



RULE-MAKING ORDER PERMANENT RULE ONLY

CR-103P (December 2017) (Implements RCW 34.05.360)

CODE REVISER USE ONLY

OFFICE OF THE CODE REVISER
STATE OF WASHINGTON
FILED

DATE: December 09, 2019

TIME: 10:28 AM

WSR 20-01-047

Agency: Washington State Building Code Council

Effective date of rule:

Permanent Rules

- 31 days after filing.
- Other (specify) July 1, 2020 (If less than 31 days after filing, a specific finding under RCW 34.05.380(3) is required and should be stated below)

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

- Yes No If Yes, explain:

Purpose: Adoption and amendment of the 2018 Washington State Energy Code, Residential—WAC 51-11R; WAC 51-11C Appendix A, Default heat loss coefficients

Citation of rules affected by this order:

New: 4
Repealed:
Amended: 53
Suspended:

Statutory authority for adoption: RCW 19.27A.020, 19.27A.045, 19.27A.160

Other authority: RCW 19.27

PERMANENT RULE (Including Expedited Rule Making)

Adopted under notice filed as WSR 19-16-137 on August 6, 2019 (date).

Describe any changes other than editing from proposed to adopted version:

1.	Definition: Added a definition for Pilot light, Continuously burning . This will help clarify the prohibition for continuously burning pilot lights in Section R403.1.3
2.	Definition: Added a definition for Pilot light, Intermittent . This will help clarify the prohibition for continuously burning pilot lights in Section R403.1.3
3.	Definition: Added a definition for Pilot light, Interrupted . This will help clarify the prohibition for continuously burning pilot lights in Section R403.1.3
4.	Definition: Added a definition for Pilot light, On-demand . This will help clarify the prohibition for continuously burning pilot lights in Section R403.1.3
5.	Section R402.4.2.1: The language for gas fireplace efficiency was revised to better correlate with the International Fuel Gas Code and the Canadian standard. The required efficiency was changed to 50 percent and decorative appliances were exempted. The proposed exemption was deleted as it was no longer necessary with the exemption of decorative appliances. Decorative fireplaces must also be labeled with their fireplace efficiency ratings even though they are not required to meet the 50 percent efficiency rating.
6.	Section R403.1.3: An exception was added to item 5 to clarify that certain types of ignition were still allowed for gas fireplaces.
7.	Section R403.5.5: The language for the requirement for insulation under electric water heaters was revised to specify a compressive strength for the required insulation.
8.	Section R405.3: Coordinating with the reduction of credits needed for a Small Dwelling Unit, the percentage over code needed to comply with the performance path was reduced to 73 percent.
9.	Table R405.3: The metric for carbon emissions for electricity was changed to 0.8.

10.	Table R406.2: The credits assigned to System Type 4, zonal electric heat with ductless heat pump, was increased to 0.5
11.	Section R406.3: The number of credit needed for Small Dwelling Unit was reduced to 3.0.
12.	Table R406.3: The credit value for Option 3.2 was increased to 1 credit; the credit value for Option 5.4 was increased to 1.5; the credit value for Option 5.5 was increased to 2.0; and the credit value for Option 5.6 was increased to 2.5. These values were all increased by 0.5 credits.

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

Name: Richard Brown
Address: PO Box 41449, Olympia WA 98504-1449
Phone: 360-407-9277
Fax:
TTY:
Email: Richard.brown@des.wa.gov
Web site: sbcc.wa.gov
Other:

**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	<u>3</u>	Repealed	___
Recently enacted state statutes:	New	___	Amended	___	Repealed	___

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

New	<u>3</u>	Amended	<u>49</u>	Repealed	___
-----	----------	---------	-----------	----------	-----

The number of sections adopted on the agency's own initiative:

New	___	Amended	___	Repealed	___
-----	-----	---------	-----	----------	-----

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

New	___	Amended	___	Repealed	___
-----	-----	---------	-----	----------	-----

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>53</u>	Repealed	___

Signature:

Date Adopted: November 8, 2019

Name: Doug Orth

Title: Council Chair



Chapter 51-11R WAC
**STATE BUILDING CODE ADOPTION AND AMENDMENT OF THE ((2015)) 2018 EDI-
TION OF THE INTERNATIONAL ENERGY CONSERVATION CODE, RESIDENTIAL**

AMENDATORY SECTION (Amending WSR 17-17-160, filed 8/23/17, effective 10/1/17)

WAC 51-11R-10100 Section R101—Scope and general requirements.

R101.1 Title. This code shall be known as the *Washington State Energy Code-Residential*, and shall be cited as such. It is referred to herein as "this code."

R101.2 Scope. This code applies to *residential buildings* and the buildings sites and associated systems and equipment. This code shall be the maximum and minimum energy code for residential construction in each town, city and county. Residential *sleeping units*, Group I-1, Condition 2 assisted living facilities licensed by Washington state under chapter 388-78A WAC and Group I-1, Condition 2 residential treatment facilities licensed by Washington state under chapter 246-337 WAC shall utilize the commercial building sections of the energy code regardless of the number of stories of height above grade plane.

R101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

R101.4 Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

R101.4.1 Mixed ((~~occupancy~~)) residential and commercial buildings. Where a building includes both *residential building* and *commercial ((~~occupancies~~)) building portions*, each ((~~occupancy~~)) portion shall be separately considered and meet the applicable provisions of the WSEC - Commercial ((~~and~~)) or WSEC - Residential Provisions.

R101.5 Compliance. *Residential buildings* shall meet the provisions of WSEC - Residential Provisions. *Commercial buildings* shall meet the provisions of WSEC - Commercial Provisions.

R101.5.1 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-10200 Section R102—(~~Applicability Duties and powers of the code official~~) Alternative materials, design and methods of construction and equipment.

R102.1 (~~Alternate materials, design and methods of construction and equipment~~) General. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code (~~provided that any such alternative has been approved~~). The *code official* shall (~~be permitted~~) have the authority to approve an alternative material, design or method of construction (~~where~~) upon application of the owner or owner's authorized agent. The code official shall first find(~~s~~) that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, (~~at least~~) not less than the equivalent of that prescribed in this code for strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the code official shall respond in writing, stating the reason why the alternative was not approved.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-10400 Section R104—Inspections.

R104.1 General. Construction or work for which a permit is required shall be subject to inspection by the *code official* or his or her designated agent, and such construction or work shall remain (~~accessible and exposed~~) visible and able to be accessed for inspection purposes until approved. It shall be the duty of the permit applicant to cause the work to remain (~~accessible and exposed~~) visible and able to be accessed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.

R104.2 Required inspections. The *code official* or his or her designated agent, upon notification, shall make the inspections set forth in Sections R104.2.1 through R104.2.5.

R104.2.1 Footing and foundation inspection. Inspections associated with footings and foundations shall verify compliance with the code as to R-value, location, thickness, depth of burial and protection of insulation as required by the code and approved plans and specifications.

R104.2.2 Framing and rough-in inspection. Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation; fenestration properties (*U*-factor and SHGC) and proper installation;

and air leakage controls as required by the code and approved plans and specifications.

R104.2.2.1 Wall insulation inspection. The building official, upon notification, shall make a wall insulation inspection in addition to those inspections required in Section R109 of the International Residential Code. This inspection shall be made after all wall and cavity insulation is in place and prior to cover.

R104.2.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and approved plans and specifications as to types of insulation and corresponding R-values and protection, and required controls.

R104.2.4 Mechanical rough-in inspection. Inspections at mechanical rough-in shall verify compliance as required by the code and approved plans and specifications as to installed HVAC equipment type and size, required controls, system insulation and corresponding R-value, system air leakage control, programmable thermostats, dampers, whole-house ventilation and minimum fan efficiency.

EXCEPTION: Systems serving multiple dwelling units shall be inspected in accordance with Section C104.2.4.

R104.2.5 Final inspection. The building shall have a final inspection and not be occupied until *approved*.

R104.3 Reinspection. A building shall be reinspected when determined necessary by the *code official*.

R104.4 Approved inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the building components and systems they are inspecting.

R104.5 Inspection requests. It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

R104.6 Reinspection and testing. Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.

R104.7 Approval. After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official*.

R104.7.1 Revocation. The *code official* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-20201 Section R202.1—A.

ABOVE-GRADE WALL. A wall enclosing *conditioned space* that is not a below-grade wall. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

ACCESSIBLE. Admitting close approach as a result of not being guarded by locked doors, elevation or other effective means (see "*Readily accessible*").

ADDITION. An extension or increase in the *conditioned space* floor area, number of stories or height of a building or structure.

ADVANCED FRAMED WALLS. Studs framed on 24-inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2x material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall. (See **Standard Framing** and Appendix A, of this code.)

AIR BARRIER. (~~Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials~~) One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies.

AIR-IMPERMEABLE INSULATION. An insulation that functions as an air barrier material.

ALTERATION. Any construction, retrofit or renovation to an existing structure other than repair or addition (~~that requires a permit~~). Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation (~~that requires a permit~~).

APPROVED. (~~Approval by~~) Acceptable to the code official (~~as a result of investigation and tests conducted by him or her, or by reason of accepted principles or tests by nationally recognized organizations~~).

APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests or furnishing inspection services, (~~when~~) or furnishing product certification, where such agency has been approved by the *code official*.

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature or mechanical configuration (see "*Manual*").

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-20202 Section R202.2—B.

BASEMENT WALL. See *above-grade wall* and *below-grade wall*.

BELOW-GRADE WALL. That portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy, including any mechanical systems, service water heating systems and electric power and lighting systems located on the building site and supporting the building.

BUILDING SITE. A contiguous area of land that is under the ownership or control of one entity.

BUILDING THERMAL ENVELOPE. The *below-grade walls, above-grade walls, floors, ceilings, roofs, and any other building element((s)) assemblies* that enclose *conditioned space* or provides a boundary between *conditioned space* and exempt or unconditioned space.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-20203 Section R202.3—C.

C-FACTOR (THERMAL CONDUCTANCE). The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces (Btu/h ft² × °F) [W/(m² × K)].

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to the fixture supply and back to the water-heating equipment.

CLIMATE ZONE. A geographical region based on climatic criteria as specified in this code.

CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

COMMERCIAL BUILDING. For this code, all buildings that are not included in the definition of "Residential buildings."

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the *conditioned space*.

CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

CONNECTED THERMOSTAT. An internet enabled device that automatically adjusts heating and cooling temperature settings.

CONTINUOUS AIR BARRIER. A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

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

CURTAIN WALL. Fenestration products used to create an external nonload-bearing wall that is designed to separate the exterior and interior environments.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-20204 Section R202.4—D.

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system (~~(where pump(s) prime the service hot water piping with heated water upon demand for hot water)~~) having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe.

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

DUCT SYSTEM. A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

DUCTLESS MINI-SPLIT HEAT PUMP SYSTEM. A heating and cooling system that is comprised of one or multiple indoor evaporator/air-handling units and an outdoor condensing unit that is connected by refrigerant piping and electrical wiring. A ductless mini-split system is capable of cooling or heating one or more rooms without the use of a central ductwork system.

DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-20206 Section R202.6—F.

FENESTRATION. Products classified as either vertical fenestration or skylights.

VERTICAL FENESTRATION. Windows (fixed or (~~moveable~~) operable), glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of (~~at least~~) not less than 60 degrees from horizontal. Opaque areas such as spandrel panels are not considered vertical fenestration.

SKYLIGHT. Glass or other transparent or translucent glazing material installed with a slope of less than 60 degrees from horizontal.

FENESTRATION AREA. Total area of the fenestration measured using the rough opening, and including the glazing, sash and frame.

FENESTRATION PRODUCT, FIELD-FABRICATED. A fenestration product whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration.

FENESTRATION PRODUCT, SITE-BUILT. A fenestration designed to be made up of field-glazed or field-assembled units using specific factory cut or otherwise factory-formed framing and glazing units. Examples of site-built fenestration include storefront systems, curtain walls, and atrium roof systems.

