 m²).

In lieu of required exterior openings for natural ventilation in public corridors, a mechanical ventilating system may be provided. Such system shall be capable of providing two air changes per hour with a minimum of 15 cubic feet per minute (7 L/s) of outside air per occupant during such time as the building is occupied.

The point of discharge for mechanical ventilating systems shall be at least 3 feet (914 mm) from any opening which allows air entry into occupied portions of the building.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-1203, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-1203, filed 1/6/98, effective 7/1/98.]

WAC 51-40-2900 Chapter 29—Plumbing systems.

SECTION 2901—PLUMBING CODE.

Plumbing systems shall comply with the Plumbing Code.

SECTION 2902—GENERAL

2902.1 Number of Fixtures.

2902.1.1 Requirements. Plumbing fixtures shall be provided in the minimum number shown in Table 29-A and in this Chapter. Where the proposed occupancy is not listed in Table 29-A, the building official shall determine fixture requirements based on the occupancy which most nearly resembles the intended occupancy.

Plumbing fixtures need not be provided for unoccupied buildings or facilities.

2902.1.2 Private offices. Fixtures only accessible to private offices shall not be counted to determine compliance with this section.

2902.1.3 Occupancy load distribution. The occupant load shall be divided equally between the sexes, unless data approved by the building official indicates a different distribution of the sexes.

2902.1.4 Food preparation areas. In food preparation, serving and related storage areas, additional fixture requirements may be dictated by health codes.

2902.1.5 Other requirements. For other requirements for plumbing facilities, see Sections 302.6, 807, 313.5.5 and Chapter 11.

[2002 WAC Supp—page 160]

2902.2 Access to Fixtures.

2902.2.1 Location. Plumbing fixtures shall be located in each building or conveniently in a building adjacent thereto on the same property.

2902.2.2 Multiple tenants. Access to toilets serving multiple tenants shall be through a common use area and not through an area controlled by a tenant.

2902.2.3 Multi-story buildings. Required fixtures shall not be located more than one vertical story above or below the area served.

2902.3 Separate Facilities.

2902.3.1 Requirements. Separate toilet facilities shall be provided for each sex.

EXCEPTIONS:

1. In occupancies serving 10 or fewer persons, one toilet facility designed for use by no more than one person at a time shall be permitted for use by both sexes.
2. In Group B and M Occupancies with a total floor area of 1500 square feet (139.5 m²) or less, one toilet facility designed for use by no more than one person at a time shall be permitted for use by both sexes.

2902.3.2 Food service establishments. When customers and employees share the same facilities, customers accessing the facilities are excluded from food preparation and storage areas.

2902.4 Pay Facilities. Required facilities shall be free of charge. Where pay facilities are installed, they shall be in addition to the minimum required facilities.

2902.5 is not adopted.

2902.6 is not adopted.

SECTION 2903—SPECIAL PROVISIONS

2903.1 Dwelling Units. Dwelling units shall be provided with a kitchen sink.

2903.2 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).

2903.3 Water. Each required sink, lavatory, bathtub and shower stall shall be equipped with hot and cold running water necessary for its normal operation.

2903.4 Drinking Fountains.

2903.4.1 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 1000 occupants.
2. A drinking fountain need not be provided in a drinking or dining establishment.

2904.2 Multi-story buildings. Drinking fountains shall be provided on each floor having more than 30 occupants in schools, dormitories, auditoriums, theaters, offices and public buildings.

2903.4.3 Penal Institutions. Penal institutions shall have one drinking fountain on each cell block floor and one on each exercise floor.

2903.4.4 Location. Drinking fountains shall not be located in toilet rooms.

SECTION 2904 is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-2900, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-2900, filed 1/6/98, effective 7/1/98.]

WAC 51-40-3102 Section 3102—Chimneys, fireplaces and barbecues.

3102.5.4 Emission Standards for Factory-built Fireplaces. After January 1, 1997, 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 the Washington State Building Code Standard 31-2.

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.

3102.7.14 Emission Standards for Certified Masonry and Concrete Fireplaces. After January 1, 1997, new certified masonry or concrete fireplaces installed in Washington State shall be tested and labeled in accordance with procedures and criteria specified in the Washington State Building Code Standard 31-2.

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.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-095, § 51-40-3102, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-3102, filed 1/6/98, effective 7/1/98.]

WAC 51-40-31200 Section 31-2—Standard test method for particulate emissions from fireplaces.

**WASHINGTON STATE BUILDING CODE STANDARD 31-2
STANDARD TEST METHOD FOR PARTICULATE EMISSIONS
FROM FIREPLACES**

See Sections 3102.5.4 and 3102.7.14, *Uniform Building Code*

SECTION 31.200—TITLE and SCOPE.

SECTION 31.200.1—TITLE.

This Appendix Chapter 31-2 shall be known as the "Washington State Standard Test Method for Particulate Emissions from Fireplaces" and may be cited as such; and will be referred to herein as "this Standard".

SECTION 31.200.2—SCOPE.

This Standard covers emissions performance, approval/certification procedures, test laboratory accreditation, record keeping, reporting requirements, and the test protocol for measuring particulate emissions from fireplaces.

All testing, reporting and inspection requirements of this Standard shall be conducted by a Washington State Department of Ecology (DOE) approved testing laboratory. In order to qualify for DOE approval, the test laboratory must be a U.S. Environmental Protection Agency (EPA) accredited laboratory (40 CFR Part 60, Subpart AAA). DOE may approve a test laboratory upon submittal of the following information:

1. A copy of their U.S. EPA accreditation certificate; and
2. A description of their facilities, test equipment, and test-personnel qualifications including education and work experience.

DOE may revoke a test laboratory approval when the test laboratory is no longer accredited by the U.S. EPA or if DOE determines that the test laboratory does not adhere to the testing requirements of this Chapter.

SECTION 31.201—DEFINITIONS. For the purpose of this Standard certain terms are defined as follows:

ANALYZER CALIBRATION ERROR is the difference between the gas concentration exhibited by the gas analyzer and the known concentration of the calibration gas when the calibration gas is introduced directly to the analyzer.

BURN RATE is the average rate at which test-fuel is consumed in a fireplace measured in kilograms of wood (dry basis) per hour (kg/hr) during a test-burn.

CALIBRATION DRIFT is the difference in the analyzer reading from the initial calibration response at a mid-range calibration value after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

CALIBRATION GAS is a known concentration of Carbon Dioxide (CO₂), Carbon Monoxide (CO), or Oxygen (O₂) in Nitrogen (N₂).

CERTIFICATION or AUDIT TEST is the completion of at least one, three-fuel-load test-burn cycle in accordance with Section 31.202.

FIREBOX is the chamber in the fireplace in which a test-fuel charge(s) is placed and combusted.

FIREPLACE is a wood burning device which is exempt from U.S. EPA 40 CFR Part 60, Subpart AAA and:

1. is not a cookstove, boiler, furnace, or pellet stove as defined in 40 CFR Part 60, Subpart AAA, and
2. is not a masonry heater as defined in Section 31.201, and

3. see Section 3102, Uniform Building Code for definitions of masonry and factory-built fireplaces as used in this Standard.

FIREPLACE DESIGN is the construction and/or fabrication specifications including all dimensions and materials required for manufacturing or building fireplaces with identical combustion function and particulate emissions factors.

FIREPLACE MODEL LINE is a series of fireplace models which all have the same internal assembly. Each model in a model line may have different facade designs and external decorative features.

FIREPLACE, CERTIFIED, is a fireplace that meets the emission performance standards when tested according to UBC Standard 31-2.

FIREPLACE, NONCERTIFIED, (masonry or concrete) is any fireplace that is not a certified fireplace. A noncertified fireplace will be subject to applicable burn ban restrictions.

INTERNAL ASSEMBLY is the core construction and firebox design which produces the same function and emissions factor for a fireplace model line.

MASONRY HEATER is a heating system of predominantly masonry construction having a mass of at least 800 kg (1760 lbs), excluding the chimney and foundation, which is designed to absorb a substantial portion of the heat energy from a rapidly-burned charge of solid fuel by:

a) routing of exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes at least one 180 degree change in flow direction, usually downward, before entering the chimney, and

b) being constructed of sufficient mass such that under normal operating conditions the external surface of the heater, except in the region immediately surrounding the fuel loading door(s), does not exceed 110°C (230°F).

Masonry heaters shall be listed or installed in accordance with ASTM E-1602.

RESPONSE TIME is the amount of time required for the measurement system to display 95 percent of a step change in gas concentration.

SAMPLING SYSTEM BIAS is the difference between the gas concentrations exhibited by the analyzer when a known concentration gas is introduced at the outlet of the sampling probe and when the sample gas is introduced directly to the analyzer.

SPAN is the upper limit of the gas concentration measurement range (25 percent for CO₂, O₂, and 5 percent for CO).

TEST FACILITY is the area in which the fireplace is installed, operated, and sampled for emissions.

TEST FUEL LOADING DENSITY is the weight of the as-fired test-fuel charge per unit area of usable firebox floor (or hearth).

TEST-BURN is an individual emission test which encompasses the time required to consume the mass of three consecutively burned test-fuel charges.

TEST-FUEL CHARGE is the collection of test fuel pieces placed in the fireplace at the start of certification test.

USABLE FIREBOX AREA is the floor (or hearth) area, within the fire chamber of a fireplace upon which a fire may be, or is intended to be built. Usable firebox area is calculated using the following definitions:

1. Length. The longest horizontal fire chamber dimension along the floor of the firebox that is parallel to a wall of the fire chamber.

2. Width. The shortest horizontal fire chamber dimension along the floor of the firebox that is parallel to a wall of the fire chamber.

3. For angled or curved firebox walls and/or sides, the effective usable firebox area shall be determined by calculating the sum of standard geometric areas or sub-areas of the firebox floor.

If a fireplace has a floor area within the fire chamber which is larger than the area upon which it is intended that fuel be placed and burned, the usable firebox area shall be calculated as the sum of standard geometric areas or sub-areas of the area intended for fuel placement and burning. For fireplace grates which elevate the fuel above the firebox floor, usable firebox area determined in this manner shall be multiplied by a factor of 1.5. The weight of test-fuel charges for fireplace-grate usable-firebox-area tests, shall not exceed the weight of test-fuel charges determined for the entire fireplace floor area.

ZERO DRIFT is the difference in the analyzer reading from the initial calibration response at the zero concentration level after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

Section 31.202—Testing.

31.202.1 Applicability. This method is applicable for the certification and auditing of fireplace particulate emission factors. This method describes the test facility, fireplace installation requirements, test-fuel charges, and fireplace operation as well as procedures for determining burn rates and particulate emission factors.

31.202.2 Principle. Particulate matter emissions are measured from a fireplace burning prepared test-fuel charges in a test facility maintained at a set of prescribed conditions.

31.202.3 Test Apparatus.

31.202.3.1 Fireplace Temperature Monitors. Device(s) capable of measuring flue-gas temperature to within 1.5 percent of expected absolute temperatures.

31.202.3.2 Test Facility Temperature Monitor. A thermocouple located centrally in a vertically oriented pipe shield 6 inches (150 mm) long, 2 inches (50 mm) diameter that is

open at both ends, capable of measuring air temperature to within 1.5 percent of expected absolute temperatures.

31.202.3.3 Balance. Balance capable of weighing the test-fuel charge(s) to within 0.1 lb (0.05 kg).

31.202.3.4 Moisture Meter. Calibrated electrical resistance meter for measuring test-fuel moisture to within 1 percent moisture content (dry basis).

31.202.3.5 Anemometer. Device capable of detecting air velocities less than 20 ft/min (0.10 m/sec), for measuring air velocities near the fireplace being tested.

31.202.3.6 Barometer. Mercury, aneroid or other barometer capable of measuring atmospheric pressure to within 0.1 inch Hg (2.5 mm Hg).

31.202.3.7 Draft Gauge. Electromanometer or other device for the determination of flue draft (i.e., static pressure) readable to within 0.002 inches of water column (0.50 Pa).

31.202.3.8 Combustion Gas Analyzer. Combustion gas analyzers for measuring Carbon Dioxide (CO₂), Carbon Monoxide (CO), and Oxygen (O₂) in the fireplace exhaust-gas stream must meet all of the following measurement system performance specifications:

1. **Analyzer Calibration Error.** Shall be less than ± 2 percent of the span value for the zero, mid-range, and high-range calibration gases.

2. **Sampling System Bias.** Shall be less than ± 5 percent of the span value for the zero, mid-range, and high-range calibration gases.

3. **Zero Drift.** Shall be less than ± 3 percent of the span over the period of each run.

4. **Calibration Drift.** Shall be less than ± 3 percent of the span value over the period of each run.

5. **Response Time.** Shall be less than 1.5 minutes.

31.202.4 Emissions Sampling Method. Use the emission sampler system (ESS) as described in Section 31.203.12 or an equivalent method as determined by the application of the U.S. EPA Method 301 Validation Procedure (Federal Register, December 12, 1992, Volume 57, Number 250, page 11998) and upon approval of DOE.

31.202.5 Fireplace Installation and Test Facility Requirements. The fireplace being tested must be constructed, if site-built, or installed, if manufactured, in accordance with the designer's/manufacture's written instructions. The chimney shall have a total vertical height above the base of the fire chamber of not less than 15 feet (4 600 mm). The fireplace chimney exit to the atmosphere must be freely communicating with the fireplace combustion makeup-air source. There shall be no artificial atmospheric pressure differential imposed between the chimney exit to the atmosphere and the fireplace makeup-air inlet.

31.202.6 Fireplace Aging and Curing. A fireplace of any type shall be aged before certification testing begins. The

aging procedure shall be conducted and documented by the testing laboratory.

31.202.6.1 Catalyst-Equipped Fireplaces. Operate the catalyst-equipped fireplace using fuel described in Section 31.203. Operate the fireplace with a new catalytic combustor in place and in operation for at least 50 hours. Record and report hourly catalyst exit temperatures, the hours of operation, and the weight of all fuel used.

31.202.6.2 NonCatalyst-Equipped Fireplaces. Operate the fireplace using the fuel described in Section 31.203 for at least 10 hours. Record and report the hours of operation and weight of all fuel used.

31.202.7 Pretest Preparation. Record the test-fuel charge dimensions, moisture content, weights, and fireplace (and catalyst if equipped) descriptions.

The fireplace description shall include photographs showing all externally observable features and drawings showing all internal and external dimensions needed for fabrication and/or construction. The drawings must be verified as representing the fireplace being tested and signed by an authorized representative of the testing laboratory.

31.202.8 Test Facility Conditions. Locate the test facility temperature monitor on the horizontal plane that includes the primary air intake opening for the fireplace. Locate the temperature monitor 3 to 6 feet (1 000 to 2 000 mm) from the front of the fireplace in the 90° sector in front of the fireplace. Test facility temperatures shall be maintained between 65° and 90°F (18° and 32°C). Use an anemometer to measure the air velocity. Measure and record the room-air velocity within 2 feet (600 mm) of the test fireplace before test initiation and once immediately following the test-burn completion. Air velocity shall be less than 50 feet/minute (250 mm/second) without the fireplace operating.

Section 31.203—Test protocol.

31.203.1 Test Fuel. Fuel shall be air dried Douglas fir dimensional lumber or cordwood without naturally associated bark. Fuel pieces shall not be less than 1/2 nor more than 5/6 of the length of the average fire chamber width. Fuel shall be split or cut into pieces with no cross-sectional dimension greater than 6 inches (152 mm). Spacers, if used, shall not exceed 3/4 inches (19 mm) in thickness and 15 percent of the test-fuel charge weight. Fuel moisture shall be in the range of 16 to 20 percent (wet basis) or 19 to 25 percent (dry basis) meter reading.

31.203.2 Test-Fuel Loading Density. The wet (with moisture) minimum weight of each test-fuel charge shall be calculated by multiplying the hearth area in square feet by 7.0 pounds per square foot (square meters \times 0.30 kg/m²) (\pm 10 percent). Three test-fuel charges shall be prepared for each test-burn.

31.203.3 Kindling. The initial test-fuel charge of the three test-fuel charge test-burn shall be started by using a kindling-fuel charge which is up to 50 percent of the first test-fuel charge weight. Kindling-fuel pieces can be any size

needed to start the fire or whatever is recommended in the manufacturer's (builder's) instructions to consumers. The kindling-fuel charge weight is not part of the initial test-fuel charge weight but is in addition to it.

31.203.4 Test-Burn Ignition. The fire can be started with or without paper. If used, the weight of the paper must be included in test-fuel charge weight. The remainder of the test-fuel charge may be added at any time after kindling ignition except that the entire first test-fuel charge must be added within 10 minutes after the start of the test (i.e., the time at which the flue-gas temperature at the 8-foot (2 440 mm) level is over 25°F (14°C) greater than the ambient temperature of the test facility).

31.203.5 Test Initiation. Emissions and flue-gas sampling are initiated immediately after the kindling has been ignited and when flue-gas temperatures in the center of the flue at an elevation of 8 feet (2 440 mm) above the base (floor) of the fire chamber reach 25°F (14°C) greater than the ambient temperature of the test facility.

31.203.6 Sampling Parameters. Sampling (from the 8-foot [2 440 mm] flue-gas temperature measurement location) must include:

1. Particulate Emissions
2. Carbon Dioxide (CO₂)¹
3. Carbon Monoxide (CO)¹
4. Oxygen (O₂)¹
5. Temperature(s)

¹ These gases shall be measured on-line (real-time) and recorded at a frequency of not less than once every 5 minutes. These 5-minute readings are to be arithmetically averaged over the test-burn series or alternatively, a gas bag sample can be taken at a constant sample rate over the entire test-burn series and analyzed for the required gases within one hour of the end of the test-burn.

If a fireplace is equipped with an emissions control device which is located downstream from the 8-foot (2 440 mm) flue-gas temperature measurement location, a second temperature, particulate, and gaseous emissions sampling location must be located downstream from the emissions control device but not less than 4 flue diameters upstream from the flue exit to the atmosphere. The two sampling locations must be sampled simultaneously during testing for each fireplace configuration being tested.

31.203.7 Test-Fuel Additions and Test Completion. The second and third test-fuel charges for a test-burn may be placed and burned in the fire chamber at any time deemed reasonable by the operator or when recommended by the manufacturer's and/or builder's instructions to consumers.

No additional kindling may be added after the start of a test-burn series and the flue-gas temperature at the 8-foot (2 440 mm) level above the base of the hearth must always be 25°F (14°C) greater than the ambient temperature of the test facility for a valid test-burn series. Each entire test-fuel charge must be added within 10 minutes from the addition of the first piece.

A test (i.e., a three test-fuel charge test-burn series) is completed and all sampling and measurements are stopped when all three test-fuel charges have been consumed (to more than 90 percent by weight) in the firebox and the 8-foot (2 440 mm) level flue-gas temperature drops below 25°F (14°C) greater than the ambient temperature of the test facility. Within 5 minutes after the test-burn is completed and all measurements and sampling has stopped, the remaining coals and/or unburned fuel, shall be extinguished with a carbon dioxide fire extinguisher. All of the remaining coals, unburned fuel, and ash shall be removed from the firebox and weighed to the nearest 0.1 pound (0.05 kg). The weight of these unburned materials and ash shall be subtracted from the total test-burn fuel weight when calculating the test-burn burn rate. A test-burn is invalid if less than 90 percent of the weight of the total test-fuel charges plus the kindling weight have been consumed in the fireplace firebox.

31.203.8 Test-Fuel Charge (Load) Adjustments. Test-fuel charges may be adjusted (i.e., repositioned) once during the burning of each test-fuel charge. The time used to make this adjustment shall be less than 15 seconds.

31.203.9 Air Supply Adjustment. Air supply controls, if the fireplace is equipped with controls, may not be adjusted during any test-burn series after the first 10 minutes of startup of each fuel load. All air supply settings must be set to the lowest level at the start of a test and shall remain at the lowest setting throughout a test-burn.

31.203.10 Auxiliary Fireplace Equipment Operation. Heat exchange blowers (standard or optional) sold with the fireplace shall be operated during all test-burns following the manufacturer's written instructions. If no manufacturer's written instructions are available, operate the heat exchange blower in the "high" position. (Automatically operated blowers shall be operated as designed.) Shaker grates, by-pass controls, afterburners, or other auxiliary equipment may be adjusted only once per test-fuel charge following the manufacturer's written instructions. Record and report all adjustments on a fireplace operational written-record.

31.203.11 Fireplace Configurations. One, 3 test-fuel charge test-burn shall be conducted for each of the following fireplace operating configurations:

1. Door(s) closed, with hearth grate;
2. Door(s) open, with hearth grate;
3. Door(s) closed, without hearth grate;
4. Door(s) open, without hearth grate; and
5. With no doors, and draft inducer on.

No test-burn series is necessary for any configuration the appliance design cannot or is not intended to accommodate. If a configuration is not tested, the reason must be submitted with the test report and the appliance label must state that the appliance cannot be used in that configuration by consumer users.

One emission factor result, or one emission factor average, as provided in paragraph 31.203.11.2, from each fire-

place configuration tested shall be compiled into an arithmetic average of all the configurations tested for determining compliance with the requirements of paragraph 31.204.2.

31.203.11.1 Closed-Door(s) Testing. For all closed-door test configurations, the door(s) must be closed within 10 minutes from the addition of the first test-fuel piece of each test-fuel charge in a test-burn. During a test-burn, the door(s) cannot be re-opened except during test-fuel reload and adjustment as referenced in Sections 31.203.7 and 31.203.8.

31.203.11.2 Additional Test-Burn. The testing laboratory may conduct more than one test-burn series for each of the applicable configurations specified in Section 31.203.11. If more than one test-burn is conducted for a specified configuration, the results from at least 2/3 of the test-burns for that configuration shall be used in calculating the arithmetic average emission factor for that configuration. The measurement data and results of all tests conducted shall be reported regardless of which values are used in calculating the average emission factor for that configuration.

31.203.12 Emissions Sampling System (ESS).

31.203.12.1 Principle. Figure 31-2-1 shows a schematic of an ESS for sampling solid-fuel-fired fireplace emissions. Except as specified in Section 31.202.4, an ESS in this configuration shall be used to sample all fireplace emissions. The ESS shall draw flue gases through a 15 inch (380 mm) long, 3/8 inch (10 mm) O.D. stainless steel probe which samples from the center of the flue at an elevation which is 8 feet (2 440 mm) above the floor of the firebox (i.e., the hearth). A flue-gas sample shall then travel through a 3/8 inch (10 mm) O.D. Teflon® tube, and a heated U.S. EPA Method 5-type glass-fiber filter (40 CFR Part 60, Appendix A) for collection of particulate matter. The filter shall be followed by an in-line flow-through cartridge containing 20 grams of XAD-2 sorbent resin for collecting semi-volatile hydrocarbons. Water vapor shall then be removed from the sampled gas by a silica-gel trap. Flue-gas oxygen concentrations, which shall be used to determine the ratio of flue-gas volume to the amount of fuel burned, are measured within the ESS system by an electrochemical cell meeting the performance specifications presented in Section 31.202.3.8 (1.).

The ESS shall use a critical orifice to maintain a nominal flue-gas sampling rate of 0.035 cfm (0.0167 liters per second). The actual flow rate through each critical orifice shall be determined to within 0.000354 cubic feet (0.01 liters) per second before and after each test-burn with a bubble flow meter to document exact sampling rates. The post-test-burn critical-orifice flow-rate determinations shall be performed before the ESS is dismantled for sample recovery and clean-up. Pre-test-burn and post-test-burn critical-orifice flow-rate measurements shall be within 0.0000117 cubic feet (0.00033 liters) per second of each other or the test-burn emissions results shall be invalid. Temperatures shall be monitored using type K ground-isolated, stainless-steel-sheathed thermocouples.

The ESS unit shall return particle-free and dry exhaust gas to the flue via a 1/4 inch (6 mm) Teflon® line and a 15

inch (380 mm) stainless steel probe inserted into the flue. A subsample aliquot of the flue-gas sample-gas stream exiting the ESS unit, shall be pumped into a 1 cubic foot (29 liter) Tedlar® bag for measuring the average carbon dioxide, carbon monoxide, and confirmation of average oxygen concentrations for the test period. Flow to the subsample gas bag shall be controlled by a solenoid valve connected to the main pump circuit and a fine-adjust needle-controlled flow valve. The solenoid valve shall be open only when the pump is activated, allowing the subsample gas to be pumped into the gas bag at all times when the ESS pump is on. The rate of flow into the bag shall be controlled by the fine-adjust metering needle-valve which is adjusted at setup so that 4.7 to 5.2 gal (18 to 20 liters) of gas is collected over the entire 3 test-fuel charge test-burn without over-pressurizing the gas sample bag.

