



RULE-MAKING ORDER

Cl. 03 (June 2004)
(Implements RCW 34.05.360)

Agency: **State Building Code Council**

- Permanent Rule**
- Emergency Rule**

Effective date of rule:

Permanent Rules

- 31 days after filing.
- Other (specify) July 1, 2005 (If less than 31 days after filing, a specific finding under RCW 34.05.380(3) is required and should be stated below)

Effective date of rule:

Emergency Rules

- Immediately upon filing.
- Later (specify) _____

Any other findings required by other provisions of law as precondition to adoption or effectiveness of rule?

- Yes
 - No
- If Yes, explain:

Purpose: To amend the Washington State Energy Code, WAC 51-11, to update mechanical efficiency, envelope, and lighting requirements for consistency with national standards and increase energy efficiency; to provide for new technology and building science; and to help increase code clarity and flexibility.

Citation of existing rules affected by this order:

Repealed:

Amended: WAC 51-11, Sections 502, 1132, 1322, 1331, 1413, 1423, 1433, 1513, 1521, and Tables 10-6, 13-1, 13-2, 14-1A, B & D, and 15-1

Suspended:

Statutory authority for adoption: RCW 19.27A.025 and RCW 19.27A.045

Other authority: RCW 19.27, 19.27A and 34.05

PERMANENT RULE ONLY (Including Expedited Rule Making)

Adopted under notice filed as WSR 04-17-120 on August 17, 2004 (date).

Describe any changes other than editing from proposed to adopted version: Section 1413.4, Humidification, was amended to provide additional clarity and flexibility; Option 1 was selected in Section 1433; the proposed amendment to Section 1437 was not adopted; and the proposed amendment to Table 15-1 was revised to retain the current lighting power allowance for schools.

If a preliminary cost-benefit analysis was prepared under RCW 34.05.328, a final cost-benefit analysis is available by contacting: N/A

Name: _____ phone () _____
 Address: _____ fax () _____
 e-mail _____

EMERGENCY RULE ONLY

Under RCW 34.05.350 the agency for good cause finds:

- That immediate adoption, amendment, or repeal of a rule is necessary for the preservation of the public health, safety, or general welfare, and that observing the time requirements of notice and opportunity to comment upon adoption of a permanent rule would be contrary to the public interest.
- That state or federal law or federal rule or a federal deadline for state receipt of federal funds requires immediate adoption of a rule.

Reasons for this finding:

Date adopted: November 12, 2004

NAME (TYPE OR PRINT)

Stan Price

SIGNATURE

TITLE

Council Chair

CODE REVISER USE ONLY

CODE REVISER'S OFFICE
STATE OF WASHINGTON

DEC 2 2004

TIME 10:50 AM/PM
 WITH 04/24/04

05-01-04
013

(COMPLETE REVERSE SIDE)

**Note: If any category is left blank, it will be calculated as zero.
No descriptive text.**

**Count by whole WAC sections only, from the WAC number through the history note.
A section may be counted in more than one category.**

The number of sections adopted in order to comply with:

Federal statute:	New	_____	Amended	_____	Repealed	_____
Federal rules or standards:	New	_____	Amended	_____	Repealed	_____
Recently enacted state statutes:	New	_____	Amended	_____	Repealed	_____

The number of sections adopted at the request of a nongovernmental entity:

New	_____	Amended	<u>13</u>	Repealed	_____
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The number of sections adopted in the agency's own initiative:

New	_____	Amended	_____	Repealed	_____
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The number of sections adopted in order to clarify, streamline, or reform agency procedures:

New	_____	Amended	<u>4</u>	Repealed	_____
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The number of sections adopted using:

Negotiated rule making:	New	_____	Amended	_____	Repealed	_____
Pilot rule making:	New	_____	Amended	_____	Repealed	_____
Other alternative rule making:	New	_____	Amended	<u>13</u>	Repealed	_____

AMENDATORY SECTION (Amending WSR 04-01-106, filed 12/17/03, effective 7/1/04)

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 23-30 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-1, 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 25 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 2603 and/or 719 of the International 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 ASTM E84-01.