F-FACTOR. The perimeter heat loss factor for slab-on-grade floors (Btu/h × ft × °F) [W/(m × K)].

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-20208 Section R202.8—H.

HEATED SLAB-ON-GRADE FLOOR. Slab-on-grade floor construction in which the heating elements, hydronic tubing, or hot air distribution system is in contact with, or placed within or under, the slab.

HIGH-EFFICACY (~~(LAMPS. Compact fluorescent lamps)~~) **LIGHT SOURCES.** Fixtures that use light emitting diodes (LED), T-8 or smaller diameter linear fluorescent lamps, or other lamps with a minimum efficacy of ((÷

1. ~~60 lumens per watt for lamps over 40 watts;~~

2. ~~50 lumens per watt for lamps over 15 watts to 40 watts; and~~

3. ~~40 lumens per watt for lamps 15 watts or less)~~) 65 lumens per watt.

HISTORIC BUILDINGS. Buildings that are listed in or eligible for listing in the *National Register of Historic Places*, or designated as historic under an appropriate state or local law.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-20212 Section R202.12—L.

LABELED. Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, (~~(inspection)~~) approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *code official* and concerned with evaluation of products or services that maintains periodic inspection of production of *listed* equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

LOG STRUCTURE. A type of construction whose primary structural elements are formed by a system of logs.

LOG WALL. An assembly of individual structural logs for use as an exterior or interior load bearing wall, shear wall or nonload bearing wall.

LOW-VOLTAGE LIGHTING. A lighting system consisting of an isolating power supply, the low voltage luminaires, and associated equipment that are all identified for the use. The output circuits of the power supply operate at 30 volts (42.4 volts peak) or less under all load conditions.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-20215 Section R202.15—O.

OPAQUE DOOR. A door that is not less than 50 percent opaque in surface area.

PILOT LIGHT, CONTINUOUSLY BURNING. A small gas flame used to ignite gas at a larger burning. Once lit, a continuous pilot light remains in operation until manually interrupted. Pilot light ignition systems with the ability to switch between intermittent and continuous mode are considered continuous.

PILOT LIGHT, INTERMITTENT. A pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner operation. The pilot is automatically extinguished when each main burner operating cycle is completed.

PILOT LIGHT, INTERRUPTED. A pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished after the main flame is established.

PILOT LIGHT, ON-DEMAND. A pilot which, once placed into operation, is intended to remain ignited for a predetermined period of time following an automatic or manual operation of the main burner gas valve.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-20218 Section R202.18—R.

READILY ACCESSIBLE. Capable of being reached quickly for operation, renewal or inspection without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders or access equipment (see "Accessible").

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover" and "Roof replacement."

RESIDENTIAL BUILDING. For this code, includes detached one- and two-family dwellings (~~and~~), multiple single-family dwellings (townhouses) (~~as well as~~) and Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane, as well as accessory structures thereto.

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, underlayment(~~(τ)~~) and roof deck, and can also include a thermal barrier, an ignition barrier, insulation(~~(τ)~~) or a vapor retarder (~~and interior finish~~).

ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

R-VALUE (THERMAL RESISTANCE). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$) [$\text{m}^2 \cdot \text{K}/\text{W}$].

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-30310 Section R303.1—Identification.

R303.1 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

R303.1.1 Building thermal envelope insulation. An R-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and R-value of installed thickness shall be *listed* on the certification. For insulated siding, the R-value shall be labeled on the product's package and shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

R303.1.1.1 Blown or sprayed roof/ceiling insulation. The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed R-value shall be *listed* on certification provided by the insulation installer.

EXCEPTION: For roof insulation installed above the deck, the R-value shall be labeled as required by the material standards specified in Table 1508.5 of the International Building Code or Table R906.2 of the International Residential Code.

R303.1.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's R-value mark is readily observable upon inspection.

R303.1.3 Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100.

EXCEPTION: Where required, garage door *U*-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined by an accredited, independent laboratory, and labeled and certified by the manufacturer.

Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table R303.1.3(1), R303.1.3(2) or R303.1.3(4). The solar heat gain coefficient (SHGC) and visible transmittance (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table R303.1.3(3).

- EXCEPTIONS:
1. Units without NFRC ratings produced by a *small business* may be assigned default *U*-factors from Table R303.1.3(5) for vertical fenestration.
 2. Owner-built, nonoperable wood frame window consisting of a double pane unit with low-*e* ($E = 0.04$ or less), 1/2-inch air space with argon fill.

R303.1.4 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (C.F.R. Title 16, Part 460) in units of $h \times ft^2 \times ^\circ F/Btu$ at a mean temperature of 75°F (24°C).

R303.1.4.1 Insulated siding. The thermal resistance (*R*-value) of insulated siding shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's installation instructions.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-30311 Table R303.1.3(1)—Default glazed fenestration *U*-factor.

TABLE R303.1.3(1)
 DEFAULT GLAZED ((FENESTRATION)) WINDOW, GLASS DOOR AND SKYLIGHT *U*-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT See Table R303.1.3(4)
Metal	1.20	0.80	
Metal with Thermal Break ^a	1.10	0.65	
Nonmetal or Metal Clad	0.95	0.55	
Glazed Block	0.60		

^a Metal Thermal Break = A metal thermal break framed window shall incorporate the following minimum design characteristics:
 1) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/h/ft²/°F;
 2) The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and
 3) All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in a) and b) above.

WAC 51-11R-30312 Table R303.1.3(2)—Default opaque door *U*-factors.

**TABLE R303.1.3(2)
DEFAULT OPAQUE DOOR *U*-FACTORS**

Door Type	No Glazed Fenestration	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.)					
Slab Doors					
Wood slab in wood frame ^a	0.46				
6% glazed fenestration (22 in. x 8 in. lite)	-	0.48	0.47	0.46	0.44
25% glazed fenestration (22 in. x 36 in. lite)	-	0.58	0.48	0.46	0.42
45% glazed fenestration (22 in. x 64 in. lite)	-	0.69	0.49	0.46	0.39
More than 50% glazed fenestration	Use Table R303.1.3(1)				
Insulated steel slab with wood edge in wood frame ^a	0.16				
6% glazed fenestration (22 in. x 8 in. lite)	-	0.21	0.20	0.19	0.18
25% glazed fenestration (22 in. x 36 in. lite)	-	0.39	0.28	0.26	0.23
45% glazed fenestration (22 in. x 64 in. lite)	-	0.58	0.38	0.35	0.26
More than 50% glazed fenestration	Use Table R303.1.3(1)				
Foam insulated steel slab with metal edge in steel frame ^b	0.37				
6% glazed fenestration (22 in. x 8 in. lite)	-	0.44	0.42	0.41	0.39
25% glazed fenestration (22 in. x 36 in. lite)	-	0.55	0.50	0.48	0.44
45% glazed fenestration (22 in. x 64 in. lite)	-	0.71	0.59	0.56	0.48
More than 50% glazed fenestration	Use Table R303.1.3(1)				
Cardboard honeycomb slab with metal edge in steel frame ^b	0.61				
Style and Rail Doors					
Sliding glass doors/French doors	Use Table R303.1.3(1)				
Site-Assembled Style and Rail Doors					
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

Note: Appendix A Tables A107.1(2) through A107.1(4) may also be used if applicable.
a Thermally broken sill (add 0.03 for nonthermally broken sill).
b Nonthermally broken sill.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40100 Section R401—General.

R401.1 Scope. This chapter applies to residential buildings.

R401.2 Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404. In addition, dwelling units and sleeping units in a residential building shall comply with Section R406.

2. Section R405 (~~(and the provisions of Sections R401 through R404 labeled "Mandatory.")~~). In addition, dwelling units and sleeping units in a residential building shall comply with Section R406.

3. Section R407.

R401.3 Certificate (~~(Mandatory)~~). A permanent certificate shall be completed by the builder or (~~registered design professional~~) other approved party and posted on a wall in the space where the furnace is located, a utility room, or an approved location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *below-grade wall*, and/or floor) and ducts outside conditioned spaces; U-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration(~~(, and)~~); the results from any required duct system and building envelope air leakage testing done on the building; and the results from the whole-house mechanical ventilation system flow rate test. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling, whole-house mechanical ventilation, and service water heating (~~(equipment)~~) appliances. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

The code official may require that documentation for any required test results include an electronic record of the time, date, and location of the test. A date-stamped smart phone photo or air leakage testing software may be used to satisfy this requirement.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-40210 Section R402.1—General.

R402.1 General (~~(Prescriptive)~~). The *building thermal envelope* shall meet the requirements of Sections R402.1.1 through ~~(R402.1.5)~~ R402.1.6.

EXCEPTION: The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft² (10.7 W/m²) or 1.0 watt/ft² of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses isolated from any conditioned space and not intended for occupancy.

R402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table R402.1.1 based on the climate zone specified in Chapter 3.

R402.1.2 R-value computation. Insulation R-value shall be determined as specified in Section R303.1.4. Insulation material used in layers, such as framing cavity insulation or continuous insulation, shall be summed to compute the corresponding component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table R402.1.1, the ~~(manufacturer must supply an ICC Report that the R-factor has been certified, or use R-5 per inch for extruded polystyrene, and R-6 per inch for polyisocyanurate rigid insulation)~~ manufacturer's labeled R-value for insulated siding shall be reduced by R-0.6.

R402.1.3 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table R402.1.3 shall be permitted as an alternative to the R-value in Table R402.1.1. U-factors shall be determined as specified in Section R402.1.5.

R402.1.4 Total UA alternative. If the ~~(total)~~ proposed building thermal envelope UA ~~(sum of U-factor times assembly area)~~ is less than or equal to the ~~(total UA resulting from using the U-factors in Table R402.1.3 (multiplied by the same assembly area as in the proposed building))~~ target UA, the building shall be considered in compliance with Table R402.1.1. The proposed UA shall be calculated in accordance with Equation 2. The target UA shall be calculated in accordance with Equation 1. U-factors shall be determined as specified in Section R402.1.5.

R402.1.5 U-factor reference and calculations. The U-factors for typical construction assemblies are included in Appendix A in chapter 51-11C WAC. These values shall be used for all calculations. Where proposed construction assemblies are not represented in Appendix A, values shall be calculated in accordance with the ASHRAE *Handbook of Fundamentals* using the framing factors listed in Appendix A where applicable and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance. ~~(When using REScheck, the U-factors calculated by the software based on component R-value descriptions are acceptable. For the base building UA calculation, the maximum glazing area is 15% of the floor area.~~

~~R402.1.5))~~ Fenestration U-factors shall comply with Section R303.1.3, Fenestration product rating.

R402.1.6 Vapor retarder. Wall assemblies in the building thermal envelope shall comply with the vapor retarder requirements of Section

R702.7 of the *International Residential Code* or Section 1405.3 of the *International Building Code*, as applicable.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-40211 Table R402.1.1—Insulation and fenestration requirements by component.

**TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

((Climate Zone	Fenestration <i>U</i>-Factor^b	Skylight^b <i>U</i>-Factor	Glazed Fenestration SHGC^{b,c}	Ceiling <i>R</i>-Value^k	Wood Frame Wall^{g,m,n} <i>R</i>-Value	Mass Wall <i>R</i>-Valueⁱ	Floor <i>R</i>-Value	Below- Grade^{c,m} Wall <i>R</i>-Value	Slab^d <i>R</i>-Value & Depth
5 and Marine 4	0.30	0.50	NR	49	21 int	21/21	30	10/15/ 21 int+TB	10, 2 ft)

Climate Zone	Fenestration <i>U</i>-Factor^b	Skylight^b <i>U</i>-Factor	Ceiling <i>R</i>-Value^c	Wood Frame Wall^{g, h} <i>R</i>-Value	Floor <i>R</i>-Value	Below-Grade^{c, h} Wall <i>R</i>-Value	Slab^{d, f} <i>R</i>-Value & Depth
5 and Marine 4	0.30	0.50	49	21 int	30	10/15/ 21 int+5TB	10, 2 ft

For SI: 1 foot = 304.8 mm, ci = continuous insulation, int = intermediate framing.
^a *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the compressed *R*-value of the insulation from Appendix Table A101.4 shall not be less than the *R*-value specified in the table.
^b The fenestration *U*-factor column excludes skylights. ((The SHGC column applies to all glazed fenestration:))
^c "10/15/21+5TB" means R-10 continuous insulation on the exterior of the wall, or R-15 on the continuous insulation on the interior of the wall, or R-21 cavity insulation plus a thermal break between the slab and the basement wall at the interior of the basement wall. "10/15/21+5TB" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the wall. "TB" means R-5 thermal break between floor slab and basement wall.
^d R-10 continuous insulation is required under heated slab on grade floors. See Section R402.2.9.1.
^e There are no SHGC requirements in the Marine Zone.
^f Reserved.
^g Reserved.
^h Reserved.
ⁱ The second *R*-value applies when more than half the insulation is on the interior of the mass wall.
^j Reserved.
^k For single rafter- or joist-vaulted ceilings, the insulation may be reduced to R-38.
^l Reserved.
^m Int. (intermediate framing) denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.
ⁿ Log and solid timber walls with a minimum average thickness of 3.5 inches are exempt from this insulation requirement.)
^c For single rafter- or joist-vaulted ceilings, the insulation may be reduced to R38 if the full insulation depth extends over the top plate of the exterior wall.
^f R-7.5 continuous insulation installed over an existing slab is deemed to be equivalent to the required perimeter slab insulation when applied to existing slabs complying with Section R503.1.1. If foam plastic is used, it shall meet the requirements for thermal barriers protecting foam plastics.
^g For log structures developed in compliance with Standard ICC 400, log walls shall meet the requirements for *climate zone 5* of ICC 400.
^h Int. (intermediate framing) denotes framing and insulation as described in Section A103.2.2 including standard framing 16 inches on center, 78 percent of the wall cavity insulated and headers insulated with a minimum of R-10 insulation.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40213 Table R402.1.3—Equivalent *U*-factors.

**TABLE R402.1.3
EQUIVALENT *U*-FACTORS^a**

((Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor^b	Floor U-Factor	Below-Grade Wall U-Factor
5 and Marine 4	0.30	0.50	0.026	0.056	0.056	0.029	0.042-))

Climate Zone 5 and Marine 4	
Fenestration U-Factor	0.30
Skylight U-Factor	0.50
Ceiling U-Factor	0.026
Above-Grade Wall U-Factor	0.056
Floor U-Factor	0.029
Slab on Grade F-Factor	0.54
Below Grade 2' Depth	
Wall U-Factor	0.042
Slab F-Factor	0.59
Below Grade 3.5' Depth	
Wall U-Factor	0.040
Slab F-Factor	0.56
Below Grade 7' Depth	
Wall U-Factor	0.035
Slab F-Factor	0.50

^a ((Nonfenestration)) *U*-factors or *F*-factors shall be obtained from measurement, calculation or an approved source or as specified in Section ((R402.1.3)) R402.1.5.

((^b Reserved.

^c Reserved.))

NEW SECTION

WAC 51-11R-40215 Target/Proposed UA equations.

**EQUATION 1 - GROUP R OCCUPANCY
TARGET UA**

$$UA_T = U_W A_W + U_{BGW} A_{BGW} + U_{VG} A_{VG} + U_{OG} A_{OG} + U_F A_F + U_{RC} A_{RC} + U_D A_D + F_S P_S + F_{BGS} P_{BGS}$$

Where:

- UA_T = The target combined thermal transmittance of the gross exterior wall, floor and roof/ceiling area.
- U_W = The thermal transmittance value of the opaque above grade wall found in Table R402.1.3.
- A_W = Opaque above grade wall area.
- U_{BGW} = The thermal transmittance value of the below grade opaque wall found in Table R402.1.3.
- A_{BGW} = Opaque below grade wall area.
- U_{VG} = The thermal transmittance value of the fenestration found in Table R402.1.3.
- A_{VG} = (a) The proposed glazing area; where proposed fenestration glazing area is less than 15 percent of the conditioned floor area, minus A_{OG}.
(b) 15 percent of the conditioned floor area; where the proposed fenestration glazing area is 15 percent or more of the conditioned floor area, minus A_{OG}.
- U_{OG} = The thermal transmittance value of the skylight glazing found in Table R402.1.3.

- A_{OG} = Skylight glazing area (if the proposed A_{OG} exceeds 15 percent, the target A_{OG} shall be 15 percent of the total floor area of the conditioned space).
- U_F = The thermal transmittance value of the floor found in Table R402.1.3.
- A_F = Floor area over unconditioned space.
- U_{RC} = The thermal transmittance value of the ceiling found in Table R402.1.3.
- A_{RC} = Roof/ceiling area.
- U_D = The thermal transmittance value of the fenestration found in Table R402.1.3.
- A_D = Opaque door area.
- F_S = Concrete slab on grade component F -factor found in Table R402.1.3.
- P_S = Lineal ft. of concrete slab on grade perimeter.
- F_{BGS} = Concrete below grade slab component F -factor found in Table R402.1.3.
- P_{BGS} = Lineal ft. of concrete below grade slab perimeter.

**EQUATION 2 – GROUP R OCCUPANCY
PROPOSED UA**

$$UA = U_W A_W + U_{BGW} A_{BGW} + U_{VG} A_{VG} + U_{OG} A_{OG} + U_F A_F + U_{RC} A_{RC} + U_D A_D + F_S P_S + F_{BGS} P_{BGS}$$

Where:

- UA = The combined thermal transmittance of the gross exterior wall, floor and roof/ceiling assembly area.
- U_W = The thermal transmittance of the opaque above grade wall area.
- A_W = Opaque above grade wall area.
- U_{BGW} = The thermal transmittance value of the below grade opaque wall.
- A_{BGW} = Opaque below grade wall area.
- U_{VG} = The thermal transmittance value of the fenestration glazing.
- A_{VG} = Fenestration glazing area, including windows in exterior doors.
- U_{OG} = The thermal transmittance value of the skylight glazing.
- A_{OG} = Skylight glazing area.
- U_F = The thermal transmittance of the floor.
- A_F = Floor area over unconditioned space.
- U_{RC} = The thermal transmittance of the ceiling.
- A_{RC} = Ceiling area.
- U_D = The thermal transmittance value of the opaque door area.
- A_D = Opaque door area.
- F_S = Concrete slab on grade component F -factor.
- P_S = Lineal ft. of concrete slab on grade perimeter.
- F_{BGS} = Concrete below grade slab component F -factor.
- P_{BGS} = Lineal ft. of concrete below grade slab perimeter.

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 subelements as:

$$U_{W1} A_{W1} + U_{W2} A_{W2} + U_{W3} A_{W3} + \dots \text{etc.}$$

NOTE: Below grade walls: The wall is assumed to extend from the slab upward to the top of the mud sill for the distance specified in Table A104.1, with 6 inches of concrete wall extending above grade. This will be calculated separately from above grade walls using the wall height that best describes the system.

WAC 51-11R-40220 Section R402.2—Specific insulation requirements.

R402.2 Specific insulation requirements (~~(Prescriptive)~~). In addition to the requirements of Section R402.1, insulation shall meet the specific requirements of Sections R402.2.1 through R402.2.11.

R402.2.1 Ceilings with attic spaces. Where Section R402.1.1 would require R-49 in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

R402.2.1.1 Loose insulation in attic spaces. 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.

R402.2.3 Eave baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal to or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material.

R402.2.4 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 that prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to 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.

EXCEPTION: Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table R402.1.1.

R402.2.5 Mass walls. Mass walls (~~(for the purposes of this chapter)~~), where used as a component of the thermal envelope of a building, shall be (~~considered~~) one of the following:

1. Constructed of above-grade walls of concrete block, concrete, insulated concrete form (~~(ICF)~~), masonry cavity, brick (~~(other than)~~) but not brick veneer, (~~earth-~~)adobe, compressed earth block, rammed earth(~~-and~~), mass timber, solid (~~(timber/logs, or)~~) timber or solid logs.

2. Any other wall(~~s~~) having a heat capacity greater than or equal to 6 Btu/ft² x °F (123 kJ/m² x K).

R402.2.6 Steel-frame ceilings, walls, and floors. Steel-frame ceilings, walls, and floors shall (~~meet~~) comply with the *U*-factor requirements of Table R402.1.3.

R402.2.7 Floors. Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of the subfloor decking. 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.

EXCEPTIONS:

1. The floor framing cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum Wood Frame Wall *R*-value in Table R402.1.1 and extends from the bottom to the top of all perimeter floor framing members.
2. 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.
3. Substantial contact with the surface being insulated is not required in enclosed floor/ceiling assemblies containing ducts where full *R*-value insulation is installed between the duct and the exterior surface.

R402.2.8 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 and shall include R-5 rigid board providing a thermal break between the concrete wall and the slab.

R402.2.9 Slab-on-grade floors. The minimum thermal resistance (*R*-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table C402.1.1. The insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. A two-inch by two-inch (maximum) pressure treated nailer may be placed at the finished floor elevation for attachment of interior finish materials. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil.

R402.2.9.1 Heated slab-on-grade floors (~~(Mandatory)~~). The entire area of a heated slab-on-grade floor 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 heated slab-on-grade floor, which results in increased convective flow below the heated slab-on-grade floor, the heated slab-on-grade floor shall be thermally isolated from the sub-slab gravel layer. R-10 heated slab-on-grade floor insulation is required for all compliance paths.

R402.2.10 Reserved.

R402.2.11 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40230 Section R402.3—Fenestration.

R402.3 Fenestration (~~(Prescriptive)~~). In addition to the requirements of Section R402, fenestration shall comply with Sections R402.3.1 through R402.3.5.

R402.3.1 U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

R402.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

R402.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m²) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section R402.1.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

R402.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (2.22 m²) in area is exempted from the *U*-factor requirement in Section R402.1.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

R402.3.5 Reserved.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40240 Section R402.4—Air leakage.

R402.4 Air leakage (~~(Mandatory)~~). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

R402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

R402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

R402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). For this test only, the volume of the home shall be the conditioned floor area in ft² (m²) multiplied by 8.5 feet (2.6 m). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*. Once visual inspection has confirmed sealing (see Table R402.4.1.1),

operable windows and doors manufactured by *small business* shall be permitted to be sealed off at the frame prior to the test.

EXCEPTION: For dwelling units that are accessed directly from the outdoors, other than detached one family dwellings and townhouses, an air leakage rate not exceeding 0.4 cfm per square foot of the dwelling unit enclosure area shall be an allowable alternative. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals) in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827. For the purpose of this test only, enclosure area to be calculated as the perimeter of the dwelling unit, measured to the outside face of the exterior walls, and the centerline of party walls, times 8.5 feet, plus the ceiling and floor area. Doors and windows of adjacent dwelling units (including top and bottom units) shall be open to the outside during the test. This exception is not permitted for dwelling units that are accessed from corridors or other enclosed common areas.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, if installed at the time of the test, shall be open, access hatches to conditioned crawl spaces and conditioned attics shall be open;
4. Exterior (~~openings~~) or interior terminations for continuous ventilation systems and heat recovery ventilators shall be (~~closed and~~) sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

EXCEPTIONS:

1. Additions less than 500 square feet of conditioned floor area.
2. Additions tested with the existing home having a combined maximum air leakage rate of 7 air changes per hour. To qualify for this exception, the date of construction of the existing house must be prior to the 2009 Washington State Energy Code.

R402.4.2 Fireplaces. New wood-burning fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air. When using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907.

R402.4.2.1 Gas fireplace efficiency. All vented gas fireplace heaters rated to ANSI Z21.88 shall be listed and labeled with a fireplace efficiency (FE) rating of 50 percent or greater in accordance with CSA P.4.1. Vented gas fireplaces (decorative appliances) certified to ANSI Z21.50 shall be listed and labeled, including their FE ratings, in accordance with CSA P.4.1.