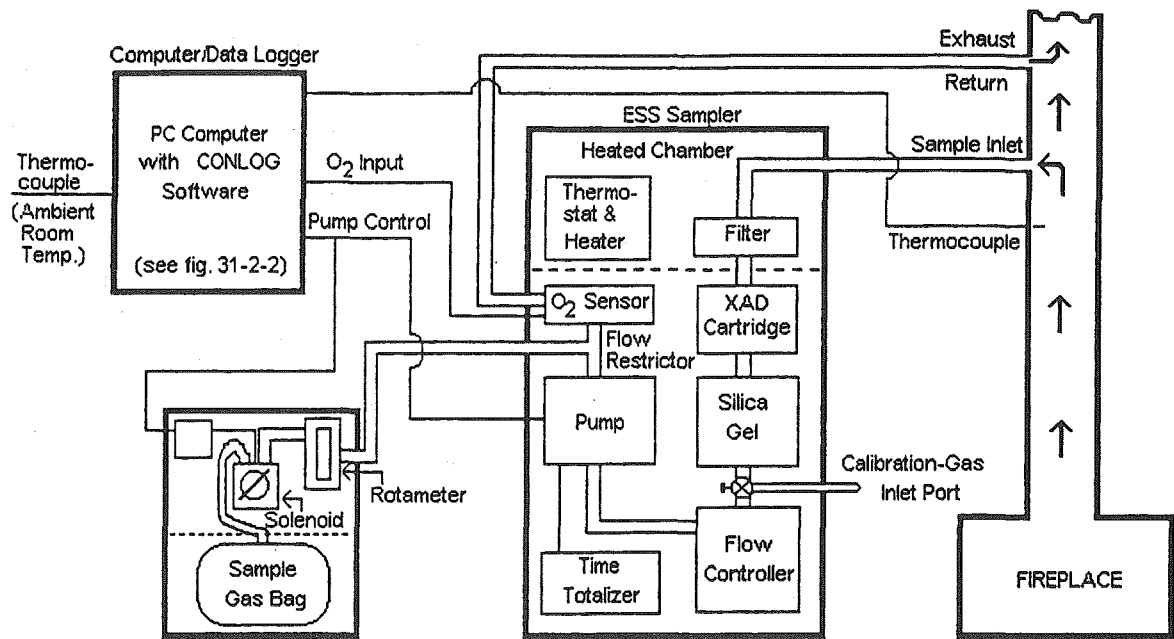


Figure 31-2-1. Schematic of ESS/Data Logger system.

31.203.12.2 The Data Acquisition and Control System. The data acquisition and control system for the ESS is shown in Figure 31-2-2. This system consists of a personal computer (PC) containing an analog-to-digital data processing board (12-bit precision), a terminal (connection) box, and specialized data acquisition and system control software (called CONLOG).

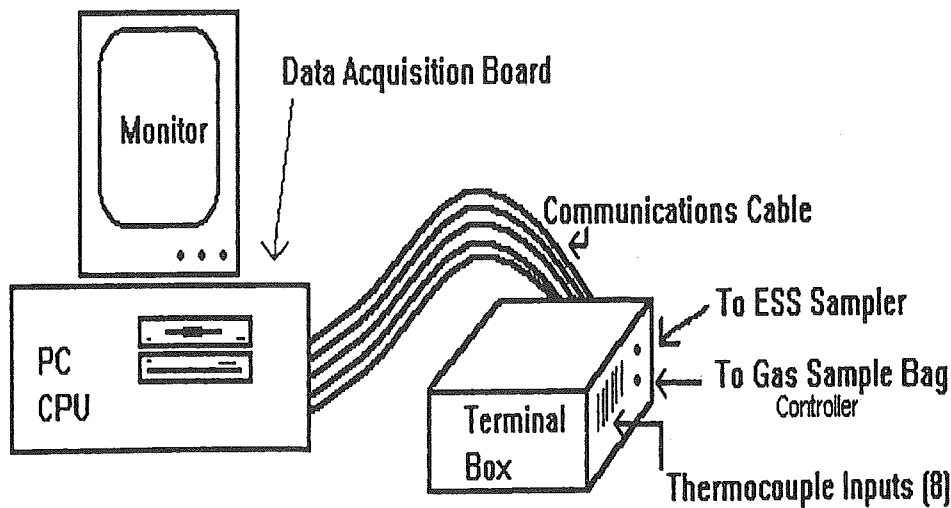


Figure 31-2-2. ESS data logger system.

For fireplace testing, the CONLOG software is configured to control, collect, and store the following data:

1. Test-period starting and ending times and dates, and total length of sampling period,
2. Pump-cycle on/off, cycle length and thermocouple (TC) cycle recording interval (frequency),
3. Temperature records, including flue-gas and ambient temperatures, averaged over pre-selected intervals,
4. Date, times, and weights of each added fuel load, and
5. Flue-gas oxygen measurements taken during each sample cycle.

During testing, instantaneous readings of real-time data shall be displayed on the system status screen. These data shall include the date, time, temperatures for each of the TCs, and flue-gas oxygen concentrations. The most recent 15 sets of recorded data shall also be displayed.

Flue-gas sampling and the recording of flue-gas oxygen concentrations shall only occur when flue-gas temperatures are above 25°F (14°C) greater than the ambient temperature of the test facility. Temperatures and fueling shall always be recorded at five-minute intervals regardless of flue-gas temperature. The ESS sampling-pump operating cycle shall be adjustable as described in Section 31.203.12.3.

31.203.12.3 ESS Sampling-Pump Operating Cycle. The ESS sampling-pump operating cycle shall be adjusted to accommodate variable test-fuel charge sizes, emission factors, and the length of time needed to complete a test-burn series. The sampler-pump operation shall be adjustable from 1 second to 5 minutes (100 percent) "on" for every 5-minute test-burn data-recording interval. This will allow adjustment for the amount of anticipated emissions materials that will be sampled and deposited on the ESS filter, XAD-2, and the other system components. It is recommended that the minimum sample quantities stipulated in Section 31.203.12.4 be used to calculate the appropriate pump cycle "on" and "off" periods. It should be noted that if the sampler collects too much particulate material on the filter and in the XAD-2 cartridge, the unit may fail the sample flow calibration check required at the end of each test-burn.

31.203.12.4 Minimum Sample Quantities. For each complete 3 test-fuel charge test-burn, the ESS must catch a minimum total particulate material mass of at least 0.231 grains (15 mg). Alternatively, the ESS must sample a minimum of 10 cubic feet (283 liters) during each 3 test-fuel charge test-burn. If this volume cannot be sampled in the test-burn time period, two ESS samplers must be utilized to sample fireplace emissions simultaneously during each test-burn. If emissions results from the two ESSs are different by more than 10 percent of the lower emissions-factor result, the test-burn results are invalid. An arithmetic average is calculated for test-burn results when two ESSs are utilized.

31.203.12.5 Equipment Preparation and Sample Processing Procedures.

31.203.12.5.1. Prior to emissions testing, the ESS unit shall be prepared with a new, tared glass-fiber filter and a clean XAD-2 sorbent-resin cartridge. Within 3 hours after testing is completed, the stainless steel sampling probe, Teflon® sampling line, filter holder, and XAD-2 cartridge(s) shall be removed from the test site and transported to the laboratory for processing. Each component of the ESS sampler shall be processed as follows:

1. Filter: The glass fiber filter (4 inches (102 mm) in diameter) shall be removed from the ESS filter housing and placed in a petri dish for desiccation and gravimetric analysis.

2. XAD-2 sorbent-resin cartridge: The sorbent-resin cartridge shall be extracted in a Soxhlet extractor with dichloromethane for 24 hours. The extraction solution shall be transferred to a tared glass beaker and evaporated in an ambient-air dryer. The beaker with dried residue shall then be desiccated to constant weight (less than ± 0.5 mg change within a 2-hour period), and the extractable residue shall be weighed.

3. ESS hardware: All hardware components which are in the flue-gas sample stream (stainless steel probe, Teflon® sampling line, stainless steel filter housing, and all other Teflon® and stainless steel fittings) through the top of the sorbent-resin cartridge, shall be cleaned with a solvent mixture of 50 percent dichloromethane and 50 percent methanol. The cleaning solvent solutions shall be placed in tared glass beakers, evaporated in an ambient-air dryer, desiccated to constant weight (less than ± 0.5 mg change within a 2-hour period), and weighed.

EPA Method 5H procedures (40 CFR Part 60, Appendix A) for desiccation and weighing time intervals shall be followed for steps 1 through 3 above.

31.203.12.5.2 The ESS shall be serviced both at the start and end of a fireplace testing period. During installation, leak checks shall be performed; the thermocouples, fuel-weighing scale, and oxygen-cell shall be calibrated, and the data logger shall be programmed. At the end of the test period, final calibration, and leak-check procedures shall again be performed, and the ESS sampling line, filter housing, XAD-2 cartridge, sampling probe, and Tedlar® bag shall be removed, sealed, and transported to the laboratory for analysis. If the pre-test and post-test leak checks of the ESS system exceed 0.00033 liters per second, the test-burn emission results shall be invalid.

31.203.12.6 Data Processing and Quality Assurance.

31.203.12.6.1 Upon returning to the laboratory facilities, the data file (computer disk) shall be reviewed to check for proper equipment operation. The data-logger data files, log books, and records maintained by field staff shall be reviewed to ensure sample integrity.

The computer-logged data file shall be used in conjunction with the ESS particulate samples and sample-gas bag

analyses to calculate the emission factor, emission rate, and fireplace operational parameters. An example ESS results report is presented in Table 31-2-A.

31.203.12.6.2 Burning Period. The total burning period is calculated by:

Total Burning Period = (Length of each sample cycle) x (Number of flue temperature readings over 25°F (14°C) greater than the ambient temperature of the test facility).

WHERE:

1. Length of each sample cycle: The time between each temperature recording as configured in the CONLOG software settings (standardized at 5 minutes).

$$\text{Particulate emission factor (g/kg)} = \frac{(\text{Particulate Catch}) \times (\text{Stoichiometric Volume}) \times (\text{Flue-gas Dilution Factor})}{(\text{Sampling Time}) \times (\text{Sampling Rate})}$$

WHERE:

1. Particulate Catch: The total mass, in grams, of particulate material caught on the filter, in the XAD-2 resin cartridge (semi-volatile compounds); and in the probe clean-up and rinse solutions.

2. Stoichiometric Volume: Stoichiometric volume is the volume of dry air needed to completely combust one dry kilogram of fuel with no "excess air". This value is determined by using a chemical reaction balance between the specific fuel being used and the chemical components of air. The stoichi-

Flue-Gas Dilution Factor

=

$$\frac{18.53 + ((1 - (\text{CO}_2 + 1/2 \text{CO})) \times 2.37)}{18.53}$$

(CO₂ + 1/2 CO)

Note: Multiplying the g/kg emission factor by the burn rate (dry kg/hr) yields particulate emissions in grams per hour (g/hr). Burn rate is calculated by the following equation:

$$\text{Burn Rate (kg/hr)} = \frac{\text{Total Fuel (kg)}}{\text{Total Burn Period (hours)}}$$

WHERE:

Total Fuel is the total fuel added during the entire test-burn minus the remaining unburned materials at the end of the test-burn.

4. Sampling Time: The number of minutes the sampler pump operated during the total test-burn period.

5. Sampling Rate: Sampling rate is controlled by the critical orifice installed in the sampler. The actual calibrated sampling rate is used here.

$$\text{CO emission factor (g/kg)} = \frac{(\text{Fraction CO}) \times (\text{Stoich. Volume}) \times (\text{Dilution Factor}) \times (\text{Molecular Weight of CO})}{(24.45 \text{ L/mole})}$$

WHERE:

1. Fraction CO: The fraction of CO measured in the gas sampling bag.

Note: Percent CO divided by 100 gives the fraction CO.

2. Molecular Weight of CO: The gram molecular weight of CO, 28 pounds per pound-mole (28.0 g/g-mole).

Multiplying the results of the above equation by the burn rate (dry kg/hr) yields the grams per hour (g/hr) CO emission rate.

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2. Number of flue temperature readings during fireplace use: The total number of temperature readings when the calibrated temperature value was more than 25°F (14°C) greater than the ambient temperature of the test facility.

31.203.12.6.3 Particulate Emissions.

31.203.12.6.3.1 ESS Particulate Emission Factor. The equation for the total ESS particulate emission factor for each test-burn presented below produces reporting units of grams per dry kilogram of fuel burned (g/kg):

ometric volume for Douglas fir is 86.78 cubic feet per pound (5 404 liters per dry kilogram) at 68°F (20°C) and 29.92 inches (760 mm) of mercury pressure.

3. Flue-gas Dilution Factor: The degree to which the sampled combustion gases have been diluted in the flue by air in excess of the stoichiometric volume (called excess air). The dilution factor is obtained by using the average sampled carbon dioxide and carbon monoxide values obtained from the sample gas bag analyses and the following equation.

$$\frac{18.53 + ((1 - (\text{CO}_2 + 1/2 \text{CO})) \times 2.37)}{18.53}$$

(CO₂ + 1/2 CO)

31.203.12.6.3.2 EPA Method 5H Particulate Emissions. ESS-measured emissions factors submitted to DOE for approval must first be converted to U.S. EPA Method 5H equivalents. The ESS particulate emissions factor results obtained in Section 31.203.12.6.1 are converted to be equivalent to the U.S. EPA Method 5H emissions factor results by the following equation:

$$1.254 + (0.302 \times \text{PEF}) + (1.261 \times 10^{-\text{PEF}})$$

WHERE:

PEF is the ESS-measured particulate emission factor for a test-burn.

31.203.12.6.4 CO Emissions. The carbon monoxide (CO) emission factor equation produces grams of CO per dry kilogram of fuel burned. The grams per kilogram equation includes some equation components described above.

Table 31-2-A Example ESS Data Results Format

ESS Emission Results

Test Facility Location: XXXX
 Test Laboratory: XXXX
 Test-Burn Number: XXXX
 Start Time/Date: XXXX
 End Time/Date: XXXX
 Fireplace Model: XXXX

TIME

Total Test Period 152.3 hours
 Total Burn Time 64.6 hours
 Flue >25 Degrees F above ambient temperature 42.4 %

ESS SETTINGS

ESS Sample Rate 1.004 l/min
 Sample Cycle 5.0 min
 Sample Time / Sample Cycle 0.443 min

TEST FUEL

Total Fuel Used (wet weight) 101.3 kg
 Ave. Fuel Moisture (dry basis) 17.7 %
 Total Fuel Used (dry weight) 86.1 kg
 Average Test-Fuel Charge 14.5 kg
 Average Burn Rate 1.33 dry kg/hr

PARTICULATE EMISSIONS (EPA Method 5H Equivalents)

Gram / Kilogram 2.6 g/kg
 Gram / Hour 3.4 g/hr
 Gram / Cubic Meter 0.06 g/m³

Notes:

NM = Not Measured, NA = Not Applicable, NU = Not Used

Total time flue temperature greater than 25 °F over ambient temperature.

TEST PERFORMED BY: XYZ Testing International, Olympia Washington, 98504

31.203.13 Calibrations.

31.203.13.1 Balance. Before each certification test, the balance used for weighing test-fuel charges shall be audited by weighing at least one calibration weight (Class F) that corresponds to 20 percent to 80 percent of the expected test-fuel charge weight. If the scale cannot reproduce the value of the calibration weight within 0.1 lb (0.05 kg) or 1 percent of the expected test-fuel charge weight, whichever is greater, re-calibrate the scale before use with at least five calibration weights spanning the operational range of the scale.

31.203.13.2 Temperature Monitor. Calibrate the temperature monitor before the first certification test and semiannually thereafter.

31.203.13.3 Fuel Moisture Meter. Calibrate the fuel moisture meter as per the manufacturer's instructions before each certification test.

CARBON MONOXIDE EMISSIONS

Gram / Kilogram 48.0 g/kg
 Gram / Hour 64.0 g/hr
 Gram / Cubic Meter 1.25 g/m³

AVERAGE TEMPERATURES

Fuel-Gas Temperatures 275 °F
 135 °C
 Flue Exit Temperature 308 °F
 154 °C
 Test Facility Ambient Temperature 66 °F
 19 °C

AVERAGE FLUE-GAS CONCENTRATIONS

Flue Oxygen (SE) 18.15 %
 Flue Oxygen (gas bag or analyzer) 18.05 %
 Flue CO (gas bag or analyzer) 0.10 %
 Flue CO₂ (gas bag or analyzer) 2.60 %

BREAKDOWN OF ESS PARTICULATE SAMPLE

Rinse 25.5 mg
 XAD 6.3 mg
 Filter 15.7 mg
 Blank 0.0 mg
TOTAL 47.4 mg

31.203.13.4 Anemometer. Calibrate the anemometer as specified by the manufacturer's instructions before the first certification test and semiannually thereafter.

31.203.13.5 Barometer. Calibrate the barometer against a mercury barometer before the first certification test and semiannually thereafter.

31.203.13.6 Draft Gauge. Calibrate the Draft Gauge as per the manufacturer's instructions; a liquid manometer does not require calibration.

31.203.13.7 ESS. The ESS shall be calibrated as specified in Section 31.203.12.1.

31.203.14 Reporting Criteria. Submit both raw and reduced data for all fireplace tests. Specific reporting requirements are as follows:

31.203.14.1 Fireplace Identification. Report fireplace identification information including manufacturer, model, and serial number. Include a copy of fireplace installation and operation manuals.

31.203.14.2 Test Facility Information. Report test facility location, temperature, and air velocity information.

31.203.14.3 Test Equipment Calibration and Audit Information. Report calibration and audit results for the test-fuel

balance, test-fuel moisture meter, analytical balance, and sampling equipment including volume metering systems and gaseous analyzers.

31.203.14.4 Pretest Information and Conditions. Report all pretest conditions including test-fuel charge weight, fireplace temperatures, and air supply settings.

31.203.14.5 Particulate Emission Data. Report a summary of test results for all test-burns conducted and the arithmetically averaged emission factor for all test-burns used for certification. Submit copies of all data sheets and other records collected during the testing. Submit examples of all calculations.

31.203.14.6 Required Test Report Information and Suggested Format. Test report information requirements to be provided to DOE for approval/certification of fireplaces are presented in this Standard. The requirements are presented here in a recommended report format.

31.203.14.6.1 Introduction.

1. Purpose of test: Certification or audit.
2. Fireplace identification: Manufacturer, model number, catalytic/noncatalytic, and options. Include a copy of fireplace installation and operation manuals.
3. Laboratory: Name, location, and participants.
4. Test information: Date fireplace was received, date of tests, sampling methods used, and number of test-burns.

31.203.14.6.2 Summary and Discussion of Results.

1. Table of results: Test-burn number, burn rate, particulate emission factor (in U.S. EPA Method 5H equivalents), efficiency (if determined), and averages (indicate which test-burns are used).
2. Summary of other data: Test facility conditions, surface temperature averages, catalyst temperature averages, test-fuel charge weights, and test-burn times.
3. Discussion: Specific test-burn problems and solutions.

31.203.14.6.3 Process Description.

1. Fireplace dimensions: Volume, height, width, lengths (or other linear dimensions), weight, and hearth area.
2. Firebox configuration: Air supply locations and operation, air supply introduction location, refractory location and dimensions, catalyst location, baffle and by-pass location and operation (include line drawings and photographs).
3. Process operation during test: Air supply settings and adjustments, fuel bed adjustments, and draft.
4. Test fuel: Test fuel properties (moisture and temperature), test fuel description (include line drawing or photograph), and test fuel charge density.

31.203.14.6.4 Sampling Locations. Describe sampling location relative to fireplace. Include linedrawings and photographs.

31.203.14.6.5 Sampling and Analytical Procedures.

1. Sampling methods: Brief reference to operational and sampling procedures, and optional and alternative procedures used.
2. Analytical methods: Brief description of sample recovery and analysis procedures.

31.203.14.6.6 Quality Control and Assurance Procedures and Results.

1. Calibration procedures and results: Certification, sampling, and analysis procedures.
2. Test method quality control procedures: Leak-checks, volume-meter checks, stratification (velocity) checks, and proportionality results.

31.203.14.6.7 Appendices.

1. **Results and Example Calculations.** Include complete summary tables and accompanying examples of all calculations.
2. **Raw Data.** Include copies of all uncorrected data sheets for sampling measurements, temperature records, and sample recovery data. Include copies of all burn rate and fireplace temperature data.
3. **Sampling and Analytical Procedures.** Include detailed description of procedures followed by laboratory personnel in conducting the certification test, emphasizing particularly, parts of the procedures differing from the prescribed methods (e.g., DOE approved alternatives).
4. **Calibration Results.** Summary of all calibrations, checks, and audits pertinent to certification test results including dates.
5. **Participants.** Test personnel, manufacturer representatives, and regulatory observers.
6. **Sampling and Operation Records.** Copies of uncorrected records of activities not included on raw data sheets (e.g., fireplace door open times and durations).
7. **Additional Information.** Fireplace manufacturer's written instructions for operation during the certification test and copies of the production-ready (print-ready) temporary and permanent labels required in Section 31.208 shall be included in the test report prepared by the test laboratory.

31.203.14.7 References.

1. Code of Federal Regulations, U.S. EPA Title 40, Part 60, Subpart AAA and Appendix A (40 CFR Part 60).
2. Barnett, S. G. and P. G. Fields, 1991, "In-Home Performance of Exempt Pellet Stoves in Medford, Oregon," prepared for U.S. Department of Energy, Oregon Department of Energy, Tennessee Valley Authority, and Oregon Department of Environmental Quality, July 1991.

3. Barnett, S. G. and R. R. Roholt, 1990, "In-Home Performance of Certified Pellet Stoves in Medford and Klamath Falls, Oregon," prepared for the U.S. Department of Energy, 1990.

4. Barnett, S. G., 1990, "Field Performance of Advanced Technology Woodstoves in Glens Falls, New York, 1988-1989," for New York State Energy Research and Development Authority, U.S. EPA, Coalition of Northeastern Governors, Canadian Combustion Research Laboratory, and the Wood Heating Alliance, December 1989.

Section 31.204—Approval procedure for fireplaces.

On or after the effective date of this regulation, a manufacturer or builder of a fireplace who wishes to have a fireplace model line or fireplace design designated as an approved (or certified) fireplace, shall submit to DOE for its review the following information:

31.204.1 Manufacturer name and street address, model or design identification, construction specifications, and drawings of the firebox and required chimney system.

31.204.2 A test report prepared in accordance with Section 31.203.14.6 showing that testing has been conducted by a DOE approved and U.S. EPA accredited laboratory, and that the arithmetically averaged particulate emission factors for that fireplace model line or design, tested in accordance with UBC Standard Section 31.202, does not exceed 7.3 g/kg (U.S. EPA Method 5H equivalent as determined in Section 31.203.12.6.3.2) for a factory-built fireplace model lines or designs or 12.0 g/kg (U.S. EPA Method 5H equivalent as determined in Section 31.203.12.6.3.2) for new certified masonry fireplace model lines or designs. After January 1, 1999, particulate emission factors for factory-built and new certified masonry fireplace model lines or designs shall not exceed 7.3 g/kg (U.S. EPA Method 5H equivalents as determined in Section 31.203.12.6.3.2).

Section 31.205—Approval of nontested fireplaces.

On or after the effective date of this regulation, DOE may grant approval for a fireplace model line or design that has not been tested pursuant to Section 31.204 upon submission of the following by the applicant:

31.205.1 Manufacturer name and street address, model or design identification, construction specifications, and drawings of the internal assembly system.

31.205.2 Documentation from an EPA accredited laboratory that the model is a fireplace within the definition of this regulation, has substantially the same core construction as a model already tested by a DOE approved and EPA accredited laboratory, and is substantially similar to the approved model in internal assembly design, combustion function, and probable emissions performance as listed in Section 31.204.2.

Section 31.206—Approval through alternative test protocol.

As provided in Section 31.202.4, an alternative testing protocol may be submitted by a DOE approved and EPA accredited laboratory for acceptance by DOE as equivalent to Uniform Building Code Standard 31-2.

Section 31.207—Approval termination.

All fireplace model line or design approvals shall terminate five years from the approval date. Previously approved fireplace model line and/or design may be granted re-approval (re-certification) upon application to and review by DOE. No testing shall be required for fireplace model line or design re-approvals unless DOE determines that design changes have been incorporated into the fireplace that could adversely affect the emissions factor, or testing is otherwise stipulated by DOE.