EXCEPTIONS:

1. Foam plastic insulation shall comply with section 2603 of the International 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 719 of the International 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 International Building Code section 1203.2 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.

EXCEPTION:

Framed cavity can be empty or partially filled provided:

1. The wall assembly calculations are performed along with a completed performance calculation for the whole building; and
2. Insulation installed in partially filled cavities is not included in the performance calculation.

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. 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 (Options IV and V in Table 6-1 and Options V and VI 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 and R-2 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.

AMENDATORY SECTION (Amending WSR 02-01-112, filed 12/18/01, effective 7/1/02)

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	Aluminum W/Thermal Break	Vinyl/Wood Frame
Single	1.45	<u>1.45</u>	1.45
Double	0.90	<u>0.85</u>	0.75
1/2 Inch Air, Fixed	0.75	<u>0.70</u>	0.60
1/2 Inch Air, Low-e ^(0.40) , Fixed	0.60	<u>0.55</u>	0.50

Vertical Glazing			
	U-Factor		
	Any Frame	Aluminum W/Thermal Break	Vinyl/Wood Frame
<u>1/2 Inch Air, Low-e^(0.10), Fixed</u>	<u>0.55</u>	<u>0.50</u>	<u>0.45</u>
<u>1/2 Inch Argon, Low-e^(0.10), Fixed</u>	0.50	<u>0.45</u>	0.40

The category for aluminum frame with a thermal break is as defined in footnote 7 to Table 10-6A.

((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))

Overhead Glazing: Sloped Glazing (Including Frame)			
	U-Factor		
	Any Frame	Aluminum W/Thermal Break	Vinyl/Wood Frame
Single	<u>1.74</u>	<u>1.74</u>	<u>1.74</u>
Double	<u>1.08</u>	<u>1.02</u>	<u>0.90</u>
<u>1/2 Inch Air, Fixed</u>	<u>0.90</u>	<u>0.84</u>	<u>0.72</u>
<u>1/2 Inch Air, Low-e^(0.40), Fixed</u>	<u>0.72</u>	<u>0.66</u>	<u>0.60</u>
<u>1/2 Inch Air, Low-e^(0.10), Fixed</u>	<u>0.66</u>	<u>0.60</u>	<u>0.54</u>
<u>1/2 Inch Argon, Low-e^(0.10), Fixed</u>	<u>0.60</u>	<u>0.54</u>	<u>0.48</u>

This default table is applicable to sloped glazing only. (Sloped glazing is a multiple-lite glazed system (similar to a

curtain wall) that is mounted at a slope greater than 15° from the vertical plane.) Other overhead glazing shall use the defaults in Table 10-6E.

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

- <1/2" = 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".
- Any low-e (emissivity) coating (0.1, 0.2 or 0.4).
- U-factors listed for argon shall consist of sealed, gas-filled insulated units for argon, CO2, SF6, argon/SF6 mixtures and Krypton.
- "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
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

DESCRIPTION ^{2,3,4,6}	FRAME TYPE ^{7,8}			
	ALUMINUM	ALUM. THERMAL BREAK ⁹	WOOD/VINYL	ALUM. CLAD WOOD/REINFORCED VINYL ¹⁰
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 nonaluminum 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
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.

AMENDATORY SECTION (Amending WSR 01-03-010, filed 1/5/01, effective 7/1/01)

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: Where the use in a space changes from one use in Table 15-1 to another use in Table 15-1, the installed lighting wattage shall comply with Section 1521 or 1531.

Other tenant improvements, alterations or repairs where 60 percent or more of the fixtures ((in a use)) in a space enclosed by walls or ceiling-height partitions (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 in a space enclosed by walls or ceiling-height partitions 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 and, as applicable, 1513.7. In addition, office areas less than 300 ft² enclosed by walls or ceiling-height partitions, and all meeting and conference rooms, and all school classrooms, shall be equipped with occupancy sensors that comply with Sections 1513.6 and 1513.7. 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~~) also comply with the other requirements in Sections 1513.6 and 1513.7.