R402.4.3 Air leakage of fenestration. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m²), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m²), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and *listed and labeled* by the manufacturer.

EXCEPTIONS:

1. Field-fabricated fenestration products (windows, skylights and doors).
2. Custom exterior fenestration products manufactured by a small business provided they meet the applicable provisions of Chapter 24 of the *International Building Code*. Once visual inspection has confirmed the presence of a gasket, operable windows and doors manufactured by *small business* shall be permitted to be sealed off at the frame prior to the test.

R402.4.4 Combustion air openings. In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion, space conditioning fuel burning appliances, the appliances and combustion air openings shall be located outside of the building thermal envelope, or enclosed in a room isolated from inside the thermal envelope.

lope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.1, where the walls, floors and ceilings shall meet the minimum of the below-grade wall R-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through conditioned space to a minimum of R-8.

- EXCEPTIONS:
1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
 2. Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the *International Residential Code*.

R402.4.5 Recessed lighting. Recessed luminaires installed in the *building thermal envelope* shall be Type IC-rated and certified under ASTM E283 as having an air leakage rate not more than 2.0 cfm (0.944 L/s) when tested at a 1.57 psf (75 Pa) pressure differential and shall have a label attached showing compliance with this test method. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40241 Table R402.4.1.1—Air barrier and insulation installation.

**TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION**

COMPONENT	AIR BARRIER CRITERIA ^a	INSULATION CRITERIA ^a
General requirements	<p>A continuous air barrier shall be installed in the building envelope.</p> <p>Exterior thermal envelope contains a continuous air barrier.</p> <p>Breaks or joints in the air barrier shall be sealed.</p>	<p>Air-permeable insulation shall not be used as a sealing material.</p>
Cavity insulation installation		<p>All cavities in the thermal envelope shall be filled with insulation. The density of the insulation shall be at the manufacturers' product recommendation and said density shall be maintained for all volume of each cavity. Batt type insulation will show no voids or gaps and maintain an even density for the entire cavity. Batt insulation shall be installed in the recommended cavity depth. Where an obstruction in the cavity due to services, blocking, bracing or other obstruction exists, the batt product will be cut to fit the remaining depth of the cavity. Where the batt is cut around obstructions, loose fill insulation shall be placed to fill any surface or concealed voids, and at the manufacturers' specified density. Where faced batt is used, the installation tabs must be stapled to the face of the stud. There shall be no compression to the batt at the edges of the cavity due to inset stapling installation tabs.</p> <p>Insulation that upon installation readily conforms to available space shall be installed filling the entire cavity and within the manufacturers' density recommendation.</p>

COMPONENT	AIR BARRIER CRITERIA ^a	INSULATION CRITERIA ^a
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. Batt insulation installed in attic roof assemblies may be compressed at exterior wall lines to allow for required attic ventilation.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking or floor framing cavity insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the underside of floor framing and extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I, black vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit and installed to the correct density without any voids or gaps or compression, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the ((drywall)) <u>finished surface</u> .	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls. There shall be no voids or gaps or compression where cut to fit. Insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate ((them)) <u>the wall</u> from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior wall	The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.	

COMPONENT	AIR BARRIER CRITERIA ^a	INSULATION CRITERIA ^a
HVAC register boots	HVAC supply and return register boots ((that penetrate building thermal envelope)) shall be sealed to the subfloor, wall covering or ((drywall)) ceiling penetrated by the boot.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

IC = insulation contact.

^a In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40250 Section R402.5—Maximum fenestration U-factor and SHGC.

R402.5 Maximum fenestration U-factor ~~((Mandatory))~~. The area-weighted average maximum fenestration U-factor permitted using tradeoffs from Section R402.1.4 or R405 shall be 0.48 for vertical fenestration, and 0.75 for skylights.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40310 Section R403.1—Controls.

R403.1 Controls ~~((Mandatory))~~. At least one thermostat shall be provided for each separate heating and cooling system.

R403.1.1 Programmable or connected thermostat. Where the primary heating system is a forced-air furnace, at least one thermostat per dwelling unit shall be Energy Star certified and capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. The thermostat shall allow for, at a minimum, a 5-2 programmable schedule (weekdays/weekends) and be capable of providing at least two programmable set-back/setup periods per day. This thermostat shall include the capability to set back, set up or temporarily operate the system to maintain zone temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C). The thermostat and/or control system shall have an adjustable deadband of not less than 10°F.

- EXCEPTIONS:
1. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
 2. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.
 3. Ductless mini-split heat pump systems that have an integral proprietary thermostat.

R403.1.2 Heat pump supplementary heat (~~(Mandatory)~~). Unitary air cooled heat pumps shall include controls that minimize supplemental heat usage during start-up, set-up, and defrost conditions. These controls shall anticipate need for heat and use compression heating as the first stage of heat. Controls shall indicate when supplemental heating is being used through visual means (e.g., LED indicators). Heat pumps equipped with supplementary heaters shall be installed with controls that prevent supplemental heater operation above 40°F. At final inspection the auxiliary heat lock out control shall be set to 35°F or less.

R403.1.3 Continuously burning pilot lights. The natural gas systems and equipment listed below are not permitted to be equipped with continuously burning pilot lights.

1. Fan-type central furnaces.
2. Household cooking appliances.

EXCEPTION: Household cooking appliances without electrical supply voltage connections and in which each pilot light consumes less than 150 Btu/hr.

3. Pool heaters.
4. Spa heaters.
5. Fireplaces.

EXCEPTION: Any fireplace with on-demand, intermittent or interrupted ignition (as defined in ANSI Z21.20) is not considered continuous.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-40320 Section R403.3—Ducts.

R403.3 Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through (~~(R403.3.5)~~) R403.3.7.

R403.3.1 Insulation (~~(Prescriptive)~~). Ducts outside the building thermal envelope shall be insulated to a minimum of R-8. Ducts within a concrete slab or in the ground shall be insulated to R-10 with insulation designed to be used below grade.

EXCEPTION: Ducts or portions thereof located completely inside the *building thermal envelope*. Ducts located in crawl spaces do not qualify for this exception.

R403.3.2 Sealing (~~(Mandatory)~~). Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.

EXCEPTIONS:

1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams, and locking-type joints and seams of other than the snap-lock and button-lock types.

R403.3.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

R403.3.3 Duct testing (~~(Mandatory)~~). Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified.

EXCEPTIONS:

1. The total leakage or leakage to the outdoors test is not required for ducts and air handlers located entirely within the building thermal envelope. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located in crawl spaces do not qualify for this exception.

2. A duct air leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with the ducts serving heating or cooling systems.

A written report of the results shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 Duct leakage (~~(Mandatory)~~). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

2. Postconstruction test: Leakage to outdoors shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area or total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

R403.3.5 Building cavities (~~(Mandatory)~~). Building framing cavities shall not be used as ducts or plenums. Installation of ducts in exterior walls, floors or ceilings shall not displace required envelope insulation.

R403.3.6 Ducts buried within ceiling insulation. Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation R-value not less than R-8.

2. At all points along each duct, the sum of the ceiling insulation R-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-19, excluding the R-value of the duct insulation.

EXCEPTION: Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

R403.3.6.1 Effective R-value of deeply buried ducts. Where using a simulated energy performance analysis, sections of ducts that are: Installed in accordance with Section R403.3.6; located directly on, or within 5.5 inches (140 mm) of the ceiling; surrounded with blown-in attic insulation having an R-value of R-30 or greater and located such that the top of the duct is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation R-value of R-25.

R403.3.7 Ducts located in conditioned space. For ducts to be considered as being located inside a conditioned space, such ducts shall comply with the following:

1. All duct systems shall be located completely within the continuous air barrier and within the *building thermal envelope*.

2. All heating, cooling and ventilation system components shall be installed inside the conditioned space including, but not limited to, forced air ducts, hydronic piping, hydronic floor heating loops,

convectors and radiators. Combustion equipment shall be direct vent or sealed combustion.

3. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts is permitted to be located outside the conditioned space, provided they are insulated to a minimum of R-8.

3.1. Metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic.

3.2. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40330 Section R403.4—Mechanical system piping insulation.

R403.4 Mechanical system piping insulation (~~(Mandatory)~~). Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-6.

EXCEPTION: Up to 200 feet of hydronic system piping installed within the conditioned space may be insulated with a minimum of 1/2-inch insulation with a *k* value of 0.28.

R403.4.1 Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance, and wind, and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40340 Section R403.5—Service hot water systems.

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5. Service water-heating equipment shall meet the requirements of DOE 10 C.F.R. Part 430 Uniform Energy Factor or the equipment shall meet the requirements of Section C404.2.

R403.5.1 Heated water circulation and temperature maintenance system (~~(Mandatory)~~). Heated water circulation systems shall be in accordance with Section R403.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. Automatic controls, temperature sensors and pumps shall be accessible. Manual controls shall be readily accessible.

R403.5.1.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosiphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identifi-

cation of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

R403.5.1.2 Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1 or UL 515. Controls for such systems shall automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

R403.5.2 Demand recirculation water systems. (~~(A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a demand recirculation water system. Pumps)~~) Demand recirculation water systems shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).

R403.5.3 Hot water pipe insulation ((~~Prescriptive~~)). Insulation for hot water pipe, both within and outside the conditioned space, shall have a minimum thermal resistance (*R*-value) of R-3.

EXCEPTION: Pipe insulation is permitted to be discontinuous where it passes through studs, joists or other structural members and where the insulated pipes pass other piping, conduit or vents, provided the insulation is installed tight to each obstruction.

R403.5.4 Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2 or IAPMO PS 92. Drain water heat recovery units shall be in accordance with CSA 55.1 or IAPMO IGC 346-2017. (~~(Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi (20.7 kPa) for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi (13.8 kPa) for individual units connected to three or more showers.)~~)

R403.5.5 Electric water heater insulation. All electric water heaters in (~~unheated~~) unconditioned spaces, or on concrete floors in conditioned spaces, shall be placed on an (~~incompressible,~~) insulated surface with a minimum thermal resistance of R-10, and a minimum compressive strength of 40 psi or engineered to support the appliance.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40350 Section R403.6—Mechanical ventilation.

R403.6 Mechanical ventilation ((~~Mandatory~~)). The building shall be provided with ventilation that meets the requirements of the *International Residential Code* or *International Mechanical Code*, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

R403.6.1 Whole-house mechanical ventilation system fan efficacy. Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.6.1.

EXCEPTION: ~~((Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.))~~ Where an air handler that is integral to the tested and listed HVAC equipment is used to provide whole-house ventilation, the air handler shall be powered by an electronically commutated motor.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40351 Table R403.6.1—Mechanical ventilation system fan efficacy.

TABLE R403.6.1
MECHANICAL VENTILATION SYSTEM FAN EFFICACY

Fan Location	Air Flow Rate Minimum (cfm)	Minimum Efficacy (cfm/watt)	Air Flow Rate Maximum (cfm)
<u>HRV or ERV</u>	<u>Any</u>	<u>1.2 cfm/watt</u>	<u>Any</u>
Range hoods	Any	2.8	Any
In-line fan	Any	2.8	Any
Bathroom, utility room	10	1.4	< 90
Bathroom, utility room	90	2.8	Any

For SI: 1 cfm = 28.3 L/min.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40360 Section R403.7—Equipment sizing.

R403.7 Equipment sizing and efficiency rating (~~((Mandatory))~~). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies. The output capacity of heating and cooling equipment shall not be greater than that of the smallest available equipment size that exceeds the loads calculated, including allowable oversizing limits. ~~((New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.))~~ Equipment shall meet the minimum federal efficiency standards as referenced in Tables C403.2.3(1), C403.2.3(2), C403.2.3(3), C403.2.3(4), C403.2.3(5), C403.2.3(6), C403.2.3(7), C403.2.3(8) and C403.2.3(9) and tested and rated in accordance with the applicable test procedure.