DOE may revoke a fireplace model line or design approval certification if it is determined that the fireplaces being produced in a specific model line do not comply with the requirements of Section 31.200. Such a determination shall be based on all available evidence, including:

1. Test data from a retesting (audit test) of the original unit on which the certification test was conducted or a sample unit from the current model line;
2. A finding that the certification test was not valid;
3. A finding that the labeling of the fireplace does not comply with the requirements of Section 31.200;
4. Failure by the fireplace manufacturer (builder) to comply with reporting and record keeping requirements under Section 31.200;
5. Physical examination showing that a significant percentage of production units inspected are not similar in all material respects to the fireplace submitted for testing; or
6. Failure of the manufacturer to conduct a quality assurance program in conformity with Section 31.208.

Revocation of certification under this section shall not take effect until the manufacturer (builder) concerned has been given written notice by DOE setting forth the basis for the proposed determination and an opportunity to request a hearing.

Section 31.208—Quality control.

Once within 30 days of each annual anniversary after the initial approval/certification, a DOE approved and U.S. EPA accredited laboratory shall inspect the most recently produced fireplace of an approved model line or design at its manufacturing location (site, if site-built) to document adherence to the approved/certified fireplace design specifications. If no fireplaces of an approved model line or design were produced (built) during the previous 12 months, no inspection is required.

An inspection report for each approved fireplace model line or design must be submitted to DOE within 30 days after

the inspection date. The inspection report shall include, as a minimum, the model identification and serial number of the fireplace inspected, the location where the model was inspected, the names of the manufacturer's and/or builder's representatives present, the date of inspection, and a description of any changes made to the approved fireplace model line or design since the last inspection. The U.S. EPA accredited laboratory which conducts the annual quality control inspection is responsible for auditing the content and format of all labels to be applied to approved fireplaces as stipulated in Section 31.209.

A fireplace model line or design shall be re-tested in accordance with Section 31.202 if it is determined during inspection that design changes have been incorporated into the approved/certified fireplace design which adversely affect the fireplace particulate emissions factor. Design elements which can affect fireplace particulate emissions include:

1. Grate placement and height;
2. Air supply minimum and maximum controls;
3. Usable hearth area; and
4. Firebox height, width, and length dimensions.

Section 31.209—Permanent label, temporary label and owner's manual.

31.209.1 Labels and the Owner's Manual. Labels and owner's manual shall be prepared and installed in all certified "For Sale" fireplaces as specified in U.S. EPA 40 CFR Part 60, Section 60.536. Information that shall be presented on all labels includes:

1. Manufacturer's or builder's name, address, and phone number;
2. Model number and/or name;
3. Month and year of manufacture;
4. Starting and ending dates for the 5-year approval period;
5. If a fireplace was tested and approved with an emissions control device which is not an integral part of the fireplace structure, the label shall state that "The fireplace can not be sold or installed without the specified emissions control device in place and operational.";
6. On certified fireplaces the statement: "This appliance has been tested and has demonstrated compliance with Washington State amendment to the UBC Standard, Chapter 31-2 requirements."

6. On certified fireplaces the statement: "This appliance has been tested and has demonstrated compliance with Washington State amendment to the UBC Standard, Chapter 31-2 requirements."

Section 31.210—List of approved fireplaces.

DOE shall maintain a list of approved fireplace model lines and designs, and that list shall be available to the public.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-095, § 51-40-31200, filed 1/3/01, effective 7/1/01; 98-02-054, § 51-40-31200, filed 1/6/98, effective 7/1/98.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

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Chapter 51-42 WAC

STATE BUILDING CODE ADOPTION AND AMENDMENT OF THE 1997 EDITION OF THE UNIFORM MECHANICAL CODE

WAC

51-42-0405	Section 405—Direct gas-fired make-up air systems.
51-42-1103	Refrigeration system classification.
51-42-1105	Machinery room, general requirements.
51-42-1109	Refrigerant piping, containers and valves.
51-42-1110	Erection of refrigerant piping.
51-42-1111	Refrigerant control valves.
51-42-1112	Pressure-limiting devices.
51-42-1113	Pressure-relief devices.
51-42-1114	Pressure-relief device settings.
51-42-1115	Marking of pressure-relief devices.
51-42-1116	Over-pressure protection.
51-42-1117	Discharge piping.
51-42-1118	Special discharge requirements.
51-42-1119	Ammonia discharge.
51-42-1120	Detection and alarm systems.
51-42-1121	Equipment identification.
51-42-1122	Testing of refrigeration equipment.
51-42-1123	Maintenance and operation.
51-42-1124	Storage of refrigerants and refrigerant oils.
51-42-1126	Tables not adopted.
51-42-1301	Section 1301—General.

WAC 51-42-0405 Section 405—Direct gas-fired make-up air systems.

405.1 General. Direct gas-fired make-up air heaters shall not be installed for comfort heating in other than Group F, S, or U Occupancies.

EXCEPTION: Direct gas-fired make-up air heaters may be installed in accordance with Section 909.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-0405, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1103 Refrigeration system classification.

1103.1 General. For the purposes of applying Tables 1104.1, 1104.2(1), and 1104.2(2), refrigeration systems shall be classified as high-probability or low-probability system based on the potential hazard resulting from a leakage of refrigerant into an occupancy-classified area other than the machinery room.

1103.2 High-probability systems. Direct systems and indirect open-spray systems shall be classified as high-probability systems.

EXCEPTION: An indirect open-spray system shall not be required to be classified as a high-probability system if the pressure of the secondary coolant is at all times (operating and standby) greater than the pressure of the refrigerant.

1103.3 Low-probability systems. Double-indirect open-spray systems, indirect closed systems and indirect-vented closed systems shall be classified as low-probability systems, provided that all refrigerant-containing piping and fittings are isolated when the quantities in Table 1104.1 are exceeded.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1103, filed 1/3/01, effective 7/1/01; 98-02-056, § 51-42-1103, filed 1/6/98, effective 7/1/98.]

WAC 51-42-1105 Machinery room, general requirements.

1105.1 General. Where required by Table 1104.2(1), a machinery room shall be provided to enclose refrigeration systems located indoors. Access to the machinery room shall be restricted to authorized personnel. For rooms where occupational exposure could occur, see WAC 296-62-07515 and 296-62-3112.

1105.2 Dimensions. A machinery room shall be dimensioned so as to provide clearances required by Chapter 3. There shall be clear head room of not less than 7 feet 3 inches (2210 mm) below equipment located over passageways.

1105.3 Doors. Each machinery room shall have self-closing, weather-stripped doors opening in the direction of egress travel. Doors and door openings shall comply with the requirements of the Building Code.

1105.4 Openings. Openings to other parts of the building that permit passage of escaping refrigerant to other parts of the building are prohibited. 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.

EXCEPTIONS:

1. Egress doors serving the machinery room.
2. Access doors and panels in air ducts and air-handling units, provided that such openings are gasketed and tight fitting.

1105.5 Refrigerant vapor detector. Machinery rooms shall contain a refrigerant vapor detector 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 vapor from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values shown in Table 1104.1. Detectors and alarms shall be placed in approved locations. Detection and alarm systems shall be powered and supervised, monitored and annunciated, and installed and maintained as required by Section 6313 of the Fire Code.

EXCEPTION: Detectors are not required for ammonia systems complying with Section 1106.8.

1105.6 Tests. Periodic tests of the detector, alarm and mechanical ventilating system shall be performed in accordance with manufacturer's specifications and as required by the code official.

1105.7 Fuel-burning equipment. Open flames that use combustion air from the machinery room shall not be installed in a machinery room.

EXCEPTIONS:

1. Matches, lighters, halide leak detectors and similar devices.
2. Where the refrigerant is carbon dioxide or water.
3. Fuel-burning equipment shall not be prohibited in the same machinery room with refrigerant-containing equipment 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.

1105.8 Sign. A sign shall be posted on the machinery room door prohibiting access of unauthorized personnel.

1105.9 Ventilation. Machinery rooms shall be mechanically ventilated to the outdoors. Mechanical ventilation shall be capable of exhausting the minimum quantity of air both at the normal operating and emergency conditions. Multiple fans or multispeed fans shall be allowed in order to produce the emergency ventilation rate and to obtain a reduced airflow for normal ventilation. Fans providing refrigeration machinery room temperature control or automatic response to refrigerant vapor are allowed to be automatically controlled to provide intermittent ventilation as conditions require.

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. 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:

$$F = \sqrt[3]{G}$$

$$\text{For SI: } F = 0.138 \sqrt[3]{G}$$

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.

1105.9.1 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.

1105.9.2 Supply air. Provisions shall be made for supply air to replace that being exhausted. Openings for supply air shall be located to avoid intake of exhaust air. Air supply and exhaust ducts to the machinery room shall serve no 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. The supply air shall be taken from directly outside the building. Intakes shall be fitted with backdraft dampers or similar approved flow control means to prevent reverse flow.

1105.9.3 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 ($0.0025 \text{ m}^3/\text{s} \cdot \text{m}^2$) of machinery room area or 20 cfm ($0.009 \text{ m}^3/\text{s}$) per person; or
2. A volume required to maintain a maximum temperature rise of 18°F (-7.8°C) based on all of the heat-producing machinery in the room.

1105.9.4 Quantity—emergency conditions. Upon actuation of the refrigerant detector required in Section 1105.5, the mechanical ventilation system shall exhaust air from the machinery room in the following quantity:

$$\begin{aligned} Q &= 100 \times \sqrt{G} \\ \text{For SI: } Q &= 0.07 \times \sqrt{G} \end{aligned}$$

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.

1105.10 Termination of relief devices. In the equipment room, pressure relief devices, fusible plugs and purge systems 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.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1105, filed 1/3/01, effective 7/1/01; 98-02-056, § 51-42-1105, filed 1/6/98, effective 7/1/98.]

WAC 51-42-1109 Refrigerant piping, containers and valves. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1109, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1110 Erection of refrigerant piping. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1110, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1111 Refrigerant control valves. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1111, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1112 Pressure-limiting devices. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1112, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1113 Pressure-relief devices. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1113, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1114 Pressure-relief device settings. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1114, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1115 Marking of pressure-relief devices. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1115, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1116 Over-pressure protection. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1116, filed 1/3/01, effective 7/1/01.]

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WAC 51-42-1117 Discharge piping. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1117, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1118 Special discharge requirements. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1118, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1119 Ammonia discharge. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1119, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1120 Detection and alarm systems. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1120, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1121 Equipment identification. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1121, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1122 Testing of refrigeration equipment. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1122, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1123 Maintenance and operation. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1123, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1124 Storage of refrigerants and refrigerant oils. This section is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1124, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1126 Tables not adopted.

Table 11-A - Refrigerant groups, properties and allowable quantities. This table is not adopted.

Table 11-B - Permissible refrigeration systems and refrigerants. This table is not adopted.

Table 11-C - Value of f (f) for equation 11-7. This table is not adopted.

Table 11-D - Field leak test pressures in psig. This table is not adopted.

Table 11-E - Condensate waste size. This table is not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-098, § 51-42-1126, filed 1/3/01, effective 7/1/01.]

WAC 51-42-1301 Section 1301—General.

1301.2 Other authorities. In addition to the Uniform Mechanical Code, provisions of chapter 480-93 WAC regarding gas pipeline safety may also apply to single meter installations serving more than one building. The provisions of chapter 480-93 WAC are enforced by the Washington Utilities and Transportation Commission.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-098, § 51-42-1301, filed 1/3/01, effective 7/1/01.]

Chapter 51-44 WAC

**STATE BUILDING CODE ADOPTION AND
AMENDMENT OF THE 1997 EDITION OF THE
UNIFORM FIRE CODE**

WAC

51-44-0103	Section 103—Inspection and enforcement.
51-44-0105	Section 105.8—Permit required.
51-44-0200	Article 2—Definitions and abbreviations.
51-44-1007	Section 1007—Fire alarm systems.
51-44-1102	Section 1102—Incineration, open burning and commercial barbecue pits.
51-44-1109	Section 1109—Control of sources of ignition.
51-44-2500	Article 25—Places of assembly.
51-44-5200	Article 52—Motor vehicle fuel-dispensing stations.
51-44-7900	Article 79—Flammable and combustible liquids.

WAC 51-44-0103 Section 103—Inspection and enforcement.

103.2.1.1 General. The chief is authorized to administer and enforce this code. Under the chief's direction, the fire department is authorized to enforce all ordinances of the jurisdiction pertaining to:

1. The prevention of fires,
2. The suppression or extinguishment of dangerous or hazardous fires,
3. The storage, use and handling of hazardous materials,
4. The installation and maintenance of automatic, manual and other private fire alarm systems and fire-extinguishing equipment,
5. The maintenance and regulation of fire escapes,
6. The maintenance of fire protection and the elimination of fire hazards on land and in buildings, structures and other property, including those under construction,
7. The maintenance of means of egress, and
8. The investigation of the cause, origin and circumstances of fire and unauthorized releases of hazardous materials.

For authority related to control and investigation of emergency scenes, see Section 104.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-0103, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-0103, filed 1/6/98, effective 7/1/98.]

WAC 51-44-0105 Section 105.8—Permit required.

105.8 f.3 Flammable or combustible liquids. See Article 79.

1. To use or operate, repair or modify a pipeline for the transportation of flammable or combustible liquids.

2. To store, handle or use Class I liquids in excess of 5 gallons (18.9 L) in a building or in excess of 10 gallons (37.9 L) outside of a building, except that a permit is not required for the following:

2.1 The storage or use of Class I liquids in the fuel tank of a motor vehicle, aircraft, motorboat, mobile power plant or mobile heating plant, unless such storage, in the opinion of the chief, would cause an unsafe condition.

2.2 The storage or use of paints, oils, varnishes or similar flammable mixtures when such liquids are stored for maintenance, painting or similar purposes for a period of not more than 30 days.

3. To store, handle or use Class II or Class III-A liquids in excess of 25 gallons (94.6 L) in a building or in excess of 60 gallons (227.1 L) outside a building, except for fuel oil used in connection with oil-burning equipment.

4. To remove Class I or Class II liquids from an underground storage tank used for fueling motor vehicles by any means other than the approved, stationary on-site pumps normally used for dispensing purposes.

5. To install, construct, alter or operate tank vehicles, equipment, tanks, plants, terminals, wells, fuel-dispensing stations, refineries, distilleries and similar facilities where flammable and combustible liquids are produced, processed, transported, stored, dispensed or used.

6. To install, alter, remove, abandon, place temporarily out of service or otherwise dispose of a flammable or combustible liquid tank.

7. To change the type of contents stored in a flammable or combustible liquid tank to a material other than that for which the tank was designed and constructed.

8. To fuel motor vehicles directly from a tank vehicle, or to operate a site where motor vehicles are fueled directly from tank vehicles.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-0105, filed 1/3/01, effective 7/1/01.]

WAC 51-44-0200 Article 2—Definitions and abbreviations.**SECTION 206 - E.**

ELECTRICAL CODE is the National Electrical Code, promulgated by the National Fire Protection Association, as adopted in chapter 296-46 WAC, or the locally adopted Electrical Code.

SECTION 207 - F.

FAMILY CHILD DAY CARE HOME is a child day care facility, licensed by the state, located in the family abode of the person or persons under whose direct care and supervision the child is placed, for the care of twelve or fewer children, including children who reside at the home.

SECTION 216 - O.**Group E Occupancies:**

Group E Occupancies shall be:

Division 1. Any building used for educational purposes through the 12th grade by 50 or more persons for more than 12 hours per week or four hours in any one day.

Division 2. Any building used for educational purposes through the 12th grade by less than 50 persons for more than 12 hours per week or four hours in any one day.

Division 3. Any building or portion thereof used for day-care purposes for more than six persons.

EXCEPTION: Family child day care homes shall be considered Group R, Division 3 Occupancies.

Group LC Occupancies:

Group LC Occupancies shall be:

Group LC Occupancies shall include buildings, structures, or portions thereof, used for the business of providing licensed care to clients in one of the following categories regulated by either the Washington Department of Health or the Department of Social and Health Services:

1. Adult residential rehabilitation facility.
2. Alcoholism intensive inpatient treatment service.
3. Alcoholism detoxification service.
4. Alcoholism long term treatment service.
5. Alcoholism recovery house service.
6. Boarding home.
7. Group care facility.
8. Group care facility for severely and multiple handicapped children.
9. Residential treatment facility for psychiatrically impaired children and youth.

EXCEPTION: Where the care provided at an alcoholism detoxification service is acute care similar to that provided in a hospital, the facility shall be classified as a Group I, Division 1.1 hospital.

Group R Occupancies:

Group R Occupancies shall be:

Division 1. Hotels and apartment houses. Congregate residences (each accommodating more than 10 persons).

Division 2. Not used.

Division 3. Dwellings, family child day care homes, adult family homes, and lodging houses. Congregate residences (each accommodating 10 persons or less).

OPEN BURNING is the burning of a bonfire, rubbish fire or other fire in an outdoor location where fuel being burned is

not contained in an incinerator, outdoor fireplace, barbecue grill or barbecue pit.

SECTION 219 - R.

RECREATIONAL FIRE is the burning of materials other than rubbish where fuel being burned is not contained in an incinerator, outdoor fireplace, barbecue grill or barbecue pit and with a total fuel area of 3 feet (914 mm) or less in diameter and 2 feet (610 mm) or less in height for pleasure, religious, ceremonial, cooking or similar purposes.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-0200, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-0200, filed 1/6/98, effective 7/1/98.]

WAC 51-44-1007 Section 1007—Fire alarm systems.

1007.1.3 Where new construction or modification is to be in compliance with adopted chapter 51-40 WAC, Chapter 11, alarm modifications shall be designed to be compatible with the requirements of UFC Article 10.

1007.3.3.3.4 Visual alarms. Where provided, alarm systems shall include both audible and visual alarms. Visual alarm devices shall be located in hotel guest rooms as required by the building code (see UBC Washington State Amendments, Section 1105.4.9); assembly areas; accessible public- and common-use areas, including toilet rooms and bathing facilities; hallways; and lobbies. (See UBC Washington State Amendments, Section 1106.15.2, for additional information about visual signals.)

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-1007, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-1007, filed 1/6/98, effective 7/1/98.]

WAC 51-44-1102 Section 1102—Incineration, open burning and commercial barbecue pits.

1102.3.1 General. Open burning shall be conducted in accordance with Section 1102.3. Open burning shall also be conducted as required by other governing agencies regulating emissions. See chapter 173-425 WAC.

EXCEPTION: Recreational fires shall be in accordance with Section 1102.4.

1102.4.1 General. Recreational fires shall be in accordance with Section 1102.4. See also chapter 173-425 WAC.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-1102, filed 1/3/01, effective 7/1/01.]

WAC 51-44-1109 Section 1109—Control of sources of ignition.

1109.8.3 Religious ceremonies. Participants in religious ceremonies shall not be precluded from carrying hand-held candles. See RCW 19.27.031(3).

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-1109, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-1109, filed 1/6/98, effective 7/1/98.]

WAC 51-44-2500 Article 25—Places of assembly.

2501.9.3 Width with Fixed Seats. Aisles in assembly occupancies with fixed seats shall comply with Section 2501.9.3. The clear width of aisles shall be based on the number of occupants within the portion of the seating areas served by the aisle.

The clear width of an aisle in inches shall not be less than the occupant load served by the aisle multiplied by 0.3 for aisles with slopes greater than 1 unit vertical to 8 units horizontal (12.5% slope) and not less than 0.2 for aisles with a slope of 1 unit vertical to 8 units horizontal (12.5% slope) or less. In addition, when the rise of steps in aisles exceeds 7 inches (178 mm), the aisle clear width shall be increased by 1 1/4 inches (32 mm) for each 100 occupants or fraction thereof served for each 1/4 inch (6.35 mm) of riser height above 7 inches (178 mm).

EXCEPTION: For buildings with smoke-protected assembly seating and for which an approved life-safety evaluation is conducted, the minimum clear width of aisles and other means of egress may be in accordance with Table 2501-B. For Table 2501-B, the number of seats specified must be within a single assembly area, and interpolation shall be permitted between the specified values shown. If Table 2501-B is used the minimum clear widths shown shall be modified in accordance with the following:

1. Where risers exceed 7 inches (178 mm) in height, multiply the stairway width in the tables by factor A, where:

$$A = 1 + \frac{(\text{riser height} - 7.0 \text{ inches})}{5} \quad (4-1)$$

For SI: $A = 1 + \frac{(\text{riser height} - 178 \text{ mm})}{127}$

Where risers do not exceed 7 inches (178 mm) in height, A = 1.

2. Stairways not having a handrail within a 30-inch (762 mm) horizontal distance shall be 25 percent wider than otherwise calculated, i.e., multiply by B = 1.25. For all other stairs, B = 1.

3. Ramps steeper than 1 unit vertical in 10 units horizontal (10% slope) where used in ascent shall have their width increased by 10 percent, i.e., multiply by C = 1.10. For ramps not steeper than 1 unit vertical in 10 units horizontal (10% slope), C = 1. Where fixed seats are arranged in rows, the clear width of aisles shall not be less than set forth above or less than the following minimum widths:

- 3.1 Forty-eight inches (1219 mm) for stairways having seating on both sides.
- 3.2 Thirty-six inches (914 mm) for stairways having seating on one side.
- 3.3 Twenty-three inches (584 mm) between a stairway handrail and seating where the aisles are subdivided by the handrail.
- 3.4 Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.
- 3.5 Thirty-six inches (914 mm) for level or ramped aisles having seating on one side.
- 3.6 Twenty-three inches (584 mm) between a stairway handrail and seating where an aisle does not serve more than five rows on one side.

Where exit access is possible in two directions, the width of such aisles shall be uniform throughout their length. Where aisles converge to form a single path of exit travel, the aisle width shall not be less than the combined required width of the converging aisles.

2501.9.5 Ramp slope. The slope of ramped aisles shall not be more than 1 unit vertical in 8 units horizontal (12.5 percent slope). Ramped aisles shall have a slip-resistant surface.

EXCEPTION: When provided with fixed seating, theaters may have a slope not steeper than 1 unit vertical to 5 units horizontal (20 percent slope).

2501.9.6.2 When required. Aisles with a slope steeper than 1 unit vertical to 8 units horizontal (12.5 percent slope) shall consist of a series of risers and treads extending across the entire width of the aisle, except as provided in subsection 2501.9.5.

The height of risers shall not be more than 8 inches (203 mm) or less than 4 inches (102 mm) and the tread run shall not be less than 11 inches (279 mm). The riser height shall be uniform within each flight and the tread run shall be uniform throughout the aisle. Variations in run or height between adjacent treads or risers shall not exceed 3/16 inch (4.8 mm). A contrasting marking stripe or other approved marking shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be a minimum of 1 inch (25.4 mm) wide and a maximum of 2 inches (51 mm) wide.

EXCEPTION: When the slope of aisle steps and the adjoining seating area is the same, the riser heights may be increased to a maximum of 9 inches (229 mm) and may be nonuniform but only to the extent necessitated by changes in the slope of the adjoining seating area to maintain adequate sightlines. Variations may exceed 3/16 inch (4.8 mm) between adjacent risers provided the exact location of such variations is identified with a marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform riser. The marking stripe shall be distinctively different from the contrasting marking stripe.

2501.17 Candles and other open-flame devices. Candles and other open-flame devices shall not be used in places of assembly or in drinking or dining establishments.

- EXCEPTIONS:**
1. When used in conjunction with approved heating or cooking appliances in areas not accessible to the public.
 2. When used in conformance with Section 1109.8.
 3. When used in conformance with Section 8203.2.1.8.
 4. Hand-held candles carried by participants in religious ceremonies. (See RCW 19.27.031(3).)

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-2500, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-2500, filed 1/6/98, effective 7/1/98.]

WAC 51-44-5200 Article 52—Motor vehicle fuel-dispensing stations.

5201.1 Scope. Automotive, marine and aircraft motor vehicle fuel-dispensing stations shall be in accordance with Article 52 and UFC Standard 52-1. Such operations shall include both public accessible and private operations.

For provisions relating to the transfer of flammable and combustible liquids directly from tank vehicles into the fuel tanks of motor vehicles, see Section 7904.5.4.2.

The storage and use of flammable and combustible liquids and LP-gas shall also be in accordance with Articles 79 and 82.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-5200, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-5200, filed 1/6/98, effective 7/1/98.]

WAC 51-44-7900 Article 79—Flammable and combustible liquids.

SECTION 7901.2.2—DEFINITIONS - LIMITED APPLICATION.

AUTO START AND STOP NOZZLE is an approved dispensing nozzle that is not capable of dispensing liquid unless the nozzle is in contact with the fuel fill opening of the motor vehicle. The nozzle must be incapable of dispensing liquid until the nozzle has entered the fuel fill opening of the motor vehicle fuel tank. The nozzle will automatically stop dispensing prior to fully extracting the nozzle from the fuel tank opening.