Where new walls or ceiling-height partitions are added to an existing space and create a new enclosed space, but the lighting fixtures are not being changed, other than being relocated, the new enclosed space shall have controls that comply with Sections 1513.1 through 1513.2, 1513.4, and 1513.6 through 1513.7.

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

AMENDATORY SECTION (Amending WSR 01-03-010, filed 1/5/01, effective 7/1/01)

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)) For prescriptive compliance only.
 - a. For glazing areas that are 30% and less of the gross wall area, the insulation of the perimeter edge of an above grade floor slab which penetrates the exterior wall may be reduced to R-5 provided the glazing U-factor is reduced by U-0.05 below that required in Tables 13-1 and 13-2.
 - b. For glazing areas that exceed 30% of the gross wall area, the perimeter edge of an above grade floor slab which penetrates the exterior wall may be left uninsulated provided that the glazing U-factor is reduced by U-0.10 below that required in Tables 13-1 and 13-2.

AMENDATORY SECTION (Amending WSR 01-03-010, filed 1/5/01, effective 7/1/01)

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 ENVSTO diskette version 2.1 of ASHRAE/HESNA Standard 90-1-1989, or an approved alternative, with the following additional requirements:

- 1- Only the Exterior Wall Requirements portion of the ENVSTO 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:))

AMENDATORY SECTION (Amending WSR 01-03-010, filed 1/5/01, effective 7/1/01)

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.

**Equation 13-1:
Target UA_{tj}**

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_{fl} = 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_{fl} = The proposed floor over unconditioned space area, A_f .
- P_{st} = The proposed lineal 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_v .

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_{wi} = The greater of:
 proposed opaque above grade wall area, and
 the gross exterior above grade wall area minus A_{di} 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

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

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_r = The thermal transmittance of the floor over unconditioned space area.

A_r = 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.

SHGC₁ = 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_{ogon} and A_{vgr} 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)) U = 0.046	((R-11 or U=0.14)) (a) Metal framing: R-19 or U = 0.109 (b) Wood framing and framing other than metal: R-19 or U = 0.062	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	Maximum U-Factor		Max. SHGC	Maximum U-Factor		Max. SHGC	Maximum U-Factor		Max. SHGC
	VG	OG		VG	OG		VG	OG		VG	OG	
1. Electric resistance heat	0.4	0.8	1.0	0.4	0.8	1.0	PRESCRIPTIVE PATH NOT ALLOWED					
2. All others including Heat pumps and VAV	0.9	1.4	1.0	0.7	1.4	1.0	0.6	1.3	0.65	0.5	1.2	0.45))

Maximum Glazing Area as % of Wall	0% to 30%				>30% to 45%			
	Maximum U-Factor		Max. SHGC ¹	Maximum U-Factor		Max. SHGC ¹		
	VG	OG		VG	OG			
1. Electric resistance heat	0.40	0.60	0.40	PRESCRIPTIVE PATH NOT ALLOWED				
2. All others including heat pumps and VAV	0.55	0.70	0.45	0.45	0.60	0.40		

Footnotes

- 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,
 - Walls shall be insulated for the first 10 feet below grade. (There shall be no credit for those portions of below grade walls and footings that are more than 10 feet below grade, and ((not)) those portions below 10 feet shall not be 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_{bgwi} ,
 - Walls insulated on the exterior shall use a target U-factor of $U = 0.070$ for U_{bgwi} ,
 - The calculations shall include the first 10 feet of walls below grade. (Those portions of below grade walls and footings that are more than 10 feet below grade(~~and not~~) shall not be included in the gross exterior wall area(~~need~~) and shall not be included when determining A_{bgwi} 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)):

 - The area weighted average U-factor may be increased to U-0.15 maximum, or minimum additional R-5.7 continuous insulation uninterrupted by framing; or
 - The wall may be ASTM C90 concrete block walls, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in/h•ft²•°F. 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 glazing requirements listed above.