R403.7.1 Electric resistance zone heated units. All detached one- and two-family dwellings and multiple single-family dwellings (townhouses) up to three stories in height above grade plane using electric zonal heating as the primary heat source shall install an inverter-driven ductless mini-split heat pump in the largest zone in the dwelling.

Building permit drawings shall specify the heating equipment type and location of the heating system.

EXCEPTION: Total installed heating capacity of 2 kW per dwelling unit or less.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40370 Section R403.8—Systems serving multiple dwelling units.

R403.8 Systems serving multiple dwelling units (~~(Mandatory)~~). Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the WSEC—Commercial Provisions in lieu of Section R403.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40380 Section R403.9—Snow melt system controls.

R403.9 Snow melt system controls (~~(Mandatory)~~). Snow and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F, and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40390 Section R403.10—Pool and spa energy consumption.

R403.10 Pool and permanent spa energy consumption (~~(Mandatory)~~). Pools and permanent spas shall comply with Sections R403.10.1 through R403.10.4.2.

R403.10.1 Heaters. The electric power to heaters shall be controlled by a *readily accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the settings of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. (~~Gas-fired heaters shall not be equipped with constant burning pilot lights.~~)

R403.10.2 Time switches. Time switches or other control method that can automatically turn off and on according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built in time switches shall be deemed in compliance with this requirement.

EXCEPTIONS: 1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

R403.10.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover, or other *approved* vapor retardant means.

EXCEPTION: Where more than ((70)) 75 percent of the energy for heating, computed over an operating season of not less than three calendar months, is ((from site-recovered energy, such as)) from a heat pump or ((solar energy source)) on-site renewable energy system, covers or other vapor-retardant means shall not be required.

R403.10.4 Residential pool pumps. Pool pump motors may not be split-phase or capacitor start-induction run type.

R403.10.4.1 Two-speed capability.

1. Pump motors: Pool pump motors with a capacity of 1 hp or more shall have the capability of operating at two or more speeds with low speed having a rotation rate that is no more than one-half of the motor's maximum rotation rate.

2. Pump controls: Pool pump motor controls shall have the capability of operating the pool pump with at least two speeds. The default circulation speed shall be the lowest speed, with a high speed override capability being for a temporary period not to exceed one normal cycle.

R403.10.4.2 Pump operation. Circulating water systems shall be controlled so that the circulation pump(s) can be conveniently turned off, automatically or manually, when the water system is not in operation.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40391 Section R403.10—Other pools and spas.

R403.11 Portable spas ((Mandatory)). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

R403.12 Residential pools and permanent residential spas. Residential swimming pools and permanent residential spas that are accessory to detached one- and two-family dwellings and townhouses three stories or less in height above grade plane and that are available only to the household and its guests shall be in accordance with APSP-15.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40410 Section R404.1—Lighting equipment.

R404.1 Lighting equipment ((Mandatory)). ((A minimum of 75)) Not less than 90 percent of lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

R404.1.1 Lighting equipment ((Mandatory)). Fuel gas lighting systems shall not have continuously burning pilot lights.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-40510 Section R405.1—Scope.

R405.1 Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, mechanical ventilation, and service water heating energy only.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-40520 Section R405.2—Mandatory requirements.

R405.2 Mandatory requirements. Compliance with this section requires (~~(that the mandatory provisions identified in Section R401.2 be met)~~) compliance with those sections shown in Table R405.2. All supply and return ducts not completely inside the *building thermal envelope* shall be insulated to a minimum of R-8.

**TABLE R405.2
MANDATORY COMPLIANCE MEASURES FOR SIMULATED PERFORMANCE ALTERNATIVE**

<u>Section</u>	<u>Title</u>	<u>Comments</u>
<u>General</u>		
<u>R401.3</u>	<u>Certificate</u>	
<u>Envelope</u>		
<u>R402.4</u>	<u>Air leakage</u>	
<u>R402.5</u>	<u>Maximum fenestration U-factor</u>	
<u>Systems</u>		
<u>R403.1</u>	<u>Controls</u>	
<u>R403.1.2</u>	<u>Heat pump supplemental heat</u>	
<u>R403.3.2</u>	<u>Sealing</u>	
<u>R403.3.1</u>	<u>Equipment and system sizing</u>	
<u>R403.3.3</u>	<u>Duct testing</u>	
<u>R403.3.4</u>	<u>Duct leakage</u>	
<u>R403.3.5</u>	<u>Building cavities</u>	
<u>R403.4</u>	<u>Mechanical system piping insulation</u>	
<u>R403.5.1</u>	<u>Heated water circulation and temperature maintenance system</u>	
<u>R403.6</u>	<u>Mechanical ventilation</u>	
<u>R403.7</u>	<u>Equipment sizing and efficiency rating</u>	
<u>R403.8</u>	<u>Systems serving multiple dwelling units</u>	
<u>R403.9</u>	<u>Snow melt system controls</u>	
<u>R403.10</u>	<u>Pool and permanent spa energy consumption</u>	

<u>Section</u>	<u>Title</u>	<u>Comments</u>
R403.11	Portable spas	
Electrical Power and Lighting		
R404.1	Lighting equipment	
R404.1.1	Lighting equipment	
R404.2	Electric readiness	
Other Requirements		
R406	Additional energy efficiency requirements	

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40530 Section R405.3—Performance-based compliance.

R405.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design*) be shown to have an annual energy consumption based on (~~site energy expressed in Btu and Btu~~) carbon emissions of the fuels and energy use in the proposed building. Carbon emissions for both the standard reference design and the proposed design shall be calculated using Table R405.3. Energy use derived from simulation analysis shall be expressed in pounds of carbon and per square foot of conditioned floor area as follows:

1. For structures less than 1,500 square feet of conditioned floor area, the annual (~~energy consumption~~) carbon emissions shall be less than or equal to (~~80~~) 73 percent of the annual (~~energy consumption~~) carbon emissions of the *standard reference design*.

2. For structures 1,500 to 5,000 square feet of conditioned floor area, the annual (~~energy consumption~~) carbon emissions shall be no more than (~~72~~) 56 percent of the *standard reference design*.

3. For structures over 5,000 square feet of conditioned floor area, the annual (~~energy consumption~~) carbon emissions shall be no more than (~~66~~) 50 percent of the *standard reference design*.

((EXCEPTION: For structures serving Group R-2 occupancies, the annual energy consumption shall be less than or equal to 85 percent of the annual energy consumption of the *standard reference design*.)

4. For structures serving Group R-2 occupancies, the annual carbon emissions shall be less than or equal to 70 percent of the annual energy consumption of the *standard reference design*.

**TABLE R405.3
CARBON EMISSIONS FACTORS**

<u>Type</u>	<u>CO2e (lb/unit)</u>	<u>Unit</u>
Electricity	0.80	kWh
Natural gas	11.7	Therm
Oil	19.2	Gallon
Propane	10.5	Gallon
Other ^a	195.00	mmBtu
On-site renewable energy	0.00	

^a District energy systems may use alternative emission factors supported by calculations *approved by the code official*.

WAC 51-11R-40551 Table R405.5.2(1)—Specifications for the standard reference and proposed designs.

**TABLE R405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: Mass wall if proposed wall is mass; otherwise wood frame. Gross area: Same as proposed U-factor: From Table R402.1.3 Solar absorptance = 0.75 Remittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Below-grade walls	Type: Same as proposed Gross area: Same as proposed U-factor: From Table R402.1.3, with insulation layer on interior side of walls.	As proposed As proposed As proposed
Above-grade floors	Type: Wood frame Gross area: Same as proposed U-factor: From Table R402.1.3	As proposed As proposed As proposed
Ceilings	Type: Wood frame Gross area: Same as proposed U-factor: From Table R402.1.3	As proposed As proposed As proposed
Roofs	Type: Composition shingle on wood sheathing Gross area: Same as proposed Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed
Attics	Type: Vented with aperture = 1 ft ² per 300 ft ² ceiling area	As proposed
Foundations	Type: Same as proposed foundation wall area above and below-grade Soil characteristics: Same as proposed.	As proposed As proposed
Opaque doors	Area: 40 ft ² Orientation: North U-factor: Same as fenestration from Table R402.1.3.	As proposed As proposed As proposed
Vertical fenestration other than opaque doors ^a	Total area ^h = (a) The proposed glazing area; where proposed glazing area is less than 15% of the conditioned floor area. (b) 15% of the conditioned floor area; where the proposed glazing area is 15% or more of the conditioned floor area.	As proposed
	Orientation: Equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: From Table R402.1.3	As proposed
	SHGC: From Table R402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
	Interior shade fraction: 0.92 - (0.21 × SHGC for the standard reference design) External shading: None	0.92 - (0.21 × SHGC as proposed) As proposed
Skylights	None	As proposed

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	Air leakage rate of 5 air changes per hour at a pressure of 0.2 inches w.g. (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: CFA = conditioned floor area N_{br} = number of bedrooms - Energy recovery shall not be assumed for mechanical ventilation.	((For residences that are not tested, the same air leakage rate as the standard reference design. For tested residences, the measured air exchange rate)) As proposed ^a . The mechanical ventilation rate ^b shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	None, except where mechanical ventilation is specified by the proposed design, in which case: Annual vent fan energy use: $kWh/yr = ((0.03942 \times CFA + 29.565)) (1e_f) \times (0.0876 \times CFA + 65.7 \times (N_{br} + 1))$ where: e_f = the minimum exhaust fan efficacy from Table R403.6.1 corresponding to a flow rate of $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ CFA = conditioned floor area N_{br} = number of bedrooms	As proposed
Internal gains	$IGain = 17,900 + 23.8 \times CFA + 4104 \times N_{br}$ (Btu/day per dwelling unit)	Same as standard reference design
Internal mass	An internal mass for furniture and contents of 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element ^c but not integral to the building envelope or structure.
Structural mass	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air.	As proposed
	For masonry basement walls, as proposed, but with insulation required by Table R402.1.3 located on the interior side of the walls.	As proposed
	For other walls, for ceilings, floors, and interior walls, wood frame construction.	As proposed
Heating systems ^{d, e}	Where the proposed design utilizes electric heating without a heat pump the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the WSEC—Commercial Provisions. For all other systems, the same system type as proposed, and the same system efficiency required by prevailing minimum federal standard. Capacity: Sized in accordance with Section R403.6	As proposed
Cooling systems ^{d, f}	Same system type as proposed. Same system efficiency as required by prevailing minimum federal standard. Capacity: Sized in accordance with Section R403.6.	As proposed
Service water heating ^{d, e, f, g}	Same system type as proposed. Same system efficiency as required by prevailing minimum federal standard. Use: Same as proposed design	As proposed gal/day = $30 + (10 \times N_{br})$

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Duct insulation: From Section R403.3.3. A thermal distribution system efficiency (DSE) of 0.93 shall be applied to both the heating and cooling system efficiencies for all systems. Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design distribution system efficiency (DES) shall be 1.	As specified in Table R405.5.2(2).
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F	Same as standard reference

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (U.S.) = 3.785 L, °C = (°F-3)/1.8, 1 degree = 0.79 rad

- a Where required by the code official, testing shall be conducted by an approved party. Hourly calculations as specified in the ASHRAE Handbook of Fundamentals, or the equivalent, shall be used to determine the energy loads resulting from infiltration.
- b The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE Handbook of Fundamentals, page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE Handbook of Fundamentals, page 26.19 for intermittent mechanical ventilation.
- c Thermal storage element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.
- d For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- e For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
- f For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- g For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
- h For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine fenestration area:

$$AF = A_s \times FA \times F$$

Where:

- AF = Total fenestration area.
- A_s = Standard reference design total fenestration area.
- FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 x below-grade boundary wall area).
- F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

L and CEA are in the same units.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-40610 Section R406.1—Scope.