MOTOR VEHICLE includes, but is not limited to, a vehicle, machine, tractor, trailer, or semi-trailer, or any combination thereof, propelled or drawn by mechanical power and used upon the highways in the transportation of passengers or property. The term "motor vehicle" also includes freight containers or cargo tanks used, or intended for use, in connection with motor vehicles. For reference, see 49 CFR Pt. 171.8 (October 1994).

REMOTE EMERGENCY SHUT-OFF DEVICE is a device capable of halting the pumping of fuel from the furthest point at which the fuel is being dispensed, but not less than 100 feet.

SECTION 7902 - STORAGE.

7902.1.7.2.4 Tanks abandoned in place. Tanks abandoned in place shall be abandoned as follows:

1. Flammable and combustible liquids shall be removed from the tank and connected piping,
2. The suction, inlet, gage, vapor return and vapor lines shall be disconnected,
3. The tank shall be filled completely with an approved, inert solid material,

EXCEPTION: Residential heating oil tanks of 1,100 gallons (4,164 L) or less, provided the fill line is permanently capped or plugged, below grade, to prevent refilling of the tank.

4. Remaining underground piping shall be capped or plugged, and

5. A record of the tank size, location and date of abandonment shall be retained.

7902.6.8 Leaking tanks. Leaking tanks shall be handled in accordance with WAC 173-360-325.

7902.6.10 Tank lining. Steel tanks are allowed to be lined only for the purpose of protecting the interior from corrosion or providing compatibility with a material to be stored. Only those liquids tested for compatibility with the lining material are allowed to be stored in lined tanks. Lining of leaking underground storage tanks shall be done in accordance with the provisions of WAC 173-360-325.

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7902.6.15.2 Cathodic protection. Cathodic protection systems provided for corrosion protection shall be in accordance with recognized standards. See WAC 173-360-320.

SECTION 7903 - DISPENSING, USE, MIXING AND HANDLING.

7903.4 Solvent Distillation Units.

7903.4.1 General. Solvent distillation units used to recycle Class I, II or III-A liquids having a distillation chamber capacity of 60 gallons (227.1 L) or less shall be listed, labeled and installed in accordance with Section 7903.4 and nationally recognized standards. See Article 90, Standard u.1.17.

EXCEPTIONS:

1. Solvent distillation units installed in dry-cleaning plants in accordance with Section 3603.
2. Solvent distillation units used in continuous throughput industrial processes where the source of heat is remotely supplied using steam, hot water, oil or other heat-transfer fluids, the temperature of which is below the auto-ignition point of the solvent(s).
3. Approved research, testing and experimental processes.

Solvent-distillation units used to recycle Class I, II or III-A liquids, having a distillation chamber capacity exceeding 60 gallons (227.1 L) shall be used in locations that comply with the use and mixing requirements of Section 7903 and other applicable provisions in Article 79.

Classes I, II and III-A liquids also classified as unstable (reactive) shall not be processed in solvent-distillation units.

EXCEPTION:

Appliances listed for the distillation of unstable (reactive) solvents.

SECTION 7904 - SPECIAL OPERATIONS.

7904.5.4.2 Destination of liquids off loaded from tank vehicles and tank cars.

7904.5.4.2.1 General. Class I, II or III liquids shall be transferred from a tank vehicle or tank car only into an approved atmospheric tank or approved portable tank, except as provided in Sections 7904.5.4.2.2 through 7904.5.4.2.7.

7904.5.4.2.2 Marine craft and special equipment. Liquids intended for use as motor fuels are allowed to be transferred from tank vehicles into the fuel tanks of marine craft and special equipment when approved, and when:

1. The tank vehicle's specific function is that of supplying fuel to fuel tanks and each premises shall require a separate permit issued in accordance with Section 105,

2. The operation shall be performed only where the general public has no access or where there is no unusual exposure to life and property,

3. The dispensing line shall not exceed 50 feet (15 240 mm) in length, and

4. The dispensing nozzle is approved.

7904.5.4.2.2.1 Vehicle fueling. When approved by the chief, dispensing of motor vehicle fuel from tank vehicles into the fuel tanks of motor vehicles is allowed in accordance with Article 52 and Sections 7904.2 and 7904.5.4.2.

7904.5.4.2.7 Fueling of motor vehicles from tank vehicles.

7904.5.4.2.7.1 General. The transfer of gasoline or other Class I flammable liquid into the fuel tank of a motor vehicle is prohibited except as provided for in Sections 7904.5.4.2.2 through 7904.5.4.2.6. The transfer of a Class II combustible liquid (e.g., diesel fuel) into the fuel tank of a motor vehicle shall be in accordance with Section 7904.5.4.2.7, except as provided for in Sections 7904.5.4.2.2 through 7904.5.4.2.6.

7904.5.4.2.7.2 Permits and plans. See also Section 105.8, Permit f.3. A permit is required:

1. To transfer fuel into a motor vehicle directly from a tank vehicle.

2. For any site where fuel is transferred into the fuel tank of a motor vehicle directly from a tank vehicle.

The following information shall be included with any application for permit to transfer fuel into a motor vehicle from a tank vehicle:

- License number of each fuel delivery vehicle.
- Proof of tank vehicle compliance with 49 CFR 178 requirements and inspections. Documentation showing inspection approval of the vehicles by a USDOT registered inspector shall be proof of compliance.
- An approved Spill Response Plan.

The following information shall be included with any application to utilize a site for the transfer of fuel into motor vehicles from tank vehicles:

- A site plan showing all property lines, buildings, facilities, hazardous materials, parking, lighting, fencing, openings into buildings, storm drains, unpaved areas, lanes of egress and the proposed location(s) of fueling.

7904.5.4.2.7.3 Fuel delivery vehicles.

7904.5.4.2.7.3.1 Maintenance. All required equipment, safety features and devices on the fuel delivery vehicle shall be maintained in full working order at all times.

7904.5.4.2.7.3.2 Compliance with USDOT regulations. Fuel delivery vehicles shall comply with all applicable 49 CFR 178 requirements. Documentation from a USDOT registered inspector shall be available for review by the fire department and shall be proof of compliance.

7904.5.4.2.7.3.3 Fuel dispensing hoses. The fueling hose shall not be extended beyond 50 feet.

EXCEPTION: The fueling hose may be extended up to a distance of 125 feet if the operator carries an approved remote emergency shut-off device capable of stopping the flow of fuel. The demonstrated distance by which the remote emergency shut-off reliably operates shall determine the approved hose distance or as denoted by the manufacturer, whichever distance is less. The hose shall be clearly marked at the approved distance. The approved distance marking on the hose shall consist of a band, the length of which shall be a minimum of 12 inches. The marking shall be of contrasting color to the hose.

All pressure hoses and couplings shall be inspected at intervals appropriate to the service. Any hose showing materials deterioration, signs of leakage or weakness in its carcass or at the couplings shall be withdrawn from service and repaired or discarded.

7904.5.4.2.7.3.4 Hose diameter. The inside diameter of the delivery hose shall not exceed 1-1/4 inches.

7904.5.4.2.7.3.5 Spill control equipment. Fuel delivery vehicles shall be equipped with clean-up supplies in accordance with the Department of Ecology's Storm-water Management in Washington State Volume IV Source Control Best Management Practice Number S1.11. Such supplies shall be readily available for employment by the operator at all times.

7904.5.4.2.7.3.6 Nozzle. The dispensing nozzle shall be an approved listed automatic closing type hose nozzle without a latch-open device or an approved auto start and stop nozzle with a latch-open device.

7904.5.4.2.7.3.7 Emergency shut-off valve. The fuel delivery vehicle shall have an approved emergency shut-off valve on the fuel delivery vehicle.

7904.5.4.2.7.3.8 Fire extinguisher. The fuel delivery vehicle shall have a fire extinguisher with a minimum rating of 2A 20BC located in a readily accessible location.

7904.5.4.2.7.4 Operation requirements.

7904.5.4.2.7.4.1 Training. Fuel delivery vehicle operators shall comply with current training and certification requirements in accordance with local, state and federal regulations for handling, dispensing and transporting hazardous materials.

7904.5.4.2.7.4.2 Notification of spills. The fuel delivery vehicle operator shall, without delay, directly notify the fire department via 911 when an unauthorized discharge becomes reportable under state, federal or local regulations or when any spill or accidental release is not contained by spill prevention measures.

7904.5.4.2.7.4.3 Location of attendant during dispensing. The attendant shall be located at the nozzle at all times when fuel is being dispensed.

7904.5.4.2.7.4.4 Signage. Signs stating NO SMOKING or OPEN FLAME WITHIN 25 FEET, or an approved equivalent, shall be visible and readable at the fueling site.

7904.5.4.2.7.4.5 Emergency communication. Each tanker shall have a mobile or portable phone or two-way radio to an attended base.

7904.5.4.2.7.4.6 Warning lights. The fuel delivery vehicle's parking brake and the hazard warning lights shall be activated during fueling operations.

7904.5.4.2.7.4.7 Spill prevention.

7904.5.4.2.7.4.7.1 Overfill and drip protection. Operators shall place a drip pan or absorbent, in good condition, under each fuel fill opening prior to and during all dispensing operations. Drip pans shall be liquid tight. The pan or absorbent shall have a capacity of at least 3 gallons. Spills retained in the drip pan or absorbent pillow need not be reported. Operators, when fueling, shall have on their persons an absorbent pad capable of capturing diesel foam overfills. Except during

fueling, the nozzle shall face upwards and an absorbent pad shall be kept under the nozzle to prevent drips. Contaminated absorbent pads shall be disposed of regularly in accordance with local, state and federal requirements.

7904.5.4.2.7.4.7.2 Topping off. Fuel expansion space shall be provided in each motor vehicle tank to prevent overflow. Tanks shall not be topped off. The operator shall cease filling and remove the fill nozzle if the automatic shut-off engages.

7904.5.4.2.7.4.8 Lighting. The operator shall provide lighting that provides clear illumination at the point of fueling. General lighting of the fueling area shall be provided for nighttime fueling.

7904.5.4.2.7.4.9 Vehicle motor shutdown. The vehicle being fueled shall be shut off during fueling operations.

7904.5.4.2.7.4.10 Fuel hoses. At no time shall the fueling hose extend across a trafficable lane without fluorescent traffic cones conspicuously placed so that all vehicle traffic is blocked.

The fuel hose shall be returned to its storage location on the vehicle prior to repositioning the vehicle. At no time shall the hose be allowed to drag behind the vehicle while it is in motion.

7904.5.4.2.7.5 Site requirements.

7904.5.4.2.7.5.1 Property owner's consent. All persons and parties with an interest in the property (i.e., property owner, lessor, real estate company, property manager as well as operators of the property) must give consent in writing to allow the mobile fueling to occur on the property. Managers, lessees, renters and other persons cannot solely give permission. Each person or party must indicate that they understand the risk of spills.

7904.5.4.2.7.5.2 Location of fueling. The fuel dispensing vehicle and the fueling operation shall be at least 15 feet from all property lines, streets, alleys, public ways, building openings and storm drains.

EXCEPTIONS:

1. The distance to storm drains can be eliminated if an approved storm drain cover or an approved equivalent that will prevent any fuel from reaching the drain is in place prior to fueling or hose being placed within 15 feet of the drain. When placement of a storm drain cover will cause the accumulation of excessive water or difficulty in safely conducting the fueling, it shall not be used and fueling shall not take place within 15 feet of a drain.
2. The distance to storm drains can be eliminated for drains that direct intake to approved oil-water separators.

7904.5.4.2.7.5.3 Sources of ignition. Fuel dispensing is prohibited within 15 feet of any source of ignition.

7904.5.4.2.7.5.4 Access. Mobile fueling operations shall not be performed during times when the public has access to the area unless restricted by remoteness of the property, fencing or other control measures.

[Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-096, § 51-44-7900, filed 1/3/01, effective 7/1/01; 98-02-053, § 51-44-7900, filed 1/6/98, effective 7/1/98.]

Chapter 51-46 WAC

STATE BUILDING CODE ADOPTION AND AMENDMENT OF THE 1997 EDITION OF THE UNIFORM PLUMBING CODE

WAC

51-46-001 through 51-46-97129 Repealed.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

51-46-001	Authority. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-001, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-002	Purpose. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-002, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-003	Uniform Plumbing Code. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-003, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-007	Exceptions. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-24-078, § 51-46-007, filed 12/1/98, effective 7/1/99; 98-02-055, § 51-46-007, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-008	Implementation. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-008, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0100	Chapter 1—Administration. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0100, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0101	Section 101 Title, scope and general. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0101, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0102	Organization and enforcement. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0102, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0103	Section 103 Permits and inspections. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0103, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0200	Chapter 2—Definitions. [Statutory Authority: RCW 19.27.031, 19.27.074, 01-02-097, § 51-46-0200, filed 1/3/01, effective 7/1/01; 98-02-055, § 51-46-0200, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0205	Section 205.0 - C. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0205, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0215	Section 215.0 - M. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0215, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0218	Section 218.0 - P. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0218, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
51-46-0300	Chapter 3—General regulations. [Statutory Authority: RCW 19.27.031 and 19.27.074, 98-02-055, § 51-46-0300, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-

- 114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0301 Materials—Standards and alterations. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0301, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0310 Workmanship. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0310, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0311 Prohibited fittings and practices. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0311, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0313 Protection of piping, materials, and structures. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0313, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0314 Hangers and supports. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0314, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0316 Joints and connections. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0316, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0392 Table 3-2 Hangers and supports. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0392, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0400 Chapter 4—Plumbing fixtures and fixture fittings. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0400, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0402 Water-conserving fixtures and fittings. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0402, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0412 Floor drains and shower stalls. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0412, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0413 Minimum number of required fixtures. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0413, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0500 Chapter 5—Water heaters. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0500, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0501 General. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0501, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0502 Definitions. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0502, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0505 Gas-fired water heater approval requirements. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0505, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0507 Combustion air. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0507, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0509 Prohibited locations. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0509, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0512 Venting of water heaters. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0512, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0513 Limitations. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0513, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0514 Vent connectors. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0514, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0515 Location and support of venting system. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0515, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0516 Length pitch and clearance. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0516, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0517 Vent termination. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0517, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0518 Area of venting system. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0518, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0519 Multiple appliance venting. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0519, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0520 Existing venting system. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0520, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0521 Draft hoods. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0521, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0522 Gas venting into existing masonry chimneys. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0522, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0523 Installation. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0523, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0524 Mechanical draft systems. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0524, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0525 Venting through ventilating hoods and exhaust systems. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0525, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0600 Water supply and distribution. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0600, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-0603 Cross-connection control. [Statutory Authority: RCW 19.27.031, 19.27.074. 01-02-097, § 51-46-0603, filed 1/3/01, effective 7/1/01; 98-02-055, § 51-46-0603, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.

51-46-0604	Materials. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0604, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	
51-46-0608	Water pressure, pressure regulators, pressure relief valves, and vacuum relief valves. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0608, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1003
51-46-0609	Installation, testing, unions, and location. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0609, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1012
51-46-0610	Size of potable water piping. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0610, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1300
51-46-0700	Sanitary drainage. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0700, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1301
51-46-0701	Materials. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0701, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1302
51-46-0704	Fixture connections (drainage). [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0704, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1303
51-46-0710	Drainage of fixtures located below the next upstream manhole or below the main sewer level. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0710, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1304
51-46-0713	Building sewers. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0713, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1305
51-46-0793	Table 7-3 Drainage fixture unit values. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0793, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1400
51-46-0800	Indirect wastes. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0800, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1401
51-46-0810	Steam and hot water drainage condensers and sumps. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0810, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-1491
51-46-0814	Refrigeration wastes. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0814, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-97120
51-46-0815	Air-conditioning equipment. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0815, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-97121
51-46-0900	Vents. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0900, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-97122
51-46-0903	Materials. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-0903, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-97123
51-46-1000	Traps and interceptors. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-1000, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.	51-46-97124

- 51-46-97125 Roof drains. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-97125, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-97126 Size of leaders, conductors, and storm drains. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-97126, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-97127 Values for continuous flow. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-97127, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-97128 Testing. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-97128, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-46-97129 Tables M-1 through M-3. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-46-97129, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.

WAC 51-46-001 through 51-46-97129 Repealed. See Disposition Table at beginning of this chapter.

Chapter 51-47 WAC

STATE BUILDING CODE ADOPTION OF APPENDIX I OF THE 1997 EDITION OF THE UNIFORM PLUMBING CODE

WAC

- 51-47-001 through 51-47-008 Repealed.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

- 51-47-001 Authority. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-47-001, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-47-002 Purpose. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-47-002, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-47-003 Uniform Plumbing Code Standards. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-47-003, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-47-007 Exceptions. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-47-007, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.
- 51-47-008 Implementation. [Statutory Authority: RCW 19.27.031 and 19.27.074. 98-02-055, § 51-47-008, filed 1/6/98, effective 7/1/98.] Repealed by 02-01-114, filed 12/18/01, effective 7/1/02. Statutory Authority: RCW 19.27.031, 19.27.074.

WAC 51-47-001 through 51-47-008 Repealed. See Disposition Table at beginning of this chapter.

Chapter 51-56 WAC

STATE BUILDING CODE ADOPTION AND AMENDMENT OF THE 2000 EDITION OF THE UNIFORM PLUMBING CODE

WAC

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| 51-56-001 | Authority. |
| 51-56-002 | Purpose. |
| 51-56-003 | Uniform Plumbing Code. |
| 51-56-007 | Exceptions. |
| 51-56-008 | Implementation. |
| 51-56-0100 | Chapter 1—Administration. |
| 51-56-0200 | Chapter 2—Definitions. |
| 51-56-0300 | Chapter 3—General regulations. |
| 51-56-0400 | Chapter 4—Plumbing fixtures and fixture fittings. |
| 51-56-0500 | Chapter 5—Water heaters. |
| 51-56-0600 | Chapter 6—Water supply and distribution. |
| 51-56-0700 | Chapter 7—Sanitary drainage. |
| 51-56-0800 | Chapter 8—Indirect wastes. |
| 51-56-0900 | Chapter 9—Vents. |
| 51-56-1300 | Chapter 13—Health care facilities and medical gas and vacuum systems. |
| 51-56-1400 | Chapter 14—Referenced standards. |
| 51-56-201300 | Appendix M—Storm drainage. |

WAC 51-56-001 Authority. These rules are adopted under the authority of chapter 19.27 RCW.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-001, filed 12/18/01, effective 7/1/02.]

WAC 51-56-002 Purpose. The purpose of these rules is to implement the provisions of chapter 19.27 RCW, which provides that the state building code council shall maintain the State Building Code in a status which is consistent with the purpose as set forth in RCW 19.27.020. In maintaining the codes, the council shall regularly review updated versions of the codes adopted under the act, and other pertinent information, and shall amend the codes as deemed appropriate by the council.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-002, filed 12/18/01, effective 7/1/02.]

WAC 51-56-003 Uniform Plumbing Code. The 2000 edition of the Uniform Plumbing Code, published by the International Association of Plumbing and Mechanical Officials, is hereby adopted by reference with the following additions, deletions and exceptions: Provided that Chapters 11, 12 and 15 of this code are not adopted. Provided further, that those requirements of the Uniform Plumbing Code relating to venting and combustion air of fuel fired appliances as found in Chapter 5 and those portions of the code addressing building sewers are not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-003, filed 12/18/01, effective 7/1/02.]

WAC 51-56-007 Exceptions. The exceptions and amendments to the uniform codes contained in the provisions of chapter 19.27 RCW shall apply in cases of conflict with any of the provisions of these rules.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-007, filed 12/18/01, effective 7/1/02.]

WAC 51-56-008 Implementation. The Uniform Plumbing Code adopted by chapter 51-56 WAC shall become effective in all counties and cities of this state on July

1, 2002, unless local government residential amendments have been approved by the state building code council.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-008, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0100 Chapter 1—Administration.

101.4.1.4 Conflict Between Codes. Delete paragraph.

102.4 Appeals. All persons shall have the right to appeal a decision of the administrative authority. The jurisdiction shall have a board of appeals to hear and rule on Plumbing Code appeals. Members of the board shall be appointed by the jurisdiction. Decisions by the board shall be reported to the jurisdiction and administered by the administrative authority.

103.1.3 Certification. State rules and regulations concerning certification shall apply.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-0100, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0200 Chapter 2—Definitions.

205.0 Certified Backflow Assembly Tester - A person certified by the Washington state department of health under chapter 246-292 WAC to inspect (for correct installation and approval status) and test (for proper operation) approved backflow assemblies.

208.0 Flammable Vapor or Fumes is the concentration of flammable constituents in air that exceeds 10 percent of its lower flammability limit (LFL).

218.0 Plumbing System – Includes all potable water building supply and distribution pipes, all plumbing fixtures and traps, all drainage and vent pipe(s), and all building drains including their respective joints and connection, devices, receptors, and appurtenances within the property lines of the premises and shall include potable water piping, potable water treating or using equipment, medical gas and medical vacuum systems, and water heaters: Provided, That no certification shall be required for the installation of a plumbing system within the property lines and outside a building.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-0200, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0300 Chapter 3—General regulations.

301.1.1 Approvals. Unless otherwise provided for in this code, all materials, fixtures or devices used or entering into the construction of plumbing systems, or parts thereof, shall be submitted to the administrative authority for approval and shall conform to approved nationally recognized standards, and shall be free from defects. All pipe, fittings, traps, fixtures, material and devices used in a plumbing system shall be listed or labeled by a listing agency or shall be approved by the administrative authority.

301.1.3 Standards. Standards listed or referred to in this chapter and Table 14-1 cover materials that conform to the requirements of this code, when used in accordance with the limitations imposed in this or other chapters thereof and their

listing. Where a standard covers materials of various grades, weights, quality, or configurations, there may be only a portion of the listed standard which is applicable. Design and materials for special conditions or materials not provided for herein are allowed to be used only by special permission of the administrative authority after the administrative authority has been satisfied as to their adequacy in accordance with Section 301.2.

311.4 Except as hereinafter provided in Sections 908.0, 909.0, 910.0, and Appendix L, Section L 6.0, no vent pipe shall be used as a soil or waste pipe, nor shall any soil or waste pipe be used as a vent.

313.6 No water, soil, or waste pipe shall be installed or permitted outside of a building 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 R-3.

313.7 All pipe penetrating floor/ceiling assemblies and fire-resistance rated walls or partitions shall be protected in accordance with the requirements of the building code.

316.1.6 Solvent Cement Plastic Pipe Joints. Plastic pipe and fittings designed to be joined by solvent cementing shall comply with this code and the manufacturer's installation instructions.

ABS pipe and fittings shall be cleaned and then joined with listed solvent cement(s).

CPVC and PVC pipe and fittings shall be cleaned and joined with listed primer(s) and solvent cement(s).

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-0300, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0400 Chapter 4—Plumbing fixtures and fixture fittings.

402.0 Water-Conserving Fixtures and Fittings.

402.1 The purpose of this section shall be to implement water conservation performance standards in accordance with RCW 19.27.170.

402.2 Application. This section shall apply to all new construction and all remodeling involving replacement of plumbing fixtures and fittings in all residential, hotel, motel, school, industrial, commercial use, or other occupancies determined by the council to use significant quantities of water. Plumbing fixtures, fittings and appurtenances shall conform to the standards specified in this section and shall be provided with an adequate supply of potable water to flush and keep the fixtures in a clean and sanitary condition without danger of backflow or cross-connection.

402.3 Water Efficiency Standards.

402.3.1 Standards for Vitreous China Plumbing Fixtures.

402.3.1.1 The following standards shall be adopted as plumbing materials, performance standards, and labeling standards

for water closets and urinals. Water closets and urinals shall meet either the ANSI/ASME standards or the CSA standard.

ANSI/ASME A112.19.2M-1998	Vitreous China Plumbing Fixtures
ANSI/ASME A112.19.6-1995	Hydraulic Requirements for Water Closets and Urinals
CSA B45	CSA Standards on Plumbing Fixtures

402.3.1.2 The maximum water use allowed in gallons per flush (gpf) or liters per flush (lpf) for any of the following water closets shall be the following:

Tank-type toilets	1.6 gpf/6.0 lpf
Flushometer-valve toilets	1.6 gpf/6.0 lpf
Flushometer-tank toilets	1.6 gpf/6.0 lpf
Electromechanical hydraulic toilets	1.6 gpf/6.0 lpf

EXCEPTIONS:

1. Water closets located in day care centers, intended for use by young children may have a maximum water use of 3.5 gallons per flush or 13.25 liters per flush.
2. Water closets with bed pan washers may have a maximum water use of 3.5 gallons per flush or 13.25 liters per flush.
3. Blow out bowls, as defined in ANSI/ASME A112.19.2M, Section 5.1.2.3 may have a maximum water use of 3.5 gallons per flush or 13.25 liters per flush.