((Maximum Glazing Area as % of Wall	0 to 10%			>10 to 15%			>15% to 20%			>20% to 25%		
	Maximum U-Factor		Max. SHGC ¹	Maximum U-Factor		Max. SHGC ¹	Maximum U-Factor		Max. SHGC ¹	Maximum U-Factor		Max. SHGC ¹
	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:)) **Roof Types:** A roof over attic is where the roof structure has at least 30 inches clear distance from the top of the bottom chord of a truss or ceiling joist to the underside of the sheathing at the roof ridge, and the ceiling is attached to the ceiling joist or the bottom of the truss or ceiling joist. Anything else is considered all other roofs.
4. **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).
5. **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 ((F = 0.040)) U = 0.039	((R-19 or U = 0.11)) (a) Metal framing: R-13 cavity insul. +R-3.8 continuous insul. or U = 0.084 (b) Wood framing and framing other than metal: R-19 or U = 0.062	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%
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	Maximum U-Factor		Max. SHGC ^d	Maximum U-Factor		Max. SHGC ^d	Maximum U-Factor		Max. SHGC ^d	Maximum U-Factor		Max. SHGC ^d
	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	0.60	0.50	1.25	0.50))

Maximum Glazing Area as % of Wall	0% to 30%						>30% to 45%					
	Maximum U-Factor			Max. SHGC ^d			Maximum U-Factor			Max. SHGC ^d		
	VG	OG		VG	OG		VG	OG		VG	OG	
1. Electric resistance heat	0.40	0.60	0.40	PRESCRIPTIVE PATH NOT ALLOWED								
2. All others including heat pumps and VAV	0.55	0.70	0.45	0.45	0.60	0.40						

- Footnotes**
1. **Below Grade Walls:**
 When complying by the prescriptive approach, Section 1322:
 a) Walls insulated on the interior shall use opaque wall values,
 b) Walls insulated on the exterior shall use a minimum of R-12 insulation,
 c) Walls shall be insulated for the first 10 feet below grade. (There shall be no credit for insulating those portions of below grade walls and footings that are more than 10 feet below grade, and ((not)) those portions below 10 feet shall not be included in the gross exterior wall area((-may be left uninsulated))).
- When complying by the component performance approach, Section 1331:
 a) Walls insulated on the interior shall use the opaque wall values when determining U_{bgwt} ,
 b) Walls insulated on the exterior shall use a target U-factor of $U = 0.061$ for U_{bgwt} ,
 c) The calculations shall include the first 10 feet of walls below grade. (Those portions of below grade walls and footings that are more than 10 feet below grade((-and not)) shall not be included in the gross exterior wall area((-need)) and shall not be included when determining A_{bgwt} and A_{bgw2}).
2. **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)) 0.123 maximum, or minimum additional R-7.6 continuous insulation uninterrupted by framing.
 - 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-)) glazing requirements above.

Maximum Glazing Area as % of Wall	0 to 5%			>5 to 7%			>7% to 10%			>10% to 15%		
	Maximum U-Factor		Max. SHGC ^d	Maximum U-Factor		Max. SHGC ^d	Maximum U-Factor		Max. SHGC ^d	Maximum U-Factor		Max. SHGC ^d
	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	0.60	1.30	0.70	0.50	1.25	0.50	0.40	0.80	0.40))

3. ((Reserved-)) **Roof Types:** A roof over attic is where the roof structure has at least 30 inches clear distance from the top of the bottom chord of a truss or ceiling joist to the underside of the sheathing at the roof ridge, and the ceiling is attached to the ceiling joist or the bottom of the truss or ceiling joist. Anything else is considered all other roofs.
4. **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).
5. **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.

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 with waterside economizer.

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))~~)).