R406.1 Scope. This section establishes (~~options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the International Residential Code, and dwelling units in residential buildings to demonstrate compliance with this code.~~) additional energy efficiency requirements for all new construction covered by this code, including additions subject to Section R502 and change of occupancy or use subject to Section R505 un-

less specifically exempted in Section R406. Credits from both Sections R406.2 and R406.3 are required.

R406.2 Carbon emission equalization. This section establishes a base equalization between fuels used to define the equivalent carbon emissions of the options specified. The permit shall define the base fuel selection to be used and the points specified in Table R406.2 shall be used to modify the requirements in Section R406.3. The sum of credits from Tables R406.2 and R406.3 shall meet the requirements of Section R406.3.

**TABLE R406.2
FUEL NORMALIZATION CREDITS**

System Type	Description of Primary Heating Source	Credits	
		All Other	Group R-2
1	Combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(4) or C403.3.2(5)	0	0
2	For an initial heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(1)C or C403.3.2(2) or Air to water heat pump units that are configured to provide both heating and cooling and are rated in accordance with AHRI 550/590	1.0	1.0
3	For heating system based on electric resistance only (either forced air or Zonal)	-1.0	-1.0
4	For heating system based on electric resistance with a ductless mini-split heat pump system in accordance with Section R403.7.1 including the exception	0.5	N/A
5	All other heating systems	-1	-0.5

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-40620 Section ((R406.2)) R406.3—Additional energy efficiency requirements.

((R406.2)) R406.3 Additional energy efficiency requirements ((Mandatory)). Each dwelling unit in a residential building shall comply with sufficient options from Table R406.2 so as to achieve the following minimum number of credits:

1. Small Dwelling Unit: ((1-5)) 3.0
credits

Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building that are greater than 500 square feet of heated floor area but less than 1500 square feet.

2. Medium Dwelling Unit: ((3-5)) 6.0
credits

All dwelling units that are not included in #1 ((or)), #3, or #4.

((Exception: Dwelling units serving R-2 occupancies shall require 2.5 credits.))

3. Large Dwelling Unit: ((4.5)) 7.0
credits
- Dwelling units exceeding 5000 square feet of conditioned floor area.
- ((Exception: Dwelling units serving R-2 occupancies shall require 2.5 credits.))
4. Dwelling units serving R-2 occupancies. 4.5 credits
5. Additions less than or equal to 500 square feet: ((0.5)) 1.5
credits

The drawings included with the building permit application shall identify which options have been selected and the point value of each option, regardless of whether separate mechanical, plumbing, electrical, or other permits are utilized for the project.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-40621 Table ((R406.2)) R406.3—Energy credits.

**TABLE ((406.2)) 406.3
ENERGY CREDITS**

((OPTIO N	DESCRIPTION	CREDIT(S)
1a	EFFICIENT BUILDING ENVELOPE 1a: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.28 Floor R-38 Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab OR Compliance based on Section R402.1.4: Reduce the Total UA by 5%.	0.5
1b	EFFICIENT BUILDING ENVELOPE 1b: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.25 Wall R-21 plus R-4 ei Floor R-38 Basement wall R-21 int plus R-5 ei Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab OR Compliance based on Section R402.1.4: Reduce the Total UA by 15%.	1.0
1c	EFFICIENT BUILDING ENVELOPE 1c:	2.0

((OPTION N	DESCRIPTION	CREDIT(S)
	<p>Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U= 0.22 Ceiling and single-rafter or joist-vaulted R-49 advanced Wood frame wall R-21 int plus R-12 ei Floor R-38 Basement wall R-21 int plus R-12 ei Slab on grade R-10 perimeter and under entire slab Below-grade-slab R-10 perimeter and under entire slab</p> <p>or</p> <p>Compliance based on Section R402.1.4: Reduce the Total UA by 30%.</p>	
1d ^a	<p>EFFICIENT BUILDING ENVELOPE 1d:</p> <p>Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U= 0.24</p>	0.5
2a	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2a:</p> <p>Compliance based on R402.4.1.2: Reduce the tested air leakage to 3.0 air changes per hour maximum and</p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> shall be met with a high efficiency fan (maximum 0.35 watts/cfm), not interlocked with the furnace fan. Ventilation systems using a furnace including an ECM motor are allowed, provided that they are controlled to operate at low speed in ventilation only mode.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the qualified ventilation system.</p>	0.5
2b	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2b:</p> <p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.70.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.</p>	1.0
2c	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2c:</p> <p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum</p>	1.5

((OPTION N	DESCRIPTION	CREDIT(S)
	<p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.85.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.</p>	
3a ^b	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3a:</p> <p>Gas, propane or oil-fired furnace with minimum AFUE of 94%, or gas, propane or oil-fired boiler with minimum AFUE of 92%.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.0
3b ^b	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3b:</p> <p>Air source heat pump with minimum HSPF of 9.0</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.0
3c ^b	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3c:</p> <p>Closed loop ground source heat pump; with a minimum COP of 3.3</p> <p>OR</p> <p>Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.5
3d ^b	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3d: DUCTLESS SPLIT SYSTEM HEAT PUMPS, ZONAL CONTROL:</p> <p>In homes where the primary space heating system is zonal electric heating, a ductless heat pump system shall be installed and provide heating to the largest zone of the housing unit.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.0
4	<p>HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM:</p> <p>All heating and cooling system components installed inside the conditioned space. This includes all equipment and distribution system components such as forced air ducts, hydronic piping, hydronic floor heating loop, convectors and radiators. All combustion equipment shall be direct vent or sealed combustion.</p>	1.0

((OPTION N	DESCRIPTION	CREDIT(S)
	<p>For forced air ducts: A maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located outside the conditioned space must be insulated to a minimum of R-8.</p> <p>Locating system components in conditioned crawl spaces is not permitted under this option.</p> <p>Electric resistance heat and ductless heat pumps are not permitted under this option.</p> <p>Direct combustion heating equipment with AFUE less than 80% is not permitted under this option.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and cooling equipment and all the ductwork.</p>	
5a	<p>EFFICIENT WATER HEATING 5a:</p> <p>All showerheads and kitchen sink faucets installed in the house shall be rated at 1.75 GPM or less. All other lavatory faucets shall be rated at 1.0 GPM or less.^c</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum flow rates for all showerheads, kitchen sink faucets, and other lavatory faucets.</p>	0.5
5b	<p>EFFICIENT WATER HEATING 5b:</p> <p>Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.74</p> <p>OR</p> <p>Water heater heated by ground source heat pump meeting the requirements of Option 3e.</p> <p>OR</p> <p>For R-2 occupancy, a central heat pump water heater with an EF greater than 2.0 that would supply DHW to all the units through a central water loop insulated with R-8 minimum pipe insulation.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</p>	1.0
5c	<p>EFFICIENT WATER HEATING 5c:</p> <p>Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.94</p> <p>OR</p>	1.5

((OPTION N	DESCRIPTION	CREDIT(S)
	<p>Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems.</p> <p>or</p> <p>Electric heat pump water heater with a minimum EF of 2.0 and meeting the standards of NEEA's Northern Climate Specifications for Heat Pump Water Heaters.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.</p>	
5d	<p>EFFICIENT WATER HEATING 5d:</p> <p>A drain water heat recovery unit(s) shall be installed, which captures waste water heat from all the showers, and has a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 52% if installed for unequal flow. Such units shall be rated in accordance with the CSA B55.1 standard and be so labeled.</p> <p>To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it and labels or other documentation shall be provided that demonstrates that the unit complies with the standard.</p>	0.5
6	<p>RENEWABLE ELECTRIC ENERGY:</p> <p>For each 1200 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:</p> <p>For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTS. Documentation noting solar access shall be included on the plans.</p> <p>For wind generation projects designs shall document annual power generation based on the following factors:</p> <p>The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the photovoltaic or wind turbine equipment type, provide documentation of solar and wind access, and include a calculation of the minimum annual energy power production.</p>	0.5

Footnotes:

^a Projects using this option may not use option 1a, 1b, or 1c.

^b Projects may only include credit from one space heating option, 3a, 3b, 3c or 3d. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.

^c **Plumbing Fixtures Flow Ratings.** Low flow plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements:

1-Residential bathroom lavatory sink faucets: Maximum flow rate – 3.8 L/min (1.0 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.

2-Residential kitchen faucets: Maximum flow rate – 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.

3-Residential showerheads: Maximum flow rate – 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.))

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
1. EFFICIENT BUILDING ENVELOPE OPTIONS			
Only one option from Items 1.1 through 1.7 may be selected in this category.			
Compliance with the conductive UA targets is demonstrated using Section R402.1.4, Total UA alternative, where $[1 - (\text{Proposed UA} / \text{Target UA})] > \text{the required \%UA reduction}$			
1.1	Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.24.	0.5	0.5
1.2	Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.20.	1.0	1.0
1.3	Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.28 Floor R-38 Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab or Compliance based on Section R402.1.4: Reduce the Total conductive UA by 5%.	0.5	N/A
1.4	Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.25 Wall R-21 plus R-4 ci Floor R-38 Basement wall R-21 int plus R-5 ci Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab or Compliance based on Section R402.1.4: Reduce the Total conductive UA by 15%.	1.0	1.0
1.5	Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.22 Ceiling and single-rafter or joist-vaulted R-49 advanced Wood frame wall R-21 int plus R-12 ci Floor R-38 Basement wall R-21 int plus R-12 ci Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab or Compliance based on Section R402.1.4: Reduce the Total conductive UA by 30%.	2.0	1.5
1.6	Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced Wood frame wall R-21 int plus R-16 ci Floor R-48 Basement wall R-21 int plus R-16 ci Slab on grade R-20 perimeter and under entire slab Below grade slab R-20 perimeter and under entire slab or Compliance based on Section R402.1.4: Reduce the Total conductive UA by 40%.	3.0	2.0

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
1.7	Advanced framing and raised heel trusses or rafters Vertical Glazing U-0.28 R-49 Advanced (U-0.020) as listed in Section A102.2.1, <i>Ceilings below a vented attic</i> and R-49 vaulted ceilings with full height of uncompressed insulation extending over the wall top plate at the eaves.	0.5	0.5
2. AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION OPTIONS Only one option from Items 2.1 through 2.4 may be selected in this category.			
2.1	Compliance based on R402.4.1.2: Reduce the tested air leakage to 3.0 air changes per hour maximum at 50 Pascals or For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.3 cfm/ft ² maximum at 50 Pascals and All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a high efficiency fan(s) (maximum 0.35 watts/cfm), not interlocked with the furnace fan (if present). Ventilation systems using a furnace including an ECM motor are allowed, provided that they are controlled to operate at low speed in ventilation only mode. To qualify to claim this credit, the building permit drawings shall specify the option being selected, the maximum tested building air leakage, and shall show the qualifying ventilation system and its control sequence of operation.	0.5	1.0
2.2	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum at 50 Pascals or For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft ² maximum at 50 Pascals and All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.65. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	1.0	1.5
2.3	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum at 50 Pascals or For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft ² maximum at 50 Pascals and All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.75. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	1.5	2.0

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
2.4	<p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.6 air changes per hour maximum at 50 Pascals</p> <p>or</p> <p>For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.15 cfm/ft² maximum at 50 Pascals</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> or Section 403.8 of the <i>International Mechanical Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.80. Duct installation shall comply with Section R403.3.7.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.</p>	2.0	2.5
3. HIGH EFFICIENCY HVAC EQUIPMENT OPTIONS			
Only one option from Items 3.1 through 3.6 may be selected in this category.			
3.1 ^a	<p>Energy Star rated (U.S. North) Gas or propane furnace with minimum AFUE of 95%</p> <p>or</p> <p>Energy Star rated (U.S. North) Gas or propane boiler with minimum AFUE of 90%.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.0	1.0
3.2 ^a	<p>Air-source centrally ducted heat pump with minimum HSPF of 9.5.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.0	N/A
3.3 ^a	<p>Closed-loop ground source heat pump; with a minimum COP of 3.3</p> <p>or</p> <p>Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.5	1.0
3.4	<p>Ductless mini-split heat pump system, zonal control: In homes where the primary space heating system is zonal electric heating, a ductless mini-split heat pump system with a minimum HSPF of 10.0 shall be installed and provide heating to the largest zone of the housing unit.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.5	2.0
3.5 ^a	<p>Air-source, centrally ducted heat pump with minimum HSPF of 11.0.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.</p>	1.5	N/A
3.6 ^a	<p>Ductless split system heat pumps with no electric resistance heating in the primary living areas. A ductless heat pump system with a minimum HSPF of 10 shall be sized and installed to provide heat to entire dwelling unit at the design outdoor air temperature.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).</p>	2.0	3.0
4. HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM OPTIONS			