402.3.1.3 The maximum water use allowed for any urinal shall be 1.0 gallons per flush or 3.78 liters per flush.

402.3.1.4 No urinal or water closet that operates on a continuous flow or continuous flush basis shall be permitted.

402.3.1.5 This section does not apply to fixtures installed before the effective date of this Section, that are removed and relocated to another room or area of the same building after the effective date of this Section.

402.3.2 Standards for Plumbing Fixture Fittings.

402.3.2.1 The following standards are adopted as plumbing material, performance requirements, and labeling standards for plumbing fixture fittings. Faucets, aerators, and shower heads shall meet either the ANSI/ASME standard or the CSA standard.

ANSI/ASME A112.18.1M-1996	Plumbing Fixture Fittings
CSA B125	Plumbing Fittings

402.3.2.2 The maximum water use allowed for any shower head is 2.5 gallons per minute or 9.5 liters per minute.

EXCEPTION: Emergency use showers shall be exempt from the maximum water usage rates.

402.3.2.3 The maximum water use allowed in gallons per minute (gpm) or liters per minute (lpm) for any of the following faucets and replacement aerators is the following:

Lavatory faucets	2.5 gpm/9.5 lpm
Kitchen faucets	2.5 gpm/9.5 lpm
Replacement aerators	2.5 gpm/9.5 lpm
Public lavatory faucets other than metering	0.5 gpm/1.9 lpm

402.4 Metering Valves. Lavatory faucets located in restrooms intended for use by the general public shall be equipped with a metering valve designed to close by spring or water pressure when left unattended (self-closing).

EXCEPTIONS:

1. Where designed and installed for use by persons with a disability.
2. Where installed in day care centers, for use primarily by children under 6 years of age.

402.5 Implementation.

402.5.1 The standards for water efficiency and labeling contained within Section 402.3 shall be in effect as of July 1, 1993, as provided in RCW 19.27.170 and amended July 1, 1998.

402.5.2 No individual, public or private corporation, firm, political subdivision, government agency, or other legal entity, may, for purposes of use in the state of Washington, distribute, sell, offer for sale, import, install, or approve for installation any plumbing fixtures or fittings unless the fixtures or fittings meet the standards as provided for in this Section.

Sections 402.6 through 402.9 are not adopted.

412.2 Location of Floor Drains. Floor drains shall be installed in the following areas:

412.2.1 Toilet rooms 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 toward the floor drains.

412.2.2 Laundry rooms in commercial buildings and common laundry facilities in multi-family dwelling buildings.

413.0 Minimum Number of Required Fixtures. For minimum number of plumbing fixtures required, see Building Code Chapter 29 and Table 29-A.

Sections 413.1 through 413.7 and Table 4-1 are not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074, 02-01-114, § 51-56-0400, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0500 Chapter 5—Water heaters.

501.0 General. The regulations of this chapter shall govern the construction, location, and installation of fuel burning and other water heaters heating potable water. The minimum capacity for water heaters shall be in accordance with the first hour rating listed in Table 5-1. See the Mechanical Code for combustion air and installation of all vents and their connectors. All design, construction, and workmanship shall be in conformity with accepted engineering practices, manufacturer's installation instructions, and applicable standards and shall be of such character as to secure the results sought to be obtained by this Code. No water heater shall be hereinafter installed which does not comply in all respects with the type and model of each size thereof approved by the administrative authority. A list of accepted gas equipment standards is included in Table 14-1.

Water heaters used for space heating only are prohibited.

TABLE 5-1^{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	42	54	54	54	67	67	80	67	80	80	80

Notes: ¹The first hour rating is found on the "Energy Guide" label.

²Nonstorage and solar water heaters shall be sized to meet the appropriate first hour rating as shown in the table.

³For replacement water heaters, see Section 101.4.1.1.1.

502.1 Chimney – Delete definition.

502.2 Chimney Connector – Delete definition.

502.5 Direct Vent Appliance – Delete definition.

502.7 Unusually Tight Construction – Delete definition.

502.8 Vent – Delete definition.

502.9 Vent Collar – Delete definition

502.10 Vent Connector – Delete definition.

502.11 Venting System – Delete definition.

502.12 Venting Systems-Types – Delete definition.

504.1 Inspection of Chimneys or Vents. Delete paragraph.

505.0 Gas-Fired Water Heater Approval Requirements.

505.1 Gas fired water heaters shall conform to approved recognized applicable standards or to other standards acceptable to the administrative authority. Each such water heater shall bear the label of an approved testing agency, certifying and attesting that such equipment has been tested and inspected and meets the requirements of applicable standards.

505.2 Except when reconditioned by the manufacturer or the manufacturer's approved agent in accordance with its original approval requirements and reinstalled at its original location, each reconditioned water heater shall be tested for safety and conformity to approved standards, and shall bear the label of an approved testing agency certifying and attesting that such equipment has been tested and inspected and meets the requirements of applicable standards. Such label shall also state clearly that the water heater has been reconditioned, and shall give the name and address of the reconditioner. Every person applying for a permit to install a used or reconditioned water heater shall clearly state on the application for permit that such equipment is used or reconditioned.

505.3 Gas storage-type water heaters shall be provided with, in addition to the primary temperature controls, an over-temperature safety protection device constructed, listed, and installed in accordance with nationally recognized applicable standards for such devices and a combination temperature and pressure relief valve.

506.2 All storage-type water heaters deriving heat from fuels or types of energy other than gas, shall be provided with, in addition to the primary temperature controls, an over-temperature safety protection device constructed, listed, and installed in accordance with nationally recognized applicable

standards for such devices and a combination temperature and pressure relief valve.

507.0 Combustion Air. For issues relating to combustion air, see the Mechanical Code.

Sections 507.1 through 507.5 are not adopted.

509.0 Prohibited Locations. Water heaters which depend on the combustion of fuel for heat shall not be installed in a room used or designed to be used for sleeping purposes, bathroom, clothes closets or in a closet or other confined space opening into a bath or bedroom.

EXCEPTIONS:

1. Direct vent water heaters.
2. Water heaters installed in a closet that has a weather-stripped solid door with an approved door closing device, and designed exclusively for the water heater and where all air for combustion and ventilation is supplied from the outdoors.
3. Water heaters of the automatic storage type installed as a replacement in a bathroom, when specifically approved, properly vented and supplied with adequate combustion air.

Where not prohibited by other regulations, water heaters may be located under a stairway or landing.

512.0 Venting of Water Heaters Delete entire section.

513.0 Limitations. Delete entire section.

514.0 Vent Connectors. Delete entire section.

515.0 Location and Support of Venting System. Delete entire section.

516.0 Length Pitch and Clearance. Delete entire section.

517.0 Vent Termination. Delete entire section.

518.0 Area of Venting System. Delete entire section.

519.0 Multiple Appliance Venting. Delete entire section.

520.0 Existing Venting System. Delete entire section.

521.0 Draft Hoods. Delete entire section.

522.0 Gas Venting into Existing Masonry Chimneys. Delete entire section.

523.0 Chimney Connectors. Delete entire section.

524.0 Mechanical Draft Systems. Delete entire section.

525.0 Venting Through Ventilating Hoods and Exhaust Systems. Delete entire section.

[Statutory Authority: RCW 19.27.031, 19.27.074, 02-01-114, § 51-56-0500, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0600 Chapter 6—Water supply and distribution.

603.0 Cross-Connection Control. Cross-connection control shall be provided in accordance with the provisions of this

chapter. Devices or assemblies for protection of the public water system must be models approved by the department of health under WAC 246-290-490. The administrative authority shall coordinate with the local water purveyor where applicable in all matters concerning cross-connection control within the property lines of the premises.

No person shall install any water operated equipment or mechanism, or use any water treating chemical or substance, if it is found that such equipment, mechanism, chemical or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when equipped with an approved backflow prevention device or assembly.

603.3.3 For devices and assemblies other than those regulated by the Washington department of health in conjunction with the local water purveyor for the protection of public water systems, the administrative authority shall ensure that the premise owner or responsible person shall have the backflow prevention assembly tested by a Washington state department of health certified backflow assembly tester:

- (1) At the time of installation, repair or relocation; and
- (2) At least on an annual schedule thereafter, unless more frequent testing is required by the administrative authority.

603.4.6.1 Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following devices:

- (1) Atmospheric vacuum breaker.
- (2) Pressure vacuum breaker.
- (3) Reduced pressure backflow preventer.
- (4) A double check valve may be allowed when approved by the water purveyor and the administrative authority.
- (5) A spill proof pressure vacuum breaker may be allowed when approved by the water purveyor and the administrative authority.

603.4.13 Potable Water Supply to Carbonators shall be protected by a listed reduced pressure principle backflow preventer as approved by the administrative authority for the specific use.

603.4.18.1 Except as provided under Sections 603.4.18.2 and 603.4.18.3, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one or two family residential flow-through or combination sprinkler systems piped in materials approved for potable water distribution systems, shall be protected from back-pressure and back-siphonage by one of the following testable devices:

1. Double check valve assembly.
2. Double check detector assembly.
3. Reduced pressure backflow preventer.
4. Reduced pressure detector assembly.

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall meet the requirements of the appropriate standard(s) referenced in Table 14-1.

604.1 Water distribution pipe, building supply water pipe and fittings shall be of brass, copper, cast iron, galvanized malleable iron, galvanized wrought iron, galvanized steel or other approved materials. Except as provided in Section 604.13, asbestos-cement, CPVC, PE, PVC, or PEX water pipe materials manufactured to recognized standards may be used for cold water distribution systems outside a building. CPVC, PEX water pipe, tubing, and fittings, manufactured to recognized standards may be used for hot and cold water distribution systems within a building. Other products not listed in this section are acceptable for their intended use, provided that such materials or distribution systems are listed and approved in accordance with nationally recognized standards. All materials used in the water supply system, except valves and similar devices shall be of like material, except where otherwise approved by the administrative authority.

604.13 Plastic water service piping may terminate within a building, provided the connection to the potable water distribution system shall be made as near as is practical to the point of entry and shall be accessible. Barbed insert fittings with hose clamps are prohibited as a transition fitting within the building.

608.5 Relief valves located inside a building shall be provided with a drain, not smaller than the relief valve outlet, of galvanized steel, hard drawn copper piping and fittings, CPVC, or listed relief valve drain tube with fittings which will not reduce the internal bore of the pipe or tubing (straight lengths as opposed to coils) and shall extend from the valve to the outside of the building with the end of the pipe not more than two (2) feet (610 mm) nor less than six (6) inches (152 mm) above the ground or the flood level of the area receiving the discharge and pointing downward. Such drains may terminate at other approved locations. No part of such drain pipe shall be trapped or subject to freezing. The terminal end of the drain pipe shall not be threaded.

EXCEPTION:

Replacement water heating equipment shall only be required to provide a drain pointing downward from the relief valve to extend between two feet (610 mm) and six inches (152 mm) from the floor. No additional floor drain need be provided.

610.4 Systems within the range of Table 6-5 may be sized from that table or by the method set forth in Section 610.5.

Listed parallel water distribution systems shall be installed in accordance with their listing.

[Statutory Authority: RCW 19.27.031, 19.27.074, 02-01-114, § 51-56-0600, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0700 Chapter 7—Sanitary drainage.

701.1.2 ABS and PVC DWV piping installations shall be installed in accordance with IS 5, IS 9, and Appendix M "Firstop Protection for DWV and Stormwater Application." 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, when tested in accordance with the Test for Surface-Burning Characteristics of the Building Materials (See the Building Code standards based on ASTM E-84 and ANSI/UL 723).

704.3 Delete entire section.

710.3 The minimum size of any pump or any discharge pipe from a sump having a water closet connected thereto shall be not less than two (2) inches (52 mm).

Sections 710.3.1 through 710.3.3 are not adopted.

CHAPTER 7, PART II—BUILDING SEWERS

Part II Building Sewers. Delete all of Part II (Sections 713 through 723, and Tables 7-7 and 7-8).

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-0700, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0800 Chapter 8—Indirect wastes.

810.4 Strainers. Every indirect waste interceptor receiving discharge containing particles that would clog the receptor drain shall have a readily removable dome strainer.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-0800, filed 12/18/01, effective 7/1/02.]

WAC 51-56-0900 Chapter 9—Vents.

903.1.2 ABS and PVC DWV piping installations shall be installed in accordance with IS 5, IS 9, and Appendix M "Firestop Protection for DWV and Stormwater Application." 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, when tested in accordance with the Test for Surface-Burning Characteristics of the Building Materials (see the Building Code standards based on ASTM E-84 and ANSI/UL 723).

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-0900, filed 12/18/01, effective 7/1/02.]

WAC 51-56-1300 Chapter 13—Health care facilities and medical gas and vacuum systems.

1302 Medical Gas and Vacuum Piping Systems.

The installation of medical gas and vacuum piping systems shall be in accordance with the requirements of this chapter and/or the appropriate standards adopted by the administrative authority, for additional standards see Table 14-1. The administrative authority shall require evidence of the competency of the installers.

Part II Medical Gas and Vacuum Systems

1309.0 Scope.

1309.1 The provisions herein shall apply to the design, installation, testing, and verification of medical gas, medical vacuum systems, and related permanent equipment for safe use in patient care hospitals, clinics, and other health care facilities.

1309.2 The purpose of this chapter is to provide minimum requirements for the design, installation and verification of medical gas, medical vacuum systems, and related permanent equipment

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1310.0 Definitions.

1310.1 Building Supply – The pipe from the source of supply to a building or structure.

1310.2 Critical Care Area – An area in a medical facility where special care is provided, including intensive care units, coronary care units, recovery rooms, and respiratory care units.

1310.3 Installer Performance Testing – Testing conducted by the installer or representative prior to system verification using oil-free, dry nitrogen as stated in Chapter 14.

1310.4 Manifold – A device for connecting outlets of one or more gas cylinders to the central piping system for that specific gas.

1310.5 Medical Air – Compressed air used in a medical facility.

1310.6 Medical Gas – Gases used in a medical facility, including oxygen, nitrous oxide, nitrogen, carbon dioxide, helium, medical air, and mixtures of these gases. Standards of purity apply.

1310.7 Medical Gas System – A system consisting of a central supply system (manifold, bulk, or compressors), including control equipment and piping extending to station outlets in the facility where medical gases may be required.

1310.8 Medical Vacuum System – A system consisting of central vacuum-producing equipment with vacuum switches and operating controls, shutoff valves, alarm warning systems, gauges, and a network of piping extending to and terminating with station inlets at locations where patient suction may be required. Includes surgical vacuum systems, waste anesthesia gas disposal (as scavenging systems), and bedside suction systems.

1310.9 Purge, Flow – The removal of oxygen from a system by oil-free dry nitrogen during brazing.

1310.10 Purge, System – The removal of nitrogen from a system with the medical gas required for that system.

1310.11 SCFM – Standard cubic feet per minute, the unit measure for a volume of gas at standard conditions (68 degrees F (20 degrees C) and 1 atmosphere of pressure).

1310.12 Special Hazard Area – An area, such as a kitchen or electrical switch gear room.

1310.13 Station Inlet – An inlet in a vacuum piping system at which the user makes connections and disconnections.

1310.14 Station Outlet – An outlet point in a medical gas piping system at which the user makes connections and disconnections.

1310.15 System Verification – Testing conducted by a qualified party other than the installer or material vendor after the installer performance testing and prior to the medical gas system being put into service.

1310.16 Use Point – A room or area within a room, where medical gases are dispensed to a patient for medical purposes.

1310.17 User Outlet – See station outlet.

1310.18 Valve, Isolation – A valve which isolates one piece of equipment from another.

1310.19 Valve, Riser – A valve at the base of a vertical riser, which isolates that riser.

1310.20 Valve, Service – A valve serving horizontal piping extending from a riser to a station outlet or inlet.

1310.21 Valve, Source – A single valve at the source which controls a number of units that make up the total source.

1310.22 Valve, Zone – A valve which controls the gas or vacuum to a particular area.

1311.3 The administrative authority shall require evidence of the competency of the installers.

1311.4 Delete paragraph.

1313.0 System Installation and Installer Performance Testing.

1313.1 Medical gas and medical vacuum systems shall be designed and installed in accordance with the requirements of this chapter and the installation requirements of this code, specifically Chapter 14 of this code.

1313.2 A report of completion of the installer performance testing which includes the specific items in Chapter 14 shall be furnished to the administrative authority prior to system verification.

1314.0 System Verification.

1314.1 Prior to any medical gas system being placed in service, each and every system shall be verified as described in Chapter 14. This verification shall be accomplished by an independent third party verification agency which is approved by the administrative authority.

1314.2 A report which includes at least the specific items in Chapter 14 shall be furnished to the administrative authority prior to final acceptance of the system.

Sections 1315 through 1331 are not adopted.

[Statutory Authority: RCW 19.27.031, 19.27.074, 02-01-114, § 51-56-1300, filed 12/18/01, effective 7/1/02.]

WAC 51-56-1400 Chapter 14—Referenced standards.

TABLE 14-1

Standards for Materials, Equipment, Joints and Connections

Where more than one standard has been listed for the same material or method, the relevant portions of all such standards shall apply.

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
AHAM DW-1-92	Household Electric Dishwashers	Appliances	
AHAM DW-2PR-86	Plumbing Requirements for Household Dishwashers	Appliances	
AHAM FWD-1-83	Food Waste Disposers	Appliances	
AHAM HLW-2 PR-86	Plumbing Requirements for Home Laundry Equipment Appliances		
ANSI A13.1-81(R93)	Scheme for the Identification of Piping Systems		
ANSI A21.10-93	Piping Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water and Other Liquids (same as AWWA C110)	Piping, Ferrous	
ANSI A21.11-90	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings (same as AWWA C111)	Piping, Ferrous	
ANSI A21.51-91	Ductile-Iron Pipe, Centrifugally Cast, for Water (same as AWWA C151)	Piping, Ferrous	
ANSI A21.53-88	Ductile-Iron Compact Fittings, 3 in. Through 24 in. (76 mm Through 610 mm) and 54 in. Through 64 in. (1,400 mm Through 1,600 mm), for Water Service (same as AWWA C153)	Piping, Ferrous	
ANSI A40.3-93	Stainless steel	Piping, Ferrous	
ANSI A106.6-70	Vitrified Clay Pipe (now CSA A60.1M1976(C1992))	Piping, Nonmetallic	
ANSI A106.6-77	Silver brazing joints for wrought and cast bronze solder joint fittings	Joints	
ANSI A112.14.1-75 (R90)	Backwater Valves	Valves	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
ANSI A112.19.5-79	Trim for Water-Closet Bowls, Tanks and Urinals	Fixtures	
ANSI A112.21.2M-83	Roof Drains	DWV Components	
ANSI A118.10-93	Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installations	Fixtures	
ANSI B2.1-90	Pipe Threads (Except Dryseal) (replaced by ASME B1.20.1-98)	Joints	
ANSI B125.1-84	Steel pipe (galvanized)	Piping, Ferrous	
ANSI B125.2-72	Steel pipe (galvanized)	Piping, Ferrous	
ANSI Z21.10.1a-94	Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 BTU per Hour or Less (22 kW)	Appliances	
ANSI Z21.10.1b-92	Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 BTU per Hour or Less (22 kW)	Appliances	
ANSI Z21.10.3-90	Gas Water Heaters - Volume III - Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters	Appliances	
ANSI Z21.10.3a-94	"	Appliances	
ANSI Z21.10.3b-92	"	Appliances	
ANSI Z21.12-90	Draft Hoods	Appliances	
ANSI Z21.13-91	Gas-Fired Low-Pressure Steam and Hot Water Boilers and Addenda	Appliances	
ANSI Z21.15-92	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves	Valves	
ANSI Z21.22a-90	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems	Valves	
ANSI Z21.24-93	Metal Connectors for Gas Appliances	Appliances	
ANSI Z21.41-89	Quick-Disconnect Devices for Use with Gas Fuel	Joints	
ANSI Z21.56-98	Gas Fired Pool Heaters	Swimming Pools and Spas	
ANSI Z21.69-1997•CSA 6.16-M97	Connectors for Moveable Gas Appliances	Appliances	
ANSI Z21.70-81	Earthquake Actuated Automatic Gas Shutoff Systems (withdrawn from ANSI June, 1992)	Valves	
ANSI Z21.80-1997•CSA 6.22-M97	Line Pressure Regulators	Fuel Gas	
ANSI Z21.81-1997•CSA 6.25-M97	Cylinder Connection Devices	Fuel Gas	
ANSI Z21.86•CSA 2.32-M98	Vented Gas-Fired Space Heating Appliances	Appliances	
ANSI Z34.1-93	Certification - Third Party Certification Programs for Products, Processes, and Services	Certification	
ANSI Z124.1-95	Plastic Bathtub Units	Fixtures	
ANSI Z124.2-95	Plastic Shower Receptors and Shower Stalls	Fixtures	
ANSI Z124.3-95	Plastic Lavatories	Fixtures	
ANSI Z124.4-96	Plastic Water Closet Bowls and Tanks	Fixtures	
ANSI Z124.5-97	Plastic Toilet (Water Closet) Seats	Fixtures	
ANSI Z124.6-97	Plastic Sinks	Fixtures	
ANSI Z124.7-97	Prefabricated Plastic Spa Shells	Fixtures	
ANSI Z124.8-90	Plastic Bathtub Liners	Fixtures	
ANSI Z124.9-94	Plastic Urinal Fixtures (Note 1)	Fixtures	
ANSI Z223.1-99	National Fuel Gas Code	Fuel Gas	
ARI 1010-84	Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking Water Coolers	Appliances	
ASHRAE 90.1-89	Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings	Miscellaneous	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
ASME A112.1.2-96 ASME A112.3.1-93	Air Gaps in Plumbing Systems Stainless Steel Drainage Systems for Sanitary Storm and Chemical Application, Above and Below Ground (Note 1)	Piping Piping, Ferrous	X
ASME A112.4.1-93 ASME A112.6.1M-97	Water Heater Relief Valve Drain Tubes Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use	Appliances Fixtures	
ASME A112.18.1M-96 ASME A112.18.6-99 ASME A112.18.3-96	Plumbing Fixture Fittings Flexible Water Connectors Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings (Note 8)	Valves Piping Valves	
ASME A112.19.1M-94	Enameled Cast Iron Plumbing Fixtures (Supplement 1-1998)	Fixtures	
ASME A112.19.2M-98 ASME A112.19.3M-87	Vitreous China Plumbing Fixtures Stainless Steel Plumbing Fixtures (Designed for Residential Use)	Fixtures Fixtures	
ASME A112.19.4M-94	Porcelain Enameled Formed Steel Plumbing Fixtures (Supplement 1-1998)	Fixtures	
ASME A112.19.6-95	Hydraulic Performance Requirements for Water Closets and Urinals	Fixtures	
ASME A112.19.7M-95 ASME A112.19.8M-87	Whirlpool Bathtub Appliances Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Whirlpool Bathtub Appliances	Fixtures Swimming Pools and Spas	
ASME A112.19.9M-91 ASME A112.21.1M-91 ASME A112.21.3M-85	Nonvitreous Ceramic Plumbing Fixtures Floor Drains (Note 1) Hydrants for Utility and Maintenance Use (Note 1)	Fixtures DWV Components Valves	
ASME A112.26.1M-84 ASME A112.36.2M-91 ASME B1.20.1-83 (R1992) ASME B1.20.3-76 (R82/91/98)	Water Hammer Arresters Cleanouts (Note 1) Pipe Threads, General Purpose (Inch) Dryseal Pipe Threads, Inch	Piping DWV Components Joints Joints	
ASME B16.1-89	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800	Piping, Ferrous	
ASME B16.3-92 ASME B16.4-92	Malleable-Iron Threaded Fittings Gray Iron Threaded Fittings (includes Revision Services)	Piping, Ferrous Piping, Ferrous	
ASME B16.5-88 ASME B16.12-91 ASME B16.15-85 (R1994)	Pipe Flanges and Flanged Fittings Iron Threaded Drainage Fittings (Note 1) Cast Bronze Threaded Fittings, Classes 125 and 250	Joints Piping, Ferrous Piping, Copper Alloy	
ASME B16.18-84	Cast Copper Alloy Solder Joint Pressure Fittings (Note 1)	Piping, Copper Alloy	
ASME B16.21-92 ASME B16.22-95	Nonmetallic Flat Gaskets for Pipe Flanges Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings Alloy	Joints Piping, Copper	
ASME B16.23-92	Cast Copper Alloy Solder Joint Drainage Fittings - DWV Alloy	Piping, Copper	
ASME B16.24-91	Cast Copper Alloy Pipe Flanges and Flanged Fittings Alloy	Piping, Copper	
ASME B16.26-88	Cast copper alloy fittings for flared copper tubes Alloy	Piping, Copper	
ASME B16.29-86	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV Alloy (Note 1)	Piping, Copper	