EXCEPTIONS:

1. Health care facilities where WAC 246-320-525 allows only steam injection humidifiers in ductwork downstream of final filters.
2. Systems with water economizer.
3. 100% outside air systems with no provisions for air recirculation to the central supply fan.
4. Nonadiabatic humidifiers cumulatively serving no more than 10% of a building's air economizer capacity as measured in cfm. This refers to the system cfm serving rooms with stand alone or duct mounted humidifiers.

AMENDATORY SECTION (Amending WSR 02-01-112, filed 12/18/01, effective 7/1/02)

WAC 51-11-1423 Economizers. Economizers meeting the requirements of Section 1413 shall be installed on (~~(single package unitary fan-)~~):

- a. Cooling units installed outdoors or in a mechanical room adjacent to outdoors having a (~~(supply capacity of greater than 1,900 cfm or a)~~) total cooling capacity greater than ((54,000)) 20,000 Btu/h including those serving computer server rooms, electronic equipment, radio equipment, telephone switchgear; and
- b. Other cooling units with a total cooling capacity greater than 54,000 Btu/h, including those serving computer server rooms, electronic equipment, radio equipment, and telephone switchgear.

The total capacity of all units without economizers (i.e., those units with a total cooling capacity less than a. and b. above) 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.

AMENDATORY SECTION (Amending WSR 02-01-112, filed 12/18/01, effective 7/1/02)

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.)~~) High-efficiency cooling units with EER values more than 10% higher than minimum efficiencies listed in Tables 14-1A, 14-1B and 14-1D, in the appropriate size category, using the same test procedures. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20% 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. This exception shall not be used for RS-29 analysis nor include unitary cooling equipment installed outdoors nor in a mechanical room adjacent to outdoors.
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.
6. Systems complying with all of the following criteria:
 - a. Consist of multiple water source heat pumps connected to a common water loop;
 - b. Have a minimum of 60% air economizer;

- c. Have water source heat pumps with an EER at least 15% higher for cooling and a COP at least 15% higher for heating than that specified in Section 1411;
- d. Where provided, have a central boiler or furnace efficiency of:
- i. 90% minimum for units up to 199,000 Btu/h; and
 - ii. 85% minimum for units above 199,000 Btu/h input; and
- e. Provide heat recovery with a minimum 50% heat recovery effectiveness as defined in Section 1436 to preheat the outside air supply.
7. For Group R Occupancy, cooling units installed outdoors or in a mechanical room adjacent to outdoors with a total cooling capacity less than 20,000 Btu/h and other cooling units with a total cooling capacity less than 54,000 Btu/h.

AMENDATORY SECTION (Amending WSR 02-01-112, filed 12/18/01, effective 7/1/02)

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		ARI 210/240
		<u>Before January 23, 2006</u>	10.0 SEER	
		<u>After January 23, 2006</u>	<u>12.0 SEER</u>	
	Single Package			
	<u>Before January 23, 2006</u>	9.7 SEER		
	<u>After January 23, 2006</u>	<u>12.0 SEER</u>		
> 65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	10.3 EER ^c		
> 135,000 Btu/h and < 240,000 Btu/h	Split System and Single Package		9.7 EER ^c	ARI 340/360
			9.5 EER ^c 9.7 IPLV ^c	
			9.2 EER ^c 9.4 IPLV ^c	
> 240,000 Btu/h and < 760,000 Btu/h	Split System and Single Package			
> 760,000 Btu/h	Split System and Single Package			
<u>Through-the-Wall, Air Cooled</u>	< 30,000 Btu/h ^d	Split System		ARI 210/240
		<u>Before January 23, 2006</u>	<u>10.0 SEER</u>	