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
4.1	<p>All supply and return ducts located in an unconditioned attic shall be deeply buried in ceiling insulation in accordance with Section R403.3.7.</p> <p>For mechanical equipment located outside the conditioned space, a maximum of 10 linear feet of return duct and 5 linear feet of supply duct connections to the equipment may be outside the deeply buried insulation. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices.</p> <p>Duct leakage shall be limited to 3 cfm per 100 square feet of conditioned floor area.</p> <p>Air handler(s) shall be located within the conditioned space.</p>	0.5	0.5
4.2	<p>HVAC equipment and associated duct system(s) installation shall comply with the requirements of Section R403.3.7.</p> <p>Locating system components in conditioned crawl spaces is not permitted under this option.</p> <p>Electric resistance heat and ductless heat pumps are not permitted under this option.</p> <p>Direct combustion heating equipment with AFUE less than 80% is not permitted under this option.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and cooling equipment and all the ductwork.</p>	1.0	N/A
<p>5. EFFICIENT WATER HEATING OPTIONS</p> <p>Only one option from Items 5.2 through 5.6 may be selected in this category. Item 5.1 may be combined with any option.</p>			
5.1	<p>A drain water heat recovery unit(s) shall be installed, which captures waste water heat from all and only the showers, and has a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 54% if installed for unequal flow. Such units shall be rated in accordance with CSA B55.1 or IAPMO IGC 346-2017 and be so labeled.</p> <p>To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it. Labels or other documentation shall be provided that demonstrates that the unit complies with the standard.</p>	0.5	0.5
5.2	<p>Water heating system shall include one of the following: <u>Energy Star rated gas or propane water heater with a minimum UEF of 0.80.</u></p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</p>	0.5	0.5
5.3	<p>Water heating system shall include one of the following: <u>Energy Star rated gas or propane water heater with a minimum UEF of 0.91</u> OR <u>Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems</u> OR <u>Water heater heated by ground source heat pump meeting the requirements of Option 3.3.</u></p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.</p>	1.0	1.0

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
5.4	<p><u>Water heating system shall include one of the following:</u> <u>Electric heat pump water heater meeting the standards for Tier I of NEEA's advanced water heating specification</u> OR <u>For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier I of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</u></p>	1.5	2.0
5.5	<p><u>Water heating system shall include one of the following:</u> <u>Electric heat pump water heater meeting the standards for Tier III of NEEA's advanced water heating specification</u> OR <u>For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</u></p>	2.0	2.5
5.6	<p><u>Water heating system shall include one of the following:</u> <u>Electric heat pump water heater with a minimum UEF of 2.9 and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors. Equipment shall meet Section 4, requirements for all units, of the NEEA standard <i>Advanced Water Heating Specification</i> with the UEF noted above</u> OR <u>For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.</u></p>	2.5	3.0
6. RENEWABLE ELECTRIC ENERGY OPTION			
6.1	<p><u>For each 1200 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 1.0 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:</u> <u>For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATs or approved alternate by the code official.</u> <u>Documentation noting solar access shall be included on the plans.</u> <u>For wind generation projects designs shall document annual power generation based on the following factors:</u> <u>The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower.</u> <u>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the photovoltaic or wind turbine equipment type, provide documentation of solar and wind access, and include a calculation of the minimum annual energy power production.</u></p>	1.0	1.0
7. APPLIANCE PACKAGE OPTION			

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2
7.1	<p>All of the following appliances shall be new and installed in the dwelling unit and shall meet the following standards:</p> <p>Dishwasher – Energy Star rated Refrigerator (if provided) – Energy Star rated Washing machine – Energy Star rated Dryer – Energy Star rated, ventless dryer with a minimum CEF rating of 5.2.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the appliance type and provide documentation of Energy Star compliance. At the time of inspection, all appliances shall be installed and connected to utilities. Dryer ducts and exterior dryer vent caps are not permitted to be installed in the dwelling unit.</p>	0.5	1.5

^a An alternative heating source sized at a maximum of 0.5 Watts/ft² (equivalent) of heated floor area or 500 Watts, whichever is bigger, may be installed in the dwelling unit.

NEW SECTION

WAC 51-11R-40700 Section R407—Certified passive house.

R407.1 General. Projects shall comply with Section R407.2 or R407.3.

R407.2 Passive House Institute U.S. (PHIUS). Projects shall comply with PHIUS+ 2018 Passive Building Standard, including its USDOE Energy Star and Zero Energy Ready Home co-requisites, and performance calculations by PHIUS-approved software. Projects shall also comply with the provisions of Table R405.2.

R407.2.1 PHIUS documentation. Prior to the issuance of a building permit, the following items must be provided to the building official:

1. A list of compliance features.
2. A PHIUS precertification letter.

Prior to the issuance of a certificate of occupancy, the following item must be provided to the building official:

1. A PHIUS+ 2018 (or later) project certificate.

R407.3 Passive House Institute (PHI). Projects shall comply with Low Energy Building Standard, version 9f or later, including performance calculations by PHI-approved software. Projects shall also comply with the provisions of Section R401 through R404.

R407.3.1 PHI documentation. Prior to the issuance of a building permit, the following items must be provided to the building official:

1. A list of compliance features.
2. A statement from a passive house certifier that the modeled energy performance is congruent with the plans and specifications, and that the modeled performance meets said standard.

Prior to the issuance of a certificate of occupancy, the following item must be provided to the building official:

1. A PHI Low Energy Building project certificate.

WAC 51-11R-50100 Section R501—General.

R501.1 Scope. The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing buildings and structures.

R501.1.1 Additions, alterations, or repairs. Additions, alterations, or repairs to an existing building, building system or portion thereof shall comply with Sections R502, R503 or R504. Unaltered portions of the existing building or building supply system shall not be required to comply with this code.

R501.1.2 Thermostats for accessory dwelling units. Where a separate dwelling unit, that provides independent facilities for living, sleeping, cooking, bathing and sanitation, is established within or attached to an existing dwelling unit, the heating and cooling for the newly-created dwelling unit shall be controllable with a separate programmable thermostat in accordance with Section R403.1.1.

R501.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

R501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and systems that are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's authorized agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

R501.4 Compliance. Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, in this code and the International Residential Code, International Building Code, International Existing Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, Uniform Plumbing Code, International Property Maintenance Code, and NFPA 70.

R501.5 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided hazards to life, health or property are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

R501.6 Historic buildings. The building official may modify the specific requirements of this code for historic buildings and require alternate provisions which will result in a reasonable degree of energy efficiency. This modification may be allowed for those buildings or structures that are listed in the state or national register of his-

toric places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a national register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the national or state register of historic places either individually or as a contributing building to a historic district by the state historic preservation officer or the keeper of the *National Register of Historic Places*.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-50200 Section R502—Additions.

R502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition uses no more energy than the existing building. Additions shall be in accordance with Section R502.1.1 or R502.1.2.

R502.1.1 Prescriptive compliance. Additions shall comply with Sections R502.1.1.1 through R502.1.1.4.

R502.1.1.1 Building envelope. New building envelope assemblies that are part of the addition shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4.

EXCEPTION: Where nonconditioned space is changed to conditioned space, the building envelope of the addition shall comply where the UA, as determined in Section R402.1.4, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to UA generated for the existing building.

R502.1.1.2 Heating and cooling systems. New heating, cooling and duct systems that are part of the addition shall comply with Section (~~R403.1, R403.2, R403.3, R403.5, and R403.6~~) R403.

EXCEPTION: The following need not comply with the testing requirements of Section R403.3.3:

1. Additions of less than 750 square feet.
2. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in WSU RS-33.
3. Ducts with less than 40 linear feet in unconditioned spaces.
4. Existing duct systems constructed, insulated or sealed with asbestos.

R502.1.1.3 Service hot water systems. New service hot water systems that are part of the addition shall comply with Section R403.5.

R502.1.1.4 Lighting. New lighting systems that are part of the addition shall comply with Section 404.1.

R502.1.2 Existing plus addition compliance (Simulated Performance Alternative). Where nonconditioned space is changed to conditioned space the addition shall comply where the annual energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy use of the existing building when modeled in accordance with Section R405. The addi-

tion and any alterations that are part of the project shall comply with Section R405 in its entirety.

AMENDATORY SECTION (Amending WSR 17-10-063, filed 5/2/17, effective 6/2/17)

WAC 51-11R-50300 Section R503—Alterations.

R503.1 General. Alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the alteration.

Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Alterations shall be such that the existing building or structure uses no more energy than the existing building or structure prior to the alteration. Alterations to existing buildings shall comply with Sections R503.1.1 through R503.2.

The *code official* may approve designs of alterations which do not fully conform to all of the requirements of this code where in the opinion of the building official full compliance is physically impossible and/or economically impractical and:

The alteration improves the energy efficiency of the building; or

The alteration is energy efficient and is necessary for the health, safety, and welfare of the general public.

R503.1.1 Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.1 or R402.1.4, Sections R402.2.1 through R402.2.11, R402.3.1, R402.3.2, R402.4.3, and R402.4.4.

EXCEPTION: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation. 2 x 4 framed walls shall be insulated to a minimum of R-15 and 2 x 6 framed walls shall be insulated to a minimum of R-21.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof recover.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing fenestration to be replaced.

R503.1.1.1 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC in Table R402.1.1. Where more than one replacement fenestration unit is being installed, an area-weighted average of the *U*-factor and SHGC of all replacement fenestration shall be permitted to be used to demonstrate compliance.

R503.1.2 Heating and cooling systems. New heating, cooling and duct systems that are part of the alteration shall comply with Section (~~§ R403.1, R403.2, R403.3, and R403.6~~) R403.

EXCEPTIONS: 1. Where ducts from an existing heating and cooling system are extended, duct systems with less than 40 linear feet in unconditioned spaces shall not be required to be tested in accordance with Section R403.2.2.
 2. Existing duct systems constructed, insulated or sealed with asbestos.

R503.1.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section R403.5.

R503.1.4 Lighting. New lighting systems that are part of the alteration shall comply with Section R404.1.

EXCEPTION: Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

R503.2 Change in space conditioning. Any nonconditioned or low-energy space that is altered to become conditioned space shall be required to be brought into full compliance with this code.

EXCEPTION: Where the simulated performance option in Section R405 is used to comply with this section, the annual energy use of the proposed design is permitted to be 110 percent of the annual energy use otherwise allowed by Section R405.3.

AMENDATORY SECTION (Amending WSR 16-02-127, filed 1/6/16, effective 7/1/16)

WAC 51-11R-51000 Chapter 6—Referenced standards. This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section R106.