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ASME B16.32-92	Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems Alloy	Piping, Copper	
ASME B16.33-90	Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig.	Valves	
ASME B16.34-88	Valves – Flanged, Threaded and Welding End	Valves	
ASME B16.38-85	Large Metallic Valves for Gas Distribution (Manually Operated, NPS 2-1/2 to 12, 125 psig Maximum)	Valves	
ASME B16.39-86	Pipe Unions, Malleable Iron Threaded (Includes Revision (R1994) Services)	Piping, Ferrous	
ASME B16.47-90	Large Diameter Steel Flanges	Piping, Ferrous	
ASME B36.10M-85	Welded and Seamless Wrought Steel Pipe	Piping, Ferrous	
ASME Section IX	Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators	Certification	
ASSE 1001-90	Pipe Applied Atmospheric-Type Vacuum Breakers	Backflow Protection	
ASSE 1002-86	Water Closet Flush Tank Ballcocks	Backflow Protection	
ASSE 1003-95	Water Pressure Reducing Valves for Domestic Water Supply Systems	Valves	
ASSE 1004-90	Backflow Prevention Requirements for Commercial Dishwashing Machines	Backflow Protection	
ASSE 1006-89	Residential Use Dishwashers	Appliances	
ASSE 1007-92	Home Laundry Equipment	Appliances	
ASSE 1008-89	Household Food Waste Disposer Units	Appliances	
ASSE 1009-90	Commercial Food Waste Grinder Units	Appliances	
ASSE 1010-98	Performance Requirements for Water Hammer Arrestors	Piping	
ASSE 1011-95	Hose-Connection Vacuum Breakers	Backflow Protection	
ASSE 1013-93	Reduced Pressure Principle Backflow Preventers	Backflow Protection	
ASSE 1014-90	Hand-Held Showers	Fixtures	
ASSE 1015-93	Double Check Backflow Prevention Assembly	Backflow Protection	
ASSE 1016-96	Individual, Thermostatic Pressure Balancing and Thermostatic Control Valves for Individual Fixtures	Valves	
ASSE 1017-86	Thermostatic Mixing Valves, Self Actuated for Primary Domestic Use	Valves	
ASSE 1018-86	Trap Seal Primer Valves (water supply fed)	Valves	
ASSE 1019-95	Performance Requirements for Vacuum Breaker Wall Hydrant, Freeze Resistant Automatic Draining Type	Backflow Protection	
ASSE 1020-90	Pressure Vacuum Breaker Assembly	Backflow Protection	
ASSE 1021-77	Dishwasher Air Gaps for Domestic Dishwasher Applications	Backflow Protection	
ASSE 1023-79	Hot Water Dispensers Household Storage Type Electrical	Appliances	
ASSE 1025-78	Diverter for Plumbing Faucets with Hose Spray, Anti-Siphon Type, Residential Applications	Valves	
ASSE 1028-81	Automatic Flow Controllers	Valves	
ASSE 1032-80	Dual Check Valve Type Backflow Preventers for Carbonated Beverage Dispensers - Post Mix Types	Backflow Protection	X
ASSE 1034-81	Fixed Flow Restrictors	Piping	
ASSE 1035-95	Laboratory Faucet Backflow Preventer	Backflow Protection	
ASSE 1037-90	Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures	Backflow Protection	
ASSE 1052-94	Hose Connection Backflow Preventers	Backflow Protection	
ASSE 1055-97	Chemical Dispensing Systems	Backflow Protection	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
ASSE 1056-95 ASSE 1062-97	Back Siphonage Backflow Vacuum Breakers Temperature Actuated, Flow Reduction Valves for Individual Fixture Fittings	Backflow Protection Valves	
ASSE 1066-97	Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings (Note 9)	Valves	
ASSE 6000-98	Medical Gas Systems Installers, Inspectors and Verifiers	Certification	
ASTM A 47-90 (R95) ASTM A 53-96 (97)	Ferritic Malleable Iron Castings Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded, and Seamless	Piping, Ferrous Piping, Ferrous	
ASTM A 74-98 ASTM A 120-84 [D]	Cast Iron Soil Pipe and Fittings (Note 1) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, (Galvanized) Welded, and Seamless for Ordinary Uses (replaced by A 53)	Piping, Ferrous Piping, Ferrous	
ASTM A 126-95	Gray Iron Castings for Valves, Flanges, and Pipe Fittings	Piping, Ferrous	
ASTM A 197-87 (R-92) ASTM A 312-93	Cupola Malleable Iron [Metric] Seamless and Welded Austenitic Stainless Steel Pipes	Piping, Ferrous Piping, Ferrous	
ASTM A 377-95 ASTM A 518-92 ^{e1}	Ductile-Iron Pressure Pipe Corrosion-Resistant High-Silicon Iron Castings [Metric]	Piping, Ferrous Piping, Ferrous	
ASTM A 536-84(R-93) ASTM A 653-96	Ductile Iron Castings Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot- Dip Process	Piping, Ferrous Piping, Ferrous	
ASTM A 733-93	Welded and Seamless Carbon Steel and Austen- itic Stainless Steel Pipe Nipples	Piping, Ferrous	
ASTM A 861-94 ^{e1} ASTM B 29-92	High-Silicon Iron Pipe and Fittings (Note 1) Pig Lead	Piping, Ferrous Joints	
ASTM B 32-96 ASTM B 42-96	Solder Metal (Note 4) Seamless Copper Pipe, Standards Sizes	Joints Piping, Copper Alloy	
ASTM B 43-96	Seamless Red Brass Pipe, Standards Sizes	Piping, Copper Alloy	
ASTM B 75-95a	Seamless Copper Tube	Piping, Copper Alloy	
ASTM B 88-96	Seamless Copper Water Tube	Piping, Copper Alloy	
ASTM B 135-96	Seamless Brass Tube	Piping, Copper Alloy	
ASTM B 152-97 ASTM B 251-97	Copper Sheet, Strip, Plate, and Rolled Bar General Requirements for Wrought Seamless Copper Copper-Alloy Tube	Miscellaneous Piping, Copper Alloy	
ASTM B 280-95a	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	Piping, Copper Alloy	
ASTM B 302-97	Threadless Copper Pipe	Piping, Copper Alloy	
ASTM B 306-96	Copper Drainage Tube (DWV)	Piping, Copper Alloy	
ASTM B 370-92 ^{e1} ASTM B 447-97	Copper Sheet and Strip for Building Construction Welded Copper Tube	Miscellaneous Piping, Copper Alloy	
ASTM B 584-96	Copper Alloy Sand Casting for General Applica- tions (Note 5)	Piping, Copper Alloy	
ASTM B 587-96	Welded Brass Tube	Piping, Copper Alloy	

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ASTM B 641-93	Seamless and Welded Copper Distribution Tube (Type D)	Piping, Copper Alloy	
ASTM B 642-88 [D]	Welded Copper Alloy UNS C21000 Water Tube (discontinued 1994)	Piping, Copper Alloy	
ASTM B 687-96	Brass, Copper, and Chromium-Plated Pipe Nipples	Piping, Copper Alloy	
ASTM B 716-93 [D]	Welded Copper Water Tube (discontinued 1994)	Piping, Copper Alloy	
ASTM B 813-93	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube	Joints	
ASTM B 819-95	Seamless Copper Tube for Medical Gas Systems	Piping, Copper Alloy	
ASTM B 828-92 ^{e1}	Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings	Joints	
ASTM C 14-95	Concrete Sewer, Storm Drain and Culvert Pipe	Piping, Nonmetallic	
ASTM C 296-93	Asbestos-Cement Pressure Pipe	Piping, Nonmetallic	
ASTM C 412-94	Concrete Drain Tile	Piping, Nonmetallic	
ASTM C 425-96	Compression Joints for Vitrified Clay Pipe and Fittings	Joints	
ASTM C 428-92	Asbestos-Cement Nonpressure Sewer Pipe (Notes 6 & 7)	Piping, Nonmetallic	
ASTM C 443-94	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets	Joints	
ASTM C 478-96	Precast Reinforced Concrete Manholes Sections	Miscellaneous	
ASTM C 564-95a	Rubber Gaskets for Cast Iron Soil Pipe and Fittings (Note 1)	Joints	
ASTM C 700-96	Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	Piping, Nonmetallic	
ASTM C 1053-90 (R95)	Borosilicate Glass Pipe and Fittings for Drain, Waste and Vent (DWV) Applications (Note 1)	Piping, Nonmetallic	
ASTM C 1173-95	Flexible Transition Couplings for Underground Piping Systems	Joints	
ASTM C 1277-94	Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings	Piping, Ferrous	
ASTM D 396-97	Specification for Fuel Oil	Miscellaneous	
ASTM D 1527-96a	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Sch. 40 and 80	Piping, Plastic	
ASTM D 1785-96a ^{e1}	Poly (Vinyl Chloride) (PVC) Plastic Pipe Sch. 40, 80 and 120	Piping, Plastic	
ASTM D 1869-95	Rubber O-rings for Asbestos-Cement Pipe	Joints	
ASTM D 2104-95	Polyethylene (PE) Plastic Pipe, Sch. 40	Piping, Plastic	
ASTM D 2146-82 [D]	Polypropylene Plastic Molding and Extrusion Materials (replaced by ASTM D 4101)	Piping, Plastic	
ASTM D 2235-96a	Solvent cement for Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe and fittings	Joints	
ASTM D 2239-96a	Polyethylene (PE) Plastic Pipe, (SDR-PR) Based on Controlled Inside Diameter	Piping, Plastic	
ASTM D 2241-96a	Poly(Vinyl Chloride) (PVC) Pressure-Rated pipe (SDR Series)	Piping, Plastic	
ASTM D 2282-96a	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)	Piping, Plastic	
ASTM D 2321-89 (R95)	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications	Piping, Plastic	
ASTM D 2447-95	Polyethylene (PE) Plastic Pipe, Sch. 40 and 80 Based on Controlled Outside Diameter	Piping, Plastic	
ASTM D 2464-96a	Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Sch. 80 (Note 1)	Piping, Plastic	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
ASTM D 2465-73[D]	Threaded Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80 (discontinued 1986)	Piping, Plastic	
ASTM D 2466-96a	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Sch. 40 (Note 1)	Piping, Plastic	
ASTM D 2467-96a	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Sch. 80 (Note 1)	Piping, Plastic	
ASTM D 2468-96a	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings (Sch. 40)	Piping, Plastic	
ASTM D 2469-76[D]	Socket-Type Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80 (discontinued 1986)	Piping, Plastic	
ASTM D 2513-96a	Thermoplastic Gas Pressure Pipe Tubing, and Fittings (Note 1)	Piping, Plastic	
ASTM D 2564-96a	Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems	Joints	
ASTM D 2609-96a	Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe (Note 1)	Piping, Plastic	
ASTM D 2657-96	Practice for Heating Fusion Joining of Polyolefin Pipe and Fittings	Joints	
ASTM D 2661-96	Acrylonitrile-Butadiene-Styrene (ABS) Sch. 40 Plastic Drain, Waste and Vent Pipe and Fittings (Note 1)	Piping, Plastic	
ASTM D 2665-97a	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings	Piping, Plastic	
ASTM D 2672-96a	Joints for IPS PVC Pipe Using Solvent Cement	Joints	
ASTM D 2680-95a	Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping	Piping, Plastic	
ASTM D 2729-96	Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (Note 1)	Piping, Plastic	
ASTM D 2737-96a	Polyethylene (PE) Plastic Tubing	Piping, Plastic	
ASTM D 2740-89 e1 [D]	Poly (Vinyl Chloride) (PVC) Plastic Tubing (discontinued 1991)	Piping, Plastic	
ASTM D 2751-96	Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings (Note 1)	Piping, Plastic	
ASTM D 2846-96a	Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems	Piping, Plastic	
ASTM D 2855-96	Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings	Joints	
ASTM D 2996-95	Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) pipe	Piping, Plastic	
ASTM D 3033-85 [D]	Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (discontinued 1989)	Piping, Plastic	
ASTM D 3034-96	Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings	Piping, Plastic	
ASTM D 3036-73[D]	Poly (Vinyl Chloride) (PVC) Plastic Line Couplings (discontinued 1986)	Piping, Plastic	
ASTM D 3065-94	Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings	Piping, Plastic	
ASTM D 3122-95	Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings	Joints	
ASTM D 3139-96a	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals	Joints	
ASTM D 3140-90	Flaring Polyolefin Pipe and Tubing	Joints	
ASTM D 3212-96a	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals	Joints	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
ASTM D 3298-81 [D]	Perforated Styrene-Rubber (SR) Plastic Drain Pipe (discontinued 1989)	Piping, Plastic	
ASTM D 3311-94	Drain, Waste, and Vent (DWV) Plastic Fittings Patterns (Note 1)	Piping, Plastic	
ASTM D 3965-94	Rigid Acrylonitrile-Butadiene-Styrene (ABS) Compounds for Pipe and Fittings	Piping, Plastic	
ASTM D 4068-96 e1	Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane	Fixtures	
ASTM D 4101-96a	Propylene Plastic Injection and Extrusion Materials	Miscellaneous	
ASTM D 4551-96	Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane	Fixtures	
ASTM E 84-97a	Standard Test Method for Surface Burning Characteristics of Building Materials	Miscellaneous	
ASTM E 119-97	Standard Test Method for Fire Tests of Building Construction and Materials	Miscellaneous	
ASTM E 814-94b	Standard Test Method for Fire Tests of Through-Penetration Fire Stops	Miscellaneous	
ASTM F 402-93	Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings	Joints	
ASTM F 405-96	Corrugated polyethylene (PE) Tubing and Fittings	Piping, Plastic	
ASTM F 409-96a	Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings (Note 1)	Piping, Plastic	
ASTM F 437-96a	Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Sch. 80	Piping, Plastic	
ASTM F 438-96a	Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Sch. 40	Piping, Plastic	
ASTM F 439-96b	Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Sch. 80	Piping, Plastic	
ASTM F 441-96b	Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Sch. 40 and 80	Piping, Plastic	
ASTM F 442-96b	Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)	Piping, Plastic	
ASTM F 443-77 e1 [D]	Bell-End Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe, Schedule 40 (discontinued 1987)	Piping, Plastic	
ASTM F 480-95	Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR) Schedule 40 and Schedule 80	Piping, Plastic	
ASTM F 493-97	Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings	Joints	
ASTM F 628-96	Acrylonitrile-Butadiene-Styrene (ABS) Sch. 40 Plastic Drain, Waste and Vent Pipe with a Foam Core (Notes 1 & 3)	Piping, Plastic	
ASTM F 656-96a	Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings	Joints	
ASTM F 667-95	Large Diameter Corrugated Polyethylene Tubing and Fittings	Piping, Plastic	
ASTM F 789-95a	Type PS-46 and type PS-115 Poly(Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings (Note 1)	Piping, Plastic	
ASTM F 794-95a	Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter	Piping, Plastic	

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ASTM F 810-93	Smoothwall Polyethylene (PE) Pipe for Use in Drainage and Waste Disposal Absorption Fields	Piping, Plastic	X
ASTM F 845-95	Plastic Insert Fittings For Polybutylene (PB) Tubing	Piping, Plastic	
ASTM F 876-97 ASTM F 877-96a	Crosslinked Polyethylene (PEX) Tubing Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems	Piping, Plastic Piping, Plastic	
ASTM F 891-96	Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core	Piping, Plastic	X
ASTM F 949-96a	Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings	Piping, Plastic	
ASTM F 1216-93	Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube	Piping, Plastic	
ASTM F 1281-98	Crosslinked Polyethylene/ Aluminum/ Crosslinked Polyethylene (PEX-Al-PEX) Pressure Pipe	Piping, Plastic	X
ASTM F 1282-98	Polyethylene/ Aluminum/ Polyethylene (PE-Al-PE) Composite Pressure Pipe	Piping, Plastic	
ASTM F 1412-96	Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems	Piping, Plastic	
ASTM F 1673-95	Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems	Piping, Plastic	
ASTM F 1743-96	Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)	Piping, Plastic	
ASTM F 1807-97	Metal Insert Fittings w/ Copper Crimp Ring for SDR 9 Crosslinked Polyethylene (PEX) tubing	Piping, Plastic	
ASTM F 1866-98	Poly (Vinyl Chloride) PVC Schedule 40 Drainage and DWV Fabricated Fittings	Piping, Plastic	
ASTM F 1960-99	Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing	Piping, Plastic	
ASTM F 1961-99	Metal Cold Flare Compression Fittings with Disk Springs for Cross Linked Polyethylene (PEX) Tubing	Piping, Plastic	
ASTM F 1974-99	Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe	Piping, Plastic	
AWS A5.8-92	Filler Metals for Brazing and Braze Welding Joints AWS B2.2-91 Brazing Procedure and Performance Qualification	Certification	
AWS B2.2-91	Brazing Procedure and Performance Qualification	Certification	
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water and Other Liquids (same as ANSI A21.10-93)	Piping, Ferrous	
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings (same as ANSI A21.11-90)	Piping, Ferrous	
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast, for Water (same as ANSI A21.51-91)	Piping, Ferrous	
AWWA C153	Ductile-Iron Compact Fittings, 3 in. Through 24 in. (76 mm Through 610 mm) and 54 in. Through 64 in. (1,400 mm Through 1,600 mm), for Water Service (same as ANSI A21.53-88)	Piping, Ferrous	