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
		<u>After January 23, 2006</u>	<u>10.9 SEER</u>	
		<u>Single Package Before January 23, 2006</u>	<u>9.7 SEER</u>	
		<u>After January 23, 2006</u>	<u>10.6 SEER</u>	
<u>Small-Duct High-Velocity, Air Cooled</u>	<u>< 65,000 Btu/h^d</u>	<u>Split System</u>	<u>10.0 SEER</u>	<u>ARI 210/240</u>
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		ARI 210/240
		<u>Before January 23, 2006</u>	10.0 SEER	
		<u>After January 23, 2006</u>	<u>12.0 SEER</u>	
		<u>Single Package Before January 23, 2006</u>	9.7 SEER	
	<u>After January 23, 2006</u>	<u>12.0 SEER</u>		
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	10.1 EER ^c	

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split System and Single Package	9.3 EER ^c	ARI 340/360
	≥ 240,000 Btu/h	Split System and Single Package	9.0 EER ^c 9.2 IPLV ^c	
<u>Through-the-Wall (Air Cooled, Cooling Mode)</u>	< 30,000 Btu/h ^d	<u>Split System</u>		<u>ARI 210/240</u>
		<u>Before January 23, 2006</u>	<u>10.0 SEER</u>	
		<u>After January 23, 2006</u>	<u>10.9 SEER</u>	
		<u>Single Package</u>		
		<u>Before January 23, 2006</u>	<u>9.7 SEER</u>	
		<u>After January 23, 2006</u>	<u>10.6 SEER</u>	
<u>Small-Duct High-Velocity (Air Cooled, Cooling Mode)</u>	< 65,000 Btu/h ^d	<u>Split System</u>	<u>10.0 SEER</u>	<u>ARI 210/240</u>
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		ARI 210/240
		<u>Before January 23, 2006</u>	<u>6.8 HSPF</u>	
		<u>After January 23, 2006</u>	<u>7.4 HSPF</u>	
		<u>Single Package</u>		
		<u>Before January 23, 2006</u>	<u>6.6 HSPF</u>	
	<u>After January 23, 2006</u>	<u>7.4 HSPF</u>		
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.2 COP 2.2 COP	
	≥ 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.1 COP 2.0 COP	ARI 340/360

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
<u>Through-the-Wall (Air Cooled, Heating Mode)</u>	< 30,000 Btu/h ^d	<u>Split System</u>		<u>ARI 210/240</u>
		<u>Before January 23, 2006</u>	<u>6.8 HSPF</u>	
		<u>After January 23, 2006</u>	<u>7.1 HSPF</u>	
		<u>Single Package</u>		
		<u>Before January 23, 2006</u>	<u>6.6 HSPF</u>	
		<u>After January 23, 2006</u>	<u>7.0 HSPF</u>	
<u>Small-Duct High-Velocity (Air Cooled, Heating Mode)</u>	< 65,000 Btu/h ^d	<u>Split System</u>	<u>6.8 HSPF</u>	<u>ARI 210/240</u>
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 3.05 IPLV	ARI 550/590
Air Cooled, Without Condenser, Electrically Operated	All Capacities		3.10 COP 3.45 IPLV	
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	

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, 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	
<u>SPVAC (Cooling Mode)</u>	<u>All Capacities</u>	<u>95°F db/75°F wb Outdoor Air</u>	<u>8.6 EER</u>	<u>ARI-390</u>
<u>SPVHP (Cooling Mode)</u>	<u>All Capacities</u>	<u>95°F db/75°F wb Outdoor Air</u>	<u>8.6 EER</u>	
<u>SPVAC (Heating Mode)</u>	<u>All Capacities</u>	<u>47°F db/43°F wb Outdoor Air</u>	<u>2.7 COP</u>	
Room Air Conditioners, with Louvered Sides	< 6,000 Btu/h		9.7 EER	ANSI/AH AM RAC-1

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
	≥ 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	
	≥ 20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps without Louvered Sides	< 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 ^e Minimum Capacity ^e	80% E _t ^c	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

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure ^a
	≥ 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
		> 2,500,000 Btu/h ^f	Hot Water	
> 2,500,000 Btu/h ^f	Steam	80% E _c		
Boilers, Oil-Fired	< 300,000 Btu/h		80% AFUE	
	≥ 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	
	> 2,500,000 Btu/h ^f	Steam	83% E _c	