AAMA	American Architectural Manufacturers Association 1827 Walden Office Square Suite 550 Schaumburg, IL 60173-4268	
Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/1.S.2/A ((E440-H)) C440-17	North American Fenestration Standard/Specifications for Windows, Doors and Unit Skylights	R402.4.3
ACCA	Air Conditioning Contractors of America 2800 Shirlington Road, Suite 300 Arlington, VA 22206	
Standard reference number	Title	Referenced in code section number
Manual ((J-H)) J-16	Residential Load Calculation Eighth Edition	R403.7
Manual ((S-10)) S-14	Residential Equipment	R403.7
ANSI	American National Standards Institute 25 West 43rd Street, 4th Floor New York, NY 10036	
Standard reference number	Title	Referenced in code section number
Z21.50-2016/CSA 2.22-2016	Vented Decorative Gas Appliances	R402.4.2.1, R403.1.3
Z21.88-2017/CSA 2.33-2017	Vented Gas Fireplace Heaters	R402.4.2.1
APSP	The Association of Pool and Spa Professionals 2111 Eisenhower Avenue, Suite 500 Alexandria, VA 22206	
Standard reference number	Title	Referenced in code section number
ANSI/APSP/ICC 14-2014	American National Standard for Portable Electric Spa Energy Efficiency	R403.11
ANSI/APSP/ICC 15a-2011	American National Standard for Residential Swimming Pool and Spa Energy Efficiency— Includes Addenda A approved January 9, 2013	R403.12

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle, N.E. Atlanta, GA 30329-2305	
Standard reference number	Title	Referenced in code section number
ASHRAE-((2009)) 2017 ASHRAE 193-2010 (RA 2014)	ASHRAE Handbook of Fundamentals Method of Test for Determining the Airtightness of HVAC Equipment	R402.1.4, Table R405.5.2(1) R403.3.2.1
ASTM	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2859	
Standard reference number	Title	Referenced in code section number
C1363-11	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	R303.1.4.1
E 283-04 (2012)	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	R402.4.5
<u>E779-10</u>	<u>Standard Test Method for Determining Air Leakage Rate by Fan Pressurization</u>	<u>R402.4.1.2</u>
<u>E1827-11</u>	<u>Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door</u>	<u>R402.4.1.2</u>
CSA	Canadian Standards Association 5060 Spectrum Way Mississauga, Ontario, Canada L4W 5N6	
Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA ((101/1.S.2/A440-11)) <u>101/1.S.2/A440-17</u> ((CSA 55.1-2012)) <u>CSA 55.1-2015</u> ((CSA 55.2-2012)) <u>CSA 55.2-2015</u> <u>CSA P.4.1-15</u>	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Systems Drain Water Heat Recovery Units <u>Testing Method for Measuring Annual Fireplace Efficiency</u>	R402.4.3 R403.5.4, Table R406.2 R403.5.4 <u>R402.4.2.1</u>
DASMA	<u>Door and Access Systems Manufacturers Association</u> <u>1300 Sumner Avenue</u> <u>Cleveland, OH 44115-2851</u>	
<u>105-2016</u>	<u>Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors</u>	<u>R303.1.3</u>
HVI	<u>Home Ventilating Institute</u> <u>1000 North Rand Road, Suite 214</u> <u>Wauconda, IL 60084</u>	
<u>916-09</u>	<u>Airflow Test Procedure</u>	<u>R303.1.3</u>
ICC	International Code Council, Inc. 500 New Jersey Avenue, N.W. 6th Floor Washington, DC 20001	
Standard reference number	Title	Referenced in code section number
((IBC-15)) <u>IBC-17</u> ((ICC 400-15)) <u>ICC 400-17</u> ((IFC-15)) <u>IFC-17</u> ((IFGC-15)) <u>IFGC-17</u> ((IMC-15)) <u>IFGC-17</u>	International Building Code Standard on the Design and Construction of Log Structures International Fire Code International Fuel Gas Code International Mechanical Code	R201.3, R303.2, R402.11, R4501.4 Table ((R402.5.1-1)) <u>R402.1.1</u> R201.3, R501.4 R201.3, R501.4 R201.3, R403.3.2, R403.6, R501.4

(IPMC-15)) IPMC-17	International Property Maintenance Code	R501.4
((IRC-15)) IRC-17	International Residential Code	R104.2.1, R201.3, R303.2, R401.2, R403.2.2, R403.5, R406.1, R406.2, Table R406.2
IEEE	The Institute of Electrical and Electronic Engineers, Inc. 3 Park Avenue New York, NY 10016-5997	
Standard reference number	Title	Referenced in code section number
515.1-2012	IEEE Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications	R403.5.1.2
NEEA	Northwest Energy Efficiency Alliance 421 S.W. 6th Ave., Suite 600 Portland, OR 97204	
Standard reference number	Title	Referenced in code section number
NEEA-2011	Northern Climate Specification for Heat Pump Water Heaters, Vers. 4.0	Table R406.2
NFRC	National Fenestration Rating Council, Inc. 6305 Ivy Lane, Suite 140 Greenbelt, MD 20770	
Standard reference number	Title	Referenced in code section number
100-2010	Procedure for Determining Fenestration Products <i>U</i> -factors	R303.1.3
200-2010	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	R303.1.3
400-2010	Procedure for Determining Fenestration Product Air Leakage	R402.4.3
UL	Underwriters Laboratory 333 Pfingsten Road Northbrook, IL 60062	
Standard reference number	Title	Referenced in code section number
UL 127-11	Factory Built Fireplace	R402.4.2
UL 515-11	Electric Resistance Heat Tracing for Commercial and Industrial Applications	R403.5.1.2
UL 907-94	Fireplace Accessories (with revisions through April 2010)	R402.4.2
US-FTC	United States-Federal Trade Commission 600 Pennsylvania Avenue N.W. Washington, DC 20580	
Standard reference number	Title	Referenced in code section number
C.F.R. Title 16 (May 31, 2005)	<i>R</i> -value	Rule R303.1.4
WDMA	Window and Door Manufacturers Association 1400 East Touhy Avenue, Suite 470 Des Plaines, IL 60018	
Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440-11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	R402.4.3
WSU	Washington State University Energy Extension Program 905 Plum Street S.E., Bldg 3 P.O. Box 43165 Olympia, WA 98506-3166	
Standard reference number	Title	Referenced in code section number
WSU RS 33	Duct Testing Standard for New and Existing Construction Publication No. WSUEEP15-016	R403.3.3

NEW SECTION

WAC 51-11R-58000 Appendix RA—Optional energy efficiency measures—One step. Building owners may choose to use this appendix to achieve an additional 6 percent savings in building energy use. The number of additional energy efficiency credits required by Section R406.3 would be increased by the following amounts:

1.0 credit for each new single-family, two-family and townhouse dwelling unit.

0.5 credit for each new dwelling unit within an R-2 occupancy building.

0.5 credit for each addition smaller than 500 square feet to a single-family, two-family or townhouse dwelling unit.

1.0 credit for each addition of 500 square feet or larger to a single-family, two-family or townhouse dwelling unit.

Where Section R405, Simulated performance alternative, is used, the maximum allowable energy consumption shall be 92 percent of the value calculated according to Section R405.3.

NEW SECTION

WAC 51-11R-59000 Appendix RB—Optional energy efficiency measures—Two step. Building owners may choose to use this appendix to achieve an additional 12 percent savings in building energy use. The number of additional energy efficiency credits required by Section R406.3 would be increased by the following amounts:

2.0 credit for each new single-family, two-family and townhouse dwelling unit.

1.0 credit for each new dwelling unit within an R-2 occupancy building.

1.0 credit for each addition smaller than 500 square feet to a single-family, two-family or townhouse dwelling unit.

1.5 credit for each addition of 500 square feet or larger to a single-family, two-family or townhouse dwelling unit.

Where Section R405, Simulated performance alternative, is used, the maximum allowable energy consumption shall be 92 percent of the value calculated according to Section R405.3.

AMENDATORY SECTION (Amending WSR 13-04-055, filed 2/1/13, effective 7/1/13)

WAC 51-11R-60000 Appendix RC—Exterior design conditions. As required by Section R302.2, the heating or cooling outdoor design temperatures shall be selected from Table RC-1.

WAC 51-11R-60100 Table RC-1—Outdoor design temperatures for Washington.

**TABLE RC-1
OUTDOOR DESIGN TEMPERATURES**

Location	Outdoor Design Temp Heating (°F)	Outdoor Design Temp Cooling (°F)
Aberdeen 20NNE	25	83
Anacortes	24	72
Anatone	-4	89
Auburn	25	84
Battleground	19	91
Bellevue	24	83
Bellingham 2N	19	78
Blaine	17	73
Bremerton	29	83
Burlington	19	77
Chehalis	21	87
Chelan	10	89
Cheney	4	94
Chesaw	-11	81
Clarkston	10	94
Cle Elum	1	91
Colfax 1NW	2	94
Colville AP	-2	92
Concrete	19	83
Connell 4NNW	6	100
Cougar 5E	25	93
Dallesport AP	14	99
Darrington RS	13	85
Davenport	5	92
Edmonds	24	82
Ellensburg AP	2	90
Elma	24	88
Ephrata AP	7	97
Everett Paine AFB	21	79
Forks 1E	23	81
Glacier RS	13	82
Glenoma (Kosmos)	18	89
Goldendale	7	94
Grays River Hatchery	24	86
Greenwater	1.4	84
Grotto	21	84

Location	Outdoor Design Temp Heating (°F)	Outdoor Design Temp Cooling (°F)
Hoquiam AP	26	79
Inchelium 2NW	0	92
John Day Dam	19	100
Kent	21	85
Kirkland	17	83
La Grande	23	88
Leavenworth	-3	93
Little Goose Dam	22	101
Long Beach 3NNE	25	77
Longview	24	87
Lower Granite Dam	14	98
Lower Monument Dam	18	103
Marysville	23	79
Metaline Falls	-1	89
Methow 2W	1	89
Nespelem 2S	-4	93
Newhalem	19	89
Newport	-5	92
Northport	2	92
Oak Harbor	16	74
Odessa	7	100
Olga 2SE	24	71
Olympia AP	17	85
Omak 2NW	3	90
Oroville	5	93
Othello	9	98
Packwood	16	90
Plain	-3	89
Pleasant View	16	98
Pomeroy	3	95
Port Angeles	28	75
Port Townsend	25	76
Prosser	12	97
Puyallup	19	86
Quilcene 2SW	23	83
Quinault RS	25	84
Rainier, Longmire	15	85
Paradise RS	8	71
Raymond	28	81
Redmond	17	83
Republic	-9	87
Richland	11	101
Ritzville	6	99

Location	Outdoor Design Temp Heating (°F)	Outdoor Design Temp Cooling (°F)
Satus Pass	10	90
Seattle: SeaTac AP	24	83
Sedro Woolley 1E	19	78
Sequim	23	78
Shelton	23	85
Smyrna	8	102
Snohomish	21	81
Snoqualmie Pass	6	80
Spokane AP	4	92
Spokane CO	10	96
Stampede Pass	7	76
Stehekin 3NW	12	85
Stevens Pass	6	77
Tacoma CO	29	82
Tatoosh Island	31	63
Toledo AP	17	84
Vancouver	22	88
Vashon Island	28	78
Walla Walla AP	6	96
Waterville	1	88
Wellpinit	1	93
Wenatchee CO	10	92
Whidbey Island	11	71
Willapa Harbor	26	81
Wilson Creek	3	96
Winthrop 1WSW	-12	91
Yakima AP	11	94

ABBREVIATIONS:

AFB Air Force Base
AP Airport
CO City Office
RS Ranger Station
Typical: "4 (miles) NE"

WAC 51-11C-610334 Section A103.3.4—Log wall.

A103.3.4 Log wall. ((See ~~Table A103.3.4.~~

**Table A103.3.4
Log Walls**

	Average Log Diameter, Inches	U-factor
NOTE: R-value of wood:	-6	0.148
R-1.25 per inch thickness	-8	0.111
	10	0.089
Average wall thickness	12	0.074
90% average log diameter	14	0.063
	16	0.056))

U-factors for log walls shall be determined using ICC 400 Table 305.3.1.1, U-Factor of log wall (U_w) by log thickness (W_L) and specific gravity.

WAC 51-11C-61041 Section A104.1—General.

A104.1 General. Table A104.1 lists heat loss coefficients for below-grade walls and floors.

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

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

**Table A104.1
Default Wall U-factors and Slab F-factors for Basements**

	((Below Grade Wall U-factor	Below-Grade Slab F-factor
2 Foot Depth Below-Grade		
Uninsulated	0.350	0.59
R-11 Interior