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AWWA C203-91	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enameled and Tape - Hot Applied Piping AWWA C213-96 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines	Piping, Ferrous	X
AWWA C213-96	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines	Piping, Ferrous	
AWWA C215-94	Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines	Piping, Ferrous	
AWWA C400-93	Asbestos-Cement Distribution Pipe, 4 in. Through 16 in. (100 mm Through 400 mm) for Water Distribution Systems	Piping, Nonmetallic	
AWWA C500-93	Metal-Seated Gate Valves for Water Supply Service	Valves	
AWWA C504-88	Rubber-Seated Butterfly Valves	Valves	
AWWA C507-91	Ball Valves, 6 in. Through 48 in. (152 mm Through 1200 mm)	Valves	
AWWA C510-92	Double Check Valve Backflow-Prevention Assembly	Backflow Protection	
AWWA C511-92	Reduced-Pressure Principle Backflow-Prevention Assemblies	Backflow Protection	
AWWA C606-87	Grooved and Shouldered Joints	Joints	
AWWA C900-89	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution	Piping, Plastic	
AWWA C901-88	Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. (13 mm) Through 3 in. (76 mm), for Water	Piping, Plastic	
AWWA C902-88	Polybutylene (PB) Pipe, Tubing, and Fittings, 1/2 in. Through 3 in., for Water	Piping, Plastic	
CABO A117.1-92	Specifications to Make Buildings and Facilities Accessible and Usable	Miscellaneous	
CISPI 301-97	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications (Note 1)	Piping, Ferrous	
CISPI HSN-85	Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings	Joints	
CISPI 310-97	Couplings for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications	Joints	
FS A-A-51145C	Flux, Soldering, Nonelectronic, Paste and Liquid	Joints	
FS K65.59-71	Acrylonitrile-Butadiene-Styrene (ABS) sewer pipe and fittings	Piping, Plastic	
FS M265-811	Acrylonitrile-Butadiene-Styrene (ABS) Sch. 40 plastic drain, waste and vent pipe and fittings	Piping, Plastic	
FS O-F-499D-85	Flux brazing	Joints	
FS O-F-506C-72 (D)	Flux, soldering	Joints	
FS OO-L-201 f-70	Shower pans-sheet lead, grade B, 4 lb. min.	Miscellaneous	
FS QQ-R-571C-69 [D]	Copper and nickel alloys (rods)	Miscellaneous	
FS TT-S-1732-71	Seal compound pipe joint and thread	Joints	
FS WW-P 325B-76	Lead pipe and bends	Piping	
FS WW-P-521F-77	Copper alloy (bronze) unions	Piping, Copper Alloy	
FS WW-P-541-E-Gen.1980	Plumbing fixtures, general specification	Fixtures	
FS WW-U-516A-74(b)	Copper alloy (bronze) unions	Piping, Copper Alloy	
FS WW-V-54d	Valve, Gate, Bronze (125, 150 and 200 Pound, Screwed Flange, Solder-End, for Land Use)	Valves	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
FS WW-V 58b	Valves, Gate, Cast Iron; 125 and 250-Pound, Screwed and Flanged (for Land Use)	Valves	
IAPMO IS 1-91 e1	Nonmetallic Building Sewers	Piping, Nonmetallic	
IAPMO IS 2-90	Tile-Lined Roman Bathtubs	Fixtures	
IAPMO IS 3-93 e1	Copper Plumbing Tube, Pipe and Fittings	Piping, Copper Alloy	
IAPMO IS 4-96	Tile-Lined Shower Receptors (and Replacements)	Fixtures	
IAPMO IS 5-92 e1	ABS Building Drain, Waste, and Vent Pipe and Fittings	Piping, Plastic	
IAPMO IS 6-95	Hubless Cast Iron Sanitary and Rainwater Systems	Piping, Ferrous	
IAPMO IS 7-90 e1	Polyethylene (PE) cold Water Building Supply	Piping, Plastic	
IAPMO IS 8-95 e1	PVC Cold Water Building Supply and Yard Piping	Piping, Plastic	
IAPMO IS 9-95 e1	PVC Building Drain, Waste and Vent Pipe Fittings	Piping, Plastic	
IAPMO IS 11-87 e1	ABS Sewer Pipe and Fittings	Piping, Plastic	
IAPMO IS 12-93 e1	Polyethylene (PE) for Gas Yard Piping	Piping, Plastic	
IAPMO IS 13-91 e1	Protectively Coated	Pipe Piping	
IAPMO IS 15-82	Asbestos Cement Pressure Pipe for Water Service and Yard Piping	Piping, Nonmetallic	
IAPMO IS 16-84	Low Pressure Air Test for Building Sewers	Piping	
IAPMO IS 18-85 e1	Extra Strength Vitrified Clay Pipe in Building Drains	Piping, Nonmetallic	
IAPMO IS 20-98	CPVC Solvent Cemented Hot and Cold Water Distribution Systems	Piping, Plastic	
IAPMO IS 21-89 e1	Welded Copper and Copper Alloy Water Tube	Piping, Copper Alloy	
IAPMO IS 26-99	Trenchless Polyethylene (PE) Pipe for Sewer Laterals	Piping, Plastic	
IAPMO PS 1-99	Prefabricated Septic Tanks	DWV Components	
IAPMO PS 2-89	Cast Brass and Tubing P-Traps	Piping, Copper Alloy	
IAPMO PS 4-99	Drains for Prefabricated and Precast Showers	Fixtures	
IAPMO PS 7-84	Tubing Trap Wall Adapters	DWV Components	
IAPMO PS 9-84	Diversion Tees and Twin Waste Elbows	DWV Components	
IAPMO PS 13-89	Testing and Rating Procedure for Grease Traps (Note 2)	DWV Components	
IAPMO PS 14-99	Flexible Metallic Water Connectors	Piping	
IAPMO PS 16-97	Subdrains for Built-Up Shower Pans	Fixtures	
IAPMO PS 23-89	Dishwasher Drain Airgaps	Backflow Protection	
IAPMO PS 25-84	Fittings for Joining Polyethylene Pipe for Water Service and Yard Piping	Joints	
IAPMO PS 31-95	Backflow Prevention Assemblies	Backflow Protection	
IAPMO PS 34-96	Polyethylene Encasement Sleeve for Potable Water Pipe and Tubing	Piping	
IAPMO PS 36-90	Lead-Free Sealing Compounds for Threaded Joints	Joints	
IAPMO PS 37-90	Black Plastic PVC or PE Pressure-Sensitive Corrosion Preventive Tape	Piping	
IAPMO PS 38-99	ABS and PVC Backwater Valves	DWV Components	
IAPMO PS 39-91	Testing Mechanical Fittings Composed of Multiple Components For Various Fitting Configuration For Use With Thermoplastic Gas Pressure Pipe	Fuel Gas	
IAPMO PS 40-91	Anodeless Transition Riser for Use with Polyethylene and PVC Gas Yard Piping	Fuel Gas	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
IAPMO PS 41-99	Copper and Other Metallic Roof/Deck/Balcony Drains	DWV Components	
IAPMO PS 42-96	Pipe Alignment and Secondary Support Systems	Piping	
IAPMO PS 43-91	Cushioned Bathtubs And Whirlpool Bathtub Appliances	Fixtures	
IAPMO PS 44-92	Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground	Joints	
IAPMO PS 45-91	Bathtub Three-Way Diverter Valves with Backflow Protection	Valves	
IAPMO PS 47-99	Plastic Roof Drains	DWV Components	
IAPMO PS 48-92	Material Safety Data Verification For Plumbing Products	Miscellaneous	
IAPMO PS 49-92	Backflow Prevention Requirements for Fixture Fittings with Hose Connected Singular Moveable Outlets	Backflow Protection	
IAPMO PS 50-92	Dual Flush Devices For Water Closets	Fixtures	
IAPMO PS 51-98	Plastic and Metallic Expansion Joints	Joints	
IAPMO PS 52-99	Sumps and Sewage Ejector Tanks	DWV Components	
IAPMO PS 53-92	Grooved Mechanical Pipe Couplings and Grooved End Fittings	Joints	
IAPMO PS 54-99	Metallic and Plastic Utility Boxes	Miscellaneous	
IAPMO PS 55-92	Bathwaste Strainer Drains	Fixtures	
IAPMO PS 57-92	PVC Hydraulically Actuated Diaphragm Type Water Control Valves	Valves	
IAPMO PS 58-92	Supports for Off-the-Floor Plumbing Fixtures With or Without Concealed Tanks	Fixtures	
IAPMO PS 59-92	Septic Effluent and Waste Water Diverter Valves	DWV Components	
IAPMO PS 60-96	Sewage Holding Tank Containing Sewage Ejector Pump for Direct Mounted Water Closet	DWV Components	
IAPMO PS 61-92	Fabricated Stainless Steel Security Water Closets	Fixtures	
IAPMO PS 62-93	Enameled Cast Iron Sanitary Floor Sinks	Fixtures	
IAPMO PS 63-99	Plastic Leaching Chambers	DWV Components	
IAPMO PS 64-98	Pipe Flashings	Piping	
IAPMO PS 65-93	Airgap Units for Water Conditioning Equipment Installation	Backflow Protection	
IAPMO PS 66-93	Dielectric Waterway Fittings	Piping	
IAPMO PS 67-93	Early-Closure Replacement Flappers or Early-Closure Replacement Flapper With Mechanical Assemblies	Fixtures	
IAPMO PS 69-98	Plastic Bathwaste and Overflow Assemblies	Piping, Plastic	
IAPMO PS 70-93	Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors	Fixtures	
IAPMO PS 71-93	Electronic Controlled Showers	Fixtures	
IAPMO PS 72-93	Valves with Atmospheric Vacuum Breakers	Valves	
IAPMO PS 73-93	Dental Vacuum Pumps	Miscellaneous	
IAPMO PS 74-99	Reinforced Flexible Water Connectors	Piping	
IAPMO PS 76-95	Ballcock or Flushometer Valve Tailpiece Trap Primers and Trap Primer Receptors/Adapters	DWV Components	
IAPMO PS 77-99	Electrohydraulic Water Closets	Fixtures	
IAPMO PS 78-95	Dual Flush for Electrohydraulic and Gravity 6 Liter (1.6 Gallons) Water Closet	Fixtures	
IAPMO PS 79-95	Multiport Electronic Trap Primer	DWV Components	
IAPMO PS 80-95	Grease Interceptors and Clarifiers	DWV Components	
IAPMO PS 81-95	Precast Concrete Seepage Pit Liners and Covers	DWV Components	
IAPMO PS 82-95	Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Fittings	Piping, Plastic	
IAPMO PS 83-95	Epoxy Coated Cast Iron Sanitary Floor Sinks	Fixtures	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
IAPMO PS 84-95	PVC Plastic Sanitary Floor Sinks	Fixtures	
IAPMO PS 85-95	Tools for Mechanically Formed Tee Connections in Copper Tubing	Piping	
IAPMO PS 86-95	Rainwater Diverter Valve for Nonroofed Area Slabs	DWV Components	
IAPMO PS 87-95	Diverter and Shut-Off Valves for Pool/Spas	Valves	
IAPMO PS 88-95	Pre-Pressurized Potable Water Tanks	Miscellaneous	
IAPMO PS 89-95	Soaking and Hydrotherapy (Whirlpool) Bathtubs with Hydraulic Seatlift	Fixtures	
IAPMO PS 90-95	Elastomeric Test Caps/Cleanout Caps	DWV Components	
IAPMO PS 91-95	Plastic Stabilizers for Use with Plastic Closet Bends	Piping, Plastic	
IAPMO PS 92-95	Heat Exchangers	Miscellaneous	
IAPMO PS 93-99	Water Closet Seats with Spray	Fixtures	
IAPMO PS 94-96	P-Trap, Supply Stop and Riser Insulated Protector	Miscellaneous	
IAPMO PS 95-98	Drain, Waste, and Vent Hangers and Plastic Pipe Support Hooks	Piping	
IAPMO PS 96-96	Passive Direct Solar Water Heaters	Miscellaneous	
IAPMO PS 97-97	Mechanical Cast Iron Closet Flanges	Piping, Ferrous	
IAPMO PS 98-96	Prefabricated Fiberglass Church Baptisries	Fixtures	
IAPMO PS 99-96	Terrazzo Plumbing Fixtures	Fixtures	
IAPMO PS 100-96	Porous Filter Protector for Sub-Drain Weep Holes	DWV Components	
IAPMO PS 101-97	Suction Relief Valves	Valves	
IAPMO PS 102-97	Short Pattern Fixture Trap	DWV Components	
IAPMO PS 103-97	Water Heater Stands With or Without Pans	Appliances	
IAPMO PS 104-97	Pressure Relief Connection for Dispensing Equipment	Valves	
IAPMO PS 105-97	Polyethylene Distribution Boxes	DWV Components	
IAPMO PS 106-98	Pre-Fabricated, Tileable Shower Receptors	Fixtures	
IAPMO PS 107-98	Aramid Reinforced Rubber Hose for Use in Non-potable Water Radiant Heating and Snowmelting	Piping, Plastic	
IAPMO PS 108-98	Grease Fire Suppression Systems	Appliances	X
IAPMO PS 109-96	Rigid Unshielded Mechanical Couplings for Use with Plain End Drain, Waste, and Vent (DWV) Pipe and Plain End Sewer Pipe	Joints	
IAPMO PS 110-99	PVC Cold Water Compression Fittings	Fittings	
IAPMO PS 111-99	PVC Cold Water Gripper Fittings	Fittings	
IAPMO PS 112-99	PVC Plastic Valves for Cold Water Distribution Systems Outside a Building and CPVC Plastic Valves for Hot and Cold Water Distribution Systems	Valves	
IAPMO PS 113-99	Hydraulically Powered Household Food Waster Grinders	Appliances	
IAPMO PS 114-99	Remote, Floor Box Industrial Water Supply, Air Supply, Drainage	Miscellaneous	
IAPMO PS 115-99	Hot Water Demand or Automatic Activated Hot Water Pumping Systems	Miscellaneous	
IAPMO PS 116-99	Hot Water Circulating Devices Which Do Not Use a Pump	Miscellaneous	
IAPMO SPS 3-93	Skimmers (Spas, Hot Tubs and Swimming Pools)	Swimming Pools and Spas	
IAPMO SPS 4-89	Special Use Suction Fittings for Swimming Pools, Spas and Hot Tubs (For Suction Side Automatic Swimming Pool Cleaners)	Swimming Pools and Spas	
IAS LC 1-97	Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) (same as CSA 6.26-M97)	Fuel Gas	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
MIL-F-1183 H-83 [D]	Fittings, Pipe, Cast Bronze, Silver-Brazing	Piping, Copper Alloy	
MIL-F-18180C1	Flanges and Flanged Fittings, Pipe, Steel (150, 300, 400, 600, 900, 1500, and 2500 pounds)	Piping, Ferrous	
MIL-P-17552	Pumps, Centrifugal, Water, Horizontal, General Service; and Pumps, Centrifugal Water, Horizontal, Boiler-Feed; Electric Motor or Steam Driven	Pumps	
MIL-P-21214B-92	Vertical sump pumps	Pumps	
SSPMA-85			
MIL-P-21251C	Plumping Units, Sewage, Duplex, Automatic, Wet-Pit-Type	Pumps	
MIL-P-22561-82(D)	Glass (standard cancelled per Department of Defense)	Miscellaneous	
MIL-V-29193-80(D)	Pressurized flushing devices	Fixtures	
MIL-P-52407	Pump, Centrifugal: Electric-Motor-Driven, Shallow (A)-1976 (D) Well (for Water)	Pumps	
MIL-P-62156	Submersible, axial flow, electric motor driven	Pumps	
MIL-P-B-81 (D)	(1)-1983 (D)		
SSPMA-85	Sewage pumps	Pumps	
MSS SP-25-93	Standard Marking System for Valves, Fittings, Flanges and Unions	Piping	
MSS SP-42-90 (R95)	Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends	Piping, Ferrous	
MSS SP-44-91	Steel Pipeline Flanges	Piping, Ferrous	
MSS SP-58-93	Pipe Hangers And Supports – Materials, Design and Manufacture	Piping	
MSS SP-67-90	Butterfly Valves	Valves	
MSS SP-70-90	Cast Iron Gate Valves, Flanged and Threaded Ends	Valves	
MSS SP-71-90	Cast Iron Swing Check Valves, Flanged and Threaded Ends	Valves	
MSS SP-72-92	Ball Valves with Flanged or Butt-Welding Ends for General Service	Valves	
MSS SP-73-91	Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings	Joints	
MSS SP-78-87 (R92)	Cast Iron Plug Valves, Flanged and Threaded Ends	Valves	
MSS SP-80-87	Bronze Gate, Globe, Angle and Check Valves	Valves	
MSS SP-83-87	Steel Pipe Unions Socket-Welding and Threaded	Piping, Ferrous	
MSS SP-84 [D]	Steel Valves – Socket-Welding Ends and Threaded Ends (discontinued)	Valves	
NFPA 13R-1996	Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height	Miscellaneous	
NFPA 13D-1996	Installation of Sprinkler Systems in One-and Two-Family Dwellings and Manufactured Homes	Miscellaneous	
NFPA 31-97	Installation of Oil-Burning Equipment	Miscellaneous	
NFPA 54-96	National Fuel Gas Code	Fuel Gas	
NFPA 58-98	Storage and Handling of Liquefied Petroleum Gases	Fuel Gas	
NFPA 99-99 (Ch. 2 & 4)	Medical Gas Systems	Piping	
NFPA 99-99 (Ch. 2 & 4)	Gas and Vacuum Systems	Piping	
NFPA 211-96	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	Miscellaneous	
NFPA 8501-97	Single Burner Boiler Operation	Appliances	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
NSF 3-96	Commercial Spray-Type Dishwashing and Glasswashing Machines	Appliances	
NSF 12-93	Automatic Ice Making Equipment	Appliances	
NSF 14-98	Plastic Piping Components and Related Materials	Piping, Plastic	
NSF 18-96	Manual Food and Beverage Dispensing Equipment	Appliances	
NSF 24-96	Plumbing System Components for Manufactured Homes and Recreational Vehicles	Miscellaneous	
NSF 29-93	Chemical Feeders for Commercial Dishwashers	Appliances	
NSF 40-99	Residential Wastewater Treatment Systems	DWV Components	
NSF 41-98	Nonliquid Saturated Treatment Systems	DWV Components	
NSF 42-98	Drinking Water Treatment Units - Aesthetic Effects	Appliances	
NSF 44-98	Cation Exchange Water Softeners	Appliances	
NSF 46-97	Evaluation of Components and Devices Used in Wastewater Treatment Systems	DWV Components	
NSF 53-98	Drinking Water Treatment Units - Health Effects	Appliances	
NSF 58-98	Reverse Osmosis Drinking Water Treatment Systems	Appliances	
NSF 61-98	Drinking Water System Components - Health Effects	Miscellaneous	
NSF 62-97	Water Distillation Systems	Appliances	
NSPI 1-1991	Public Swimming Pools	Swimming Pools and Spas	
PDI G-101-85	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data	DWV Components	
PDI-WH 201-92	Water Hammer Arresters	Piping	
SAE J1670-93	Type "F" Clamps for Plumbing Applications	Joints	
SAMA LF6a	Medical Care Facility Brassware	Miscellaneous	
UL 80-96	Steel Inside Tanks for Oil-Burner Fuel	Miscellaneous	
UL 103-95	Factory-Built Chimneys for Residential Type and Building Heating Appliances	Miscellaneous	
UL 125-97	Valves for Anhydrous Ammonia and LP-Gas (Other than Safety Relief)	Valves	
UL 132-97	Safety Relief Valves for Anhydrous Ammonia and LP-Gas	Valves	
UL 144-99	LP Gas Regulators	Valves	
UL 174-96	Household Electric Storage Tank Water Heaters	Appliances	
UL 343-97	Pumps for Oil-Burning Appliances	Pumps	
UL 352-97	Constant-Level Oil Valves	Valves	
UL 378-93	Draft Equipment	Miscellaneous	
UL 399-93	Drinking-Water Coolers	Appliances	
UL 430-94	Waste Disposers	Appliances	
UL 441-96	Gas Vents	Miscellaneous	
UL 443-95	Steel Auxiliary Tanks for Oil-Burner Fuel	Miscellaneous	
UL 499-97	Electrical Heating Appliances	Appliances	
UL 563-95	Ice Makers	Appliances	
UL 569-95	Pigtails and Flexible Hose Connectors for LP-Gas	Fuel Gas	
UL 723-96	Test for Surface Burning Characteristics of Building Materials	Miscellaneous	
UL 726-95	Oil-Fired Boiler Assemblies	Appliances	
UL 732-95	Oil-Fired Storage Tank Water Heaters	Appliances	
UL 749-97	Household Dishwashers	Appliances	
UL 778-96	Motor-Operated Water Pumps	Pumps	
UL 834-95	Heating, Water Supply, and Power Boilers - Electric	Appliances	

Standard Number	Standard Title	Application	Indicate if Not Approved in the UPC
UL 921-96	Commercial Electric Dishwashers	Appliances	
UL 1453-95	Electric Booster and Commercial Storage Tank Water Heaters	Appliances	
WAC 246-290-490	Washington State Department of Health Cross Connection Control Requirements	Backflow Protection	
WQA S-100-95	Household, Commercial and Portable Exchange Water Softeners (replaced by NSF 44-98)	Appliances	
WQA S-200-93	Household and Commercial Water Filters	Appliances	
WQA S-300-91	Point-of-Use Low Pressure Reverse Osmosis Drinking Water Systems	Appliances	
3-GP-28	Fuel Oil, Canadian Government Specification Board	Miscellaneous	

Footnotes:

1. Although this standard is referenced in Table 14-1, some of the pipe, tubing, fittings, valves, or fixtures included in the standard are not acceptable for use under the provisions of the Uniform Plumbing Code.
2. PDI Standard G101 by reference.
3. Additional Requirements for Inner and Outer Layers.
4. See Section 316.1.3 for restriction.
5. Alloy C85200 for cleanout plugs.
6. Limited to domestic sewage.
7. Type II only.
8. Fixture fittings with hose connected singular moveable outlets shall have two check valves and an atmospheric vacuum breaker.
9. ASSE 1066 is not intended to limit the maximum outlet temperature at point of use.
10. See section 315.0 for Trenching, Excavation, and Backfilling requirements when installing building drains and sewers. Engineers may wish to consult ASTM D2321 when preparing plans and specifications for sewer mains or specific projects.

[Statutory Authority: RCW 19.27.031, 19.27.074, 02-01-114, § 51-56-1400, filed 12/18/01, effective 7/1/02.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 51-56-201300 Appendix M—Storm drainage.

M 1.0 General.

M 1.1 Where Required. All roofs, paved areas, yards, courts, and courtyards shall be drained into a separate storm sewer system, or into a combined sewer system where a separate storm sewer system is not available, or to some other place of disposal satisfactory to the administrative authority. In the case of one- and two-family dwellings, storm water may be discharged on flat areas such as streets or lawns so long as the storm water shall flow away from the building and away from adjoining property, and shall not create a nuisance.

M 1.2 Storm Water Drainage to Sanitary Sewer Prohibited. Storm water shall not be drained into sewers intended for sanitary drainage only.

M 1.3 Material Uses. Rainwater piping placed within the interior of a building or run within a vent or shaft shall be of cast iron, galvanized steel, wrought iron, brass, copper, lead, Schedule 40 ABS DWV, Schedule 40 PVC DWV, or other approved materials, and changes in direction shall conform to the requirements of Section 706.0.

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M 1.4 Expansion Joints Required. Expansion joints or sleeves shall be provided where warranted by temperature variations or physical conditions.

M 1.5 Subsoil Drains.

M 1.5.1 Subsoil drains shall be provided around the perimeter of buildings having basements, cellars, or crawl spaces or floors below grade. Such subsoil drains may be positioned inside or outside of the footing, shall be of perforated, or open-jointed approved drain tile or pipe not less than three (3) inches (76 mm) in diameter, and shall be laid in gravel, slag, crushed rock, approved three-quarter (3/4) inch (19.1 mm) crushed recycled glass aggregate, or other approved porous material with a minimum of four (4) inches (102 mm) surrounding the pipe on all sides. Filter media shall be provided for exterior subsoil piping.

M 1.5.2 Subsoil drains shall be piped to a storm drain, to an approved water course, to the front street curb or gutter, or to an alley; or the discharge from the subsoil drains shall be conveyed to the alley by a concrete gutter. Where a continuously flowing spring or groundwater is encountered, subsoil drains shall be piped to a storm drain or an approved water course.

M 1.5.3 Where it is not possible to convey the drainage by gravity, subsoil drains shall discharge to an accessible sump pit provided with an approved automatic electric pump. A sump pit shall be at least fifteen (15) inches (381 mm) in diameter, eighteen (18) inches (457 mm) in depth, and provided with a fitted cover. The sump pump shall have an adequate capacity to discharge all water coming into the sump as it accumulates to the required discharge point, and the capacity of the pump shall not be less than fifteen (15) gpm (1.0 L/s). The discharge piping from the sump pump shall be a minimum of one and one-half (1-1/2) inches (38 mm) in diameter and have a union to make the pump accessible for servicing.

M 1.5.4 For separate dwellings not serving continuously flowing springs or ground water, the sump discharge pipe may discharge onto a concrete splash block with a minimum length of twenty-four (24) inches (610 mm). This pipe shall be within four (4) inches (102 mm) of the splash block and positioned to direct the flow parallel to the recessed line of the splash block.

M 1.5.5 Subsoil drains subject to backflow when discharging into a storm drain shall be provided with a backwater valve in the drain line so located as to be accessible for inspection and maintenance.

M 1.5.6 Nothing in Section 1501.5 shall prevent drains that serve either subsoil drains or areaways of a detached building from discharging to a properly graded open area, provided that:

- (1) They do not serve continuously flowing springs or ground water;
- (2) The point of discharge is at least ten (10) feet (3048 mm) from any property line; and
- (3) It is impracticable to discharge such drains to a storm drain, to an approved water course, to the front street curb or gutter, or to an alley.

M 1.6 Building Subdrains. Building subdrains located below the public sewer level shall discharge into a sump or receiving tank, the contents of which shall be automatically lifted and discharged into the drainage system as required for building sumps.

M 1.7 Areaway Drains. All open subsurface space adjacent to a building, serving as an entrance to the basement or cellar of a building, shall be provided with a drain or drains. Such areaway drains shall be two (2) inches (51 mm) minimum diameter for areaways not exceeding one hundred (100) square feet (9.3 m²) in area, and shall be discharged in the manner provided for subsoil drains not serving continuously flowing springs or ground water (see Section 1501.5.2). Areaways in excess of one hundred (100) square feet (9.3 m²) shall not drain into subsoil. Areaway drains for areaways exceeding one hundred (100) square feet (9.3 m²) shall be sized according to Table M-2.

M 1.8 Window Areaway Drains. Window areaways not exceeding ten (10) square feet (0.9 m²) in area may discharge to the subsoil drains through a two (2) inch (51 mm) pipe. However, window areaways exceeding ten (10) square feet (0.9 m²) in area shall be handled in the manner provided for entrance areaways (see Section 1501.7).

M 1.9 Filling Stations and Motor Vehicle Washing Establishments. Public filling stations and motor vehicle washing establishments shall have the paved area sloped toward sumps or gratings within the property lines. Curbs not less than six (6) inches (152 mm) high shall be placed where required to direct water to gratings or sumps.

M 1.10 Paved Areas. Where the occupant creates surface water drainage, the sumps, gratings or floor drains shall be piped to a storm drain or an approved water course.

M 1.11 Roof Drainage.

M 1.11.1 Primary Roof Drainage. Roof areas of a building shall be drained by roof drains or gutters. The location and sizing of drains and gutters shall be coordinated with the structural design and pitch of the roof. Unless otherwise required by the administrative authority, roof drains, gutters, vertical conductors or leaders, and horizontal storm drains for primary drainage shall be sized based on a storm of sixty (60)

minutes duration and 100-year return period (see Appendix D).

M 1.11.2 Secondary Roof Drainage.

M 1.11.2.1 Where parapet walls or other construction extend above the roof and create areas where storm water would become trapped if the primary roof drainage system failed to provide sufficient drainage, an independent secondary roof drainage system consisting of scuppers, standpipes, or roof drains shall be provided. Secondary roof drainage systems shall be sized in accordance with Section 1501.11.1 of this code. Overflow drains shall be the same size as the roof drains with the inlet flow line two (2) inches (51 mm) above the low point of the roof and shall be installed independent from the roof drains.

M 1.11.2.2 Where secondary roof drainage is provided by means of roof drains or standpipes, the secondary system shall be separate from the primary system and shall discharge independently at grade or other approved point of discharge.

M 1.11.2.3 Where secondary roof drainage is provided, the overflow level(s) into the secondary system shall be determined by the structural design of the roof, including roof deflection, at a level not less than two (2) inches (51 mm) above the level of the primary drain. An allowance shall be made to account for the required overflow head of water above the secondary inlets. The elevation of the secondary inlet plus the required overflow head shall not exceed the maximum allowable water level on the roof.

M 1.11.2.4 Scuppers shall be sized as rectangular weirs, using hydraulic principles to determine the required length and resulting overflow head (see Appendix D). Secondary roof drains and standpipes shall be sized according to Table M-1. Where standpipes are used, the head allowance required under Section 1501.11.2.3 shall be not less than one and one-half (1-1/2) inches (38 mm).

M 1.11.3 Equivalent Systems. When approved by the administrative authority, the requirements of Sections 1501.11.1 and 1501.11.2 shall not preclude the installation of an engineered roof drainage system that has sufficient capacity to prevent water from ponding on the roof in excess of that allowed in the roof structural design with a rainfall rate of at least twice that for a 100-year, 60-minute storm and with a blockage in any single point in the storm drainage system.

M 1.12 Cleanouts.

M 1.12.1 Cleanouts for building storm drains shall comply with the requirements of this section. Rain leaders and conductors connected to a building storm sewer shall have a cleanout installed at the base of the outside leader or outside conductor before it connects to the horizontal drain. Cleanouts shall be placed inside the building near the connection between the building drain and the building sewer or installed outside the building at the lower end of the building drain and extended to grade.

M 1.12.2 Each cleanout shall be installed so that it opens to allow cleaning in the direction of flow of the soil or waste or

at right angles thereto, and except in the case of wye branch and end-of-line cleanouts, shall be installed vertically above the flow line of the pipe.

M 1.12.3 Cleanouts installed under concrete or asphalt paving shall be made accessible by yard boxes, or extending flush with paving with approved materials and be adequately protected.

M 1.12.4 Approved manholes may be installed in lieu of cleanouts when first approved by the administrative authority. The maximum distance between manholes shall not exceed three hundred (300) feet (91.4 m).

The inlet and outlet connections shall be made by the use of a flexible compression joint no closer than twelve (12) inches (305 mm) to, and not farther than three (3) feet (914 mm) from the manhole. No flexible compression joints shall be embedded in the manhole base.

M 1.13 All rainwater sumps serving "public use" occupancy buildings shall be provided with dual pumps arranged to function alternately in case of overload or mechanical failure.

M 2.0 Materials.

M 2.1 Conductors.

M 2.1.1 Conductors installed aboveground in buildings shall be constructed of materials specified in Table 14-1.

M 2.1.2 The inside of conductors installed above ground level shall be of seamless copper water tube, Type K, L or M; Schedule 40 copper pipe or Schedule 40 copper alloy pipe; Type DWV copper drainage tube; service weight cast iron soil pipe or hubless cast iron soil pipe; standard weight galvanized steel pipe; or Schedule 40 ABS or Schedule 40 PVC plastic pipe.

M 2.2 Leaders.

M 2.2.1 Leaders shall be constructed of materials specified in Table 14-1.

M 2.2.2 Leaders shall be of seamless copper water tube, Type K, L or M; Schedule 40 copper pipe; Schedule 40 copper alloy pipe; type DWV copper drainage tube; service weight cast iron soil pipe or hubless cast iron soil pipe; galvanized steel sheet metal or copper sheet metal; standard weight galvanized steel pipe; Class DL or XL lead pipe; or Schedule 40 ABS or Schedule 40 PVC plastic pipe.