Equipment Type ^f	Size Category	Sub-Category or Rating Condition	Minimum Efficiency ^b	Test Procedure
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

Synchronous Speed (RPM)	Open Motors			Closed Motors		
	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)								
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

- 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:

$$((T = PR \frac{K}{K + t} - 1)) \quad T = PR \frac{K}{K + t} - 1$$

Where

- T = Minimum insulation thickness for material with conductivity K, inches.
 PR = Pipe actual outside radius, inches ((f-)).
 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)
- Runouts to individual terminal units not exceeding 12 ft. in length.

AMENDATORY SECTION (Amending WSR 01-03-010, filed 1/5/01, effective 7/1/01)

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. Within these buildings, all office areas less than 300 ft² enclosed by walls or ceiling-height partitions, and all meeting and conference rooms, and all school classrooms, shall be equipped with occupancy sensors that comply with Section

1513.6.1. For other spaces, 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 (e.g., 24-hour convenience stores), 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.
4. Hospitals and laboratory spaces.
5. Areas in which medical or dental tasks are performed are exempt from the occupancy sensor requirement.

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. Light fixtures controlled by occupancy sensors shall have a wall-mounted, manual switch capable of turning off lights when the space is occupied.

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.

AMENDATORY SECTION (Amending WSR 01-03-010, filed 1/5/01, effective 7/1/01)

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. ~~((Nonlensed, fluorescent fixtures;))~~ Luminaires have a reflector or louver assembly to direct the light (bare lamp strip or industrial fixtures do not comply with this section);
- c. Fitted with type T-1, T-2, T-4, T-5, ~~((T-6,))~~ T-8 or compact fluorescent lamps from 5 to ~~((50))~~ 60 watts (but not T-10 or T-12 lamps); and
- d. Hard-wired fluorescent electronic dimming ballasts ((+)) with photocell or programmable dimming control for all lamps in all zones (nondimming electronic ballasts and electronic ballasts that screw into medium base sockets do not comply with this section).

Track lighting is not allowed under this path.

EXCEPTIONS:

1. Up to a total of 5 percent of installed lighting fixtures ~~((need not be ballasted and))~~ may use any type of ~~((lamp))~~ ballasted lamp and do not require dimming controls.
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.)
4. LED lights other than exit lights addressed by exception 3.
5. Metal halide lighting which complies with all three of the following criteria:
 - i. Luminaires or lamps which have a reflector or louver assembly to direct the light;
 - ii. Fixtures are fitted with ceramic metal halide lamps not exceeding 150 watts; and
 - iii. Electronic ballasts.

AMENDATORY SECTION (Amending WSR 04-01-106, filed 12/17/03, effective 7/1/04)

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 building facade area by 0.25 watts per square foot or multiplying the building perimeter in feet by 7.5 watts per linear foot.

EXCEPTIONS:

1. Group U Occupancy accessory to Group R-3 or R-4 Occupancy.
2. 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.

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 (See also office and other appropriate categories)	((2-θ)) 1.8
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)) 1.20
Medical offices, clinics ¹²	1.20
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)) 1.00
Police and fire stations ⁸	((1-2)) 1.00
Atria (atriums)	1.0
Assembly spaces ⁹ , auditoriums, gymnasias ⁹ , theaters	1.0
Group R-1 and R-2 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 washrooms, elevator lobbies	0.8

Footnotes for Table 15-1

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-))~~ See Section 1532 for exterior lighting.
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.))~~ For conference rooms and offices less than 150 ft² with full-height partitions, a Unit Lighting Power Allowance of 1.20 W/ft² may be used.
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, provided that the display window is separated from the retail space by walls or at least three-quarter-height partitions (transparent or opaque) and 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 LED, 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.
12. Medical and clinical offices include those facilities which, although not providing overnight patient care, do provide medical, dental, or psychological examination and treatment. These spaces include, but are not limited to, laboratories and treatment centers.