M 2.3 Underground Building Storm Drains. All underground building storm drains shall be constructed of materials specified in Table 14-1.

M 2.4 Building Storm Sewers. Building storm sewers shall be constructed of materials specified in Table 14-1.

M 2.5 Subsoil Drains.

M 2.5.1 Subsoil drains shall be constructed of materials specified in Table 14-1.

M 2.5.2 Subsoil drains shall be open-jointed or of perforated pipe, vitrified clay, plastic, cast iron, or porous concrete.

M 3.0 Traps on Storm Drains and Leaders.

M 3.1 Where Required. Leaders and storm drains, when connected to a combined sewer, shall be trapped. Floor and area drains connected to a storm drain shall be trapped.

EXCEPTION: Traps shall not be required where roof drains, rain leaders and other inlets are at locations allowed under Section 906.0, Vent Terminals.

M 3.2 Where Not Required. No trap shall be required for a leader(s) or conductor(s) which is connected to a sewer carrying storm water exclusively.

M 3.3 Trap Size. Traps, when installed for individual conductors, shall be the same size as the horizontal drain to which they are connected.

M 3.4 Method of Installation of Combined Sewer. Individual storm-water traps shall be installed on the storm-water drain branch serving each storm-water inlet, or a single trap shall be installed in the main storm drain just before its connection with the combined building sewer. Such traps shall be provided with an accessible cleanout on the outlet side of the trap.

M 4.0 Leaders, Conductors, and Connections.

M 4.1 Improper Use. Leaders or conductors shall not be used as soil, waste, or vent pipes, nor shall soil, waste, or vent pipes be used as leaders or conductors.

M 4.2 Protection of Leaders. Leaders installed along alleyways, driveways, or other locations where they may be exposed to damage shall be protected by metal guards, recessed into the wall, or constructed from ferrous pipe.

M 4.3 Combining Storm with Sanitary Drainage. The sanitary and storm drainage system of a building shall be entirely separate, except where a combined sewer is used, in which case the building storm drain shall be connected in the same horizontal plane through single wye fittings to the combined building sewer at least ten (10) feet (3048 mm) downstream from any soil stack.

M 5.0 Roof Drains.

M 5.1 Material.

M 5.1.1 Roof drains shall be constructed of materials specified in Table 14-1.

M 5.1.2 Roof drains shall be of cast iron, copper or copper alloy, lead or plastic.

M 5.2 Dome or Strainer for General Use. All roof drains and overflow drains, except those draining to hanging gutters, shall be equipped with strainers extending not less than four (4) inches (102 mm) above the surface of the roof immediately adjacent to the drain. Strainers shall have a minimum inlet area above the roof level of not less than one and one-half (1-1/2) times the area of the conductor or leader to which the drain is connected.

M 5.3 Strainers for Flat Decks. Roof drain strainers for use on sun decks, parking decks, and similar areas which are normally serviced and maintained may be of the flat surface-

type. Such roof drain strainers shall be level with the deck and shall have an available inlet area of no less than two (2) times the area of the conductor or leader to which the drain is connected.

M 5.4 Roof Drain Flashings. Connection between the roof and roof drains which pass through the roof and into the interior of the building shall be made watertight by the use of proper flashing material.

M 5.4.1 Where lead flashing material is used, it shall be a minimum of four (4) pounds per square foot (19.5 kg/m²).

M 5.4.2 Where copper flashing material is used, it shall be a minimum of twelve (12) ounces per square foot (3.7 kg/m²).

M 6.0 Size of Leaders, Conductors, and Storm Drains.

M 6.1 Vertical Conductors and Leaders. Vertical conductors and leaders shall be sized on the basis of the maximum projected roof area and Table M-1.

M 6.2 Size of Horizontal Storm Drains and Sewers. The size of building storm drains or building storm sewers or any of their horizontal branches shall be based upon the maximum projected roof or paved area to be handled and Table M-2.

M 6.3 Size of Roof Gutters. The size of semicircular gutters shall be based on the maximum projected roof area and Table M-3.

M 6.4 Side Walls Draining onto a Roof. Where vertical walls project above a roof so as to permit storm water to drain to the roof area below the adjacent roof area may be computed from Table M-1 as follows:

1. For one (1) wall – add fifty (50) percent of the wall area to the roof area figures.
2. For two (2) adjacent walls – add thirty-five (35) percent of the total wall areas.
3. Two (2) walls opposite of same height – add no additional area.
4. Two (2) walls opposite of differing heights – add fifty (50) percent of wall area above top of lower wall.
5. Walls on three (3) sides – add fifty (50) percent of area of the inner wall below the top of the lowest wall, plus allowance for the area of wall above top of lowest wall, per (2) and (4) above.
6. Walls on four (4) sides – no allowance for wall areas below top of lowest wall – add for areas above the top of the lowest wall per (1), (2), (4) and (5) above.

M 7.0 Values for Continuous Flow.

Where there is a continuous or semi-continuous discharge into the building storm drain or building storm sewer, as from a pump, ejector, air-conditioning plant, or similar device, one (1) gpm (3.8 L/min.) of such discharge shall be computed as being equivalent to twenty-four (24) square feet (2.2 m²) of roof area, based upon a rate of rainfall of four (4) inches (102 mm) per hour.

M 8.0 Testing.

M 8.1 Testing Required. New building storm drainage systems and parts of existing systems that have been altered, extended or repaired shall be tested as described in Section 1508.2.1 to disclose leaks and defects.

M 8.2 Methods of Testing Storm Drainage Systems. Except for outside leaders and perforated or open jointed drain tile, the piping of storm drain systems shall be tested upon completion of the rough piping installation by water or air, and proved tight. The administrative authority may require the removal of any cleanout plugs to ascertain if the pressure has reached all parts of the system. Either of the following test methods shall be used:

M 8.2.1 Water Test. After piping has been installed, the water test shall be applied to the drainage system, either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed except for the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except for the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a ten (10) foot (3048 mm) head of water. In testing successive sections, at least the upper ten (10) foot (3048 mm) of the next preceding section shall be tested so that no joint of pipe in the building (except the uppermost ten (10) foot (3048 mm) of a roof drainage system, which shall be filled with water to the flood level of the uppermost roof drain) shall have been submitted to a test of less than a ten (10) foot (3048 mm) head of water. The water shall be kept in the system or in the portion under test for at least fifteen (15) minutes before inspection starts; the system shall then be tight at all points.

M 8.2.2 Air Test. The air test shall be made by attaching an air compressor testing apparatus to any suitable opening after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gage pressure of five (5) psi (34.5 kPa) or sufficient to balance a column of mercury ten (10) inches (254 mm) in height. This pressure shall be held without introduction of additional air for a period of at least fifteen (15) minutes.

M 8.2.3 Exceptions. When circumstances exist that make air and water tests, described in Sections 1508.2.1 and 1508.2.2 above, impractical, and for minor maintenance, repairs and installations, the administrative authority may perform the inspection as considered advisable by said authority to assure that the work has been in accordance with provisions of this code.

TABLE M-1
Sizing Roof Drains, Leaders, and Vertical Rainwater Piping

Size of Drain, Leader or Pipe, Inches	Flow, gpm	Maximum Allowable Horizontal Projected Roof Areas Square feet at Various Rainfall Rates					
		1"/Hr	2"/Hr	3"/Hr	4"/Hr	5"/Hr	6"/Hr
2	23	2176	1088	725	544	435	363
3	67	6440	3220	2147	1610	1288	1073
4	144	13,840	6920	4613	3460	2768	2307
5	261	25,120	12,560	8373	6280	5024	4187
6	424	40,800	20,400	13,600	10,200	8160	6800
8	913	88,000	44,000	29,333	22,000	17,600	14,667

TABLE M-1 (Metric)
Sizing Roof Drains, Leaders, and Vertical Rainwater Piping

Size of Drain, Leader or Pipe, mm	Flow, L/s	Maximum Allowable Horizontal Projected Roof Areas Square meters at Various Rainfall Rates					
		25mm/Hr	50mm/Hr	75mm/Hr	100mm/Hr	125mm/Hr	150mm/Hr
50	1.5	202	101	67	51	40	34
75	4.2	600	300	200	150	120	100
100	9.1	1286	643	429	321	257	214
125	16.5	2334	1117	778	583	467	389
150	26.8	3790	1895	1263	948	758	632
200	57.6	8175	4088	2725	2044	1635	1363

- Notes: 1. The sizing data for vertical conductors, leaders, and drains is based on the pipes flowing 7/24 full.
2. For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch/hour (25 mm/hr) column by the desired rainfall rate.
3. Vertical piping may be round, square, or rectangular. Square pipe shall be sized to enclose its equivalent round pipe. Rectangular pipe shall have at least the same cross-sectional area as its equivalent round pipe, except that the ratio of its side dimensions shall not exceed 3 to 1.

TABLE M-2
Sizing of Horizontal Rainwater Piping

Size of Pipe, inches	Flow at 1/8"/ft slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1"/Hr	2"/Hr	3"/Hr	4"/Hr	5"/Hr	6"/Hr
3	34	3288	1644	1096	822	657	548
4	78	7520	3760	2506	1880	1504	1253
5	139	13,360	6680	4453	3340	2672	2227
6	222	21,400	10,700	7133	5350	4280	3566
8	478	46,000	23,000	15,330	11,500	9200	7670
10	860	82,800	41,400	27,600	20,700	16,580	13,800
12	1384	133,200	66,600	44,400	33,300	26,650	22,200
15	2473	238,000	119,000	79,333	59,500	47,600	39,650

Size of Pipe, inches	Flow at 1/4"/ft slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1"/Hr	2"/Hr	3"/Hr	4"/Hr	5"/Hr	6"/Hr
3	48	4640	2320	1546	1160	928	773
4	110	10,600	5300	3533	2650	2120	1766
5	196	18,880	9440	6293	4720	3776	3146
6	314	30,200	15,100	10,066	7550	6040	5033
8	677	65,200	32,600	21,733	16,300	13,040	10,866
10	1214	116,800	58,400	38,950	29,200	23,350	19,450
12	1953	188,000	94,000	62,600	47,000	37,600	31,350
15	3491	336,000	168,000	112,000	84,000	67,250	56,000

Size of Pipe, inches	Flow at 1/2"/ft slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1"/Hr	2"/Hr	3"/Hr	4"/Hr	5"/Hr	6"/Hr
3	68	6576	3288	2192	1644	1310	1096
4	156	15,040	7520	5010	3760	3010	2500

Size of Pipe, inches	Flow at 1/2"ft slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1"/Hr	2"/Hr	3"/Hr	4"/Hr	5"/Hr	6"/Hr
5	278	26,720	13,360	8900	6680	5320	4450
6	445	42,800	21,400	14,267	10,700	8580	7140
8	956	92,000	46,000	30,650	23,000	18,400	15,320
10	1721	165,600	82,800	55,200	41,400	33,150	27,600
12	2768	266,400	133,200	88,800	66,600	53,200	44,400
15	4946	476,000	238,000	158,700	119,000	95,200	79,300

- Notes: 1. The sizing data for horizontal piping is based on the pipes flowing full.
2. For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch/hr (25mm/hr) column by the desired rainfall rate.

TABLE M-2 (Metric)
Sizing of Horizontal Rainwater Piping

Size of Pipe, mm	Flow at 10mm/m slope, L/s	Maximum Allowable Horizontal Projected Roof Areas Square Meters at Various Rainfall Rates					
		25mm/Hr	50mm/Hr	75mm/Hr	100mm/Hr	125mm/Hr	150mm/Hr
75	2.1	305	153	102	76	61	51
100	4.9	700	350	233	175	140	116
125	8.8	1241	621	414	310	248	207
150	14.0	1988	994	663	497	398	331
200	30.2	4273	2137	1424	1068	855	713
250	54.3	7692	3846	2564	1923	1540	1282
300	87.3	12,375	6187	4125	3094	2476	2062
375	156.0	22,110	11,055	7370	5528	4422	3683

Size of Pipe, mm	Flow at 20mm/m slope, L/s	Maximum Allowable Horizontal Projected Roof Areas Square Meters at Various Rainfall Rates					
		25mm/Hr	50mm/Hr	75mm/Hr	100mm/Hr	125mm/Hr	150 mm/Hr
75	3.0	431	216	144	108	86	72
100	6.9	985	492	328	246	197	164
125	12.4	1754	877	585	438	351	292
150	19.8	2806	1403	935	701	561	468
200	42.7	6057	3029	2019	1514	1211	1009
250	76.6	10,851	5425	3618	2713	2169	1807
300	123.2	17,465	8733	5816	4366	3493	2912
375	220.2	31,214	15,607	10,405	7804	6248	5202

Size of Pipe, mm	Flow at 40mm/m slope, L/s	Maximum Allowable Horizontal Projected Roof Areas Square Meters at Various Rainfall Rates					
		25mm/Hr	50mm/Hr	75mm/Hr	100mm/Hr	125mm/Hr	150mm/Hr
75	4.3	611	305	204	153	122	102
100	9.8	1400	700	465	350	280	232
125	17.5	2482	1241	827	621	494	413
150	28.1	3976	1988	1325	994	797	663
200	60.3	8547	4273	2847	2137	1709	1423
250	108.6	15,390	7695	5128	3846	3080	2564
300	174.6	24,749	12,374	8250	6187	4942	4125
375	312.0	44,220	22,110	14,753	11,055	8853	7367

- Notes: 1. The sizing data for horizontal piping is based on the pipes flowing full.
2. For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch/hr (25mm/hr) column by the desired rainfall rate.

TABLE M-3
Size of Gutters

Diameter of Gutter in Inches	Maximum Rainfall in Inches per Hour				
	2	3	4	5	6
1/16" per ft slope					
3	340	226	170	136	113
4	720	480	360	288	240
5	1250	834	625	500	416
6	1920	1280	960	768	640

Diameter of Gutter in Inches	Maximum Rainfall in Inches per Hour				
1/16" per ft slope	2	3	4	5	6
7	2760	1840	1380	1100	918
8	3980	2655	1990	1590	1325
10	7200	4800	3600	2880	2400

Diameter of Gutter in Inches	Maximum Rainfall in Inches per Hour				
1/8" per ft slope	2	3	4	5	6
3	480	320	240	192	160
4	1020	681	510	408	340
5	1760	1172	880	704	587
6	2720	1815	1360	1085	905
7	3900	2600	1950	1560	1300
8	5600	3740	2800	2240	1870
10	10200	6800	5100	4080	3400

Diameter of Gutter in Inches	Maximum Rainfall in Inches per Hour				
1/4" per ft slope	2	3	4	5	6
3	680	454	340	272	226
4	1440	960	720	576	480
5	2500	1668	1250	1000	834
6	3840	2560	1920	1536	1280
7	5520	3680	2760	2205	1840
8	7960	5310	3980	3180	2655
10	14,400	9600	7200	5750	4800

Diameter of Gutter in Inches	Maximum Rainfall in Inches per Hour				
1/2" per ft slope	2	3	4	5	6
3	960	640	480	384	320
4	2040	1360	1020	816	680
5	3540	2360	1770	1415	1180
6	5540	3695	2770	2220	1850
7	7800	5200	3900	3120	2600
8	11,200	7460	5600	4480	3730
10	20,000	13,300	10,000	8000	6660

TABLE M-3 (Metric)
Size of Gutters

Diameter of Gutter in mm	Maximum Rainfall in Millimeters per Hour				
5.2mm/m slope	50.8	76.2	101.6	127.0	152.4
76.2	31.6	21.0	15.8	12.6	10.5
101.6	66.9	44.6	33.4	26.8	22.3
127.0	116.1	77.5	58.1	46.5	38.7
152.4	178.4	119.1	89.2	71.4	59.5
177.8	256.4	170.9	128.2	102.2	85.3
203.2	369.7	246.7	184.9	147.7	123.1
254.0	668.9	445.9	334.4	267.6	223.0

Diameter of Gutter in mm	Maximum Rainfall in Millimeters per Hour				
10.4mm/m slope	50.8	76.2	101.6	127.0	152.4
76.2	44.6	29.7	22.3	17.8	14.9
101.6	94.8	63.3	47.4	37.9	31.6
127.0	163.5	108.9	81.8	65.4	54.5
152.4	252.7	168.6	126.3	100.8	84.1

177.8	362.3	241.5	181.2	144.9	120.8
203.2	520.2	347.5	260.1	208.1	173.7
254.0	947.6	631.7	473.8	379.0	315.9

Diameter of Gutter in mm	Maximum Rainfall in Millimeters per Hour				
20.9mm/m slope	50.8	76.2	101.6	127.0	152.4
76.2	63.2	42.2	31.6	25.3	21.0
101.6	133.8	89.2	66.9	53.5	44.6
127.0	232.3	155.0	116.1	92.9	77.5
152.4	356.7	237.8	178.4	142.7	118.9
177.8	512.8	341.9	256.4	204.9	170.9
203.2	739.5	493.3	369.7	295.4	246.7
254.0	1338.0	891.8	668.9	534.2	445.9

Diameter of Gutter in mm	Maximum Rainfall in Millimeters per Hour				
41.7mm/m slope	50.8	76.2	101.6	127.0	152.4
76.2	89.2	59.5	44.6	35.7	29.7
101.6	189.5	126.3	94.8	75.8	63.2
127.0	328.9	219.2	164.4	131.5	109.6
152.4	514.7	343.3	257.3	206.2	171.9
177.8	724.6	483.1	362.3	289.9	241.4
203.2	1040.5	693.0	520.2	416.2	346.5
254.0	1858.0	1238.4	929.0	743.2	618.7

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-56-201300, filed 12/18/01, effective 7/1/02.]

Chapter 51-57 WAC

STATE BUILDING CODE ADOPTION AND AMENDMENT OF APPENDIX A AND APPENDIX I OF THE 2000 EDITION OF THE UNIFORM PLUMBING CODE

WAC

51-57-001	Authority.
51-57-002	Purpose.
51-57-003	Uniform Plumbing Code Standards.
51-57-007	Exceptions.
51-57-008	Implementation.
51-57-790000	Installation Standard 7-90—Polyethylene cold water building supply and yard piping.
51-57-895000	Installation Standard 8-95—PVC cold water building supply and yard piping.

WAC 51-57-001 Authority. These rules are adopted under the authority of chapter 19.27 RCW.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-57-001, filed 12/18/01, effective 7/1/02.]

WAC 51-57-002 Purpose. The purpose of these rules is to implement the provisions of chapter 19.27 RCW, which provides that the state building code council shall maintain the State Building Code in a status which is consistent with the purpose as set forth in RCW 19.27.020. In maintaining the codes, the council shall regularly review updated versions of the codes adopted under the act, and other pertinent information, and shall amend the codes as deemed appropriate by the council.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-57-002, filed 12/18/01, effective 7/1/02.]

WAC 51-57-003 Uniform Plumbing Code Standards.

The 2000 edition of the Uniform Plumbing Code Standards (Appendixes A and I), published by the International Association of Plumbing and Mechanical Officials are hereby adopted by reference.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-57-003, filed 12/18/01, effective 7/1/02.]

WAC 51-57-007 Exceptions. The exceptions and amendments to the Uniform Codes contained in the provisions of chapter 19.27 RCW shall apply in cases of conflict with any of the provisions of these rules.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-57-007, filed 12/18/01, effective 7/1/02.]

WAC 51-57-008 Implementation. The Uniform Plumbing Code Standards adopted by chapter 19.27 RCW shall become effective in all counties and cities of this state on July 1, 2002, unless local government residential amendments have been approved by the state building code council.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-57-008, filed 12/18/01, effective 7/1/02.]

WAC 51-57-790000 Installation Standard 7-90— Polyethylene cold water building supply and yard piping.

604.1 Location. Polyethylene piping may terminate within a building or structure. The connection to the potable water distribution system shall be accessible, except that it may be buried underground outside of the building or structure in an accessible location. Barbed insert fittings with hose clamps are prohibited within a building.

[Statutory Authority: RCW 19.27.031, 19.27.074. 02-01-114, § 51-57-790000, filed 12/18/01, effective 7/1/02.]

**WAC 51-57-895000 Installation Standard 8-95—
PVC cold water building supply and yard piping.**

604.1 Location. PVC piping may terminate within a building or structure. The connection to the potable water distribution system shall be accessible, except that it may be buried underground outside of the building or structure in an accessible location.

[Statutory Authority: RCW 19.27.031, 19.27.074, 02-01-114, § 51-57-895000, filed 12/18/01, effective 7/1/02.]

Title 67 WAC

BLIND, DEPARTMENT OF SERVICES FOR THE

Chapters

67-25 Vocational rehabilitation and services for blind persons.

Chapter 67-25 WAC

VOCATIONAL REHABILITATION AND SERVICES FOR BLIND PERSONS

WAC

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WAC 67-25-460. What if the department of services for the blind (DSB) vocational rehabilitation (VR) program does not have sufficient resources to serve all eligible individuals? (1) The purpose of an order of priority is to establish an equitable and organized system which, when resources are not sufficient to meet the demand for services, gives the first priority to those eligible VR participants who meet the definition of "most severely disabled," WAC 67-25-470(1).

(2) In the event that sufficient funds or other resources are not available to serve all VR eligible individuals, DSB will use a prioritized order, as established in subsection (3) of this section, for selection of individuals to develop and carry out an individualized plan for employment (IPE) supported by expenditure of VR funds.

(3) When the order of priority is in effect, eligible individuals will be assigned to one of two priority categories:

(a) First priority: New eligible participants who meet the definition of "most severely disabled."

(b) Second priority: New eligible participants who do not meet the definition of "most severely disabled."

(4) Eligible individuals can develop and carry out an IPE based on:

(a) The priority of the category to which they are assigned, and whether or not that category is open for development of new IPEs.

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(b) And, the order in which they applied for DSB services as indicated by the date of application.

(5) Individuals who are receiving services under an IPE at the time an order of priority is implemented will continue to receive services as planned. They are not subject to the order of priority and are not a category within that order.

(6) The only services to individuals in a closed order of priority category will be information and referral services. These individuals will not receive counseling and guidance, assessment and training, placement, or other VR services until their category is reopened and they come off the waiting list.

[Statutory Authority: Federal Regulatory Authority for Order of Selection Rehabilitation Act of 1973, as amended, Section 101 (a)(5). 34 Code of Federal Regulations Part 361 Sec. 361.36 Ability to serve all eligible individuals; order of selection for services. Regulatory Authority for Information and Referral Services Rehabilitation Act of 1973, as amended, Section 101 (a)(20) Information and Referral services. 34 Code of Federal Regulations Part 361 Sec. 361.37 Information and referral services. The Rehabilitation Act of 1973, As Amended, Title I - Vocational Rehabilitation Services, Part A - General Provisions, Section 100 - Declaration of Policy. 01-21-073, § 67-25-460, filed 10/18/01, effective 11/18/01.]

WAC 67-25-470 How will DSB determine whether a person meets the definition of "most severely disabled"?

(1) Individuals who meet the definition of "most severely disabled" are: Individuals who have three or more functional limitations (mobility, communication, self-care, self-direction, interpersonal skills, work tolerance, or work skills) related to employment and require services over an extended period of time.

(2) A DSB vocational counselor will gather the information needed to determine whether an eligible participant meets the definition of "most severely disabled." If assessment services are to be purchased, the counselor will provide the participant with information about the providers available, so that the individual can make an informed choice.

[Statutory Authority: Federal Regulatory Authority for Order of Selection Rehabilitation Act of 1973, as amended, Section 101 (a)(5). 34 Code of Federal Regulations Part 361 Sec. 361.36 Ability to serve all eligible individuals; order of selection for services. Regulatory Authority for Information and Referral Services Rehabilitation Act of 1973, as amended, Section 101 (a)(20) Information and Referral services. 34 Code of Federal Regulations Part 361 Sec. 361.37 Information and referral services. The Rehabilitation Act of 1973, As Amended, Title I - Vocational Rehabilitation Services, Part A - General Provisions, Section 100 - Declaration of Policy. 01-21-073, § 67-25-470, filed 10/18/01, effective 11/18/01.]

WAC 67-25-480 How will DSB implement an order of priority?

(1) The director of the department of services for the blind will decide when to implement an order of priority, if necessary, and will determine which priority categories will be open or closed for the development of new IPEs. In the event that sufficient funds or other resources become available to serve all eligible individuals, the order of priority will be revoked by the director.

(2) Participants will be notified in writing of their category status when they are notified of their eligibility, as well as of the conditions pertaining to that category:

(a) Whether the category is open or closed.

(b) Their position on any existing waiting list.

(3) Participants will be placed in the highest priority category for which they are qualified. The date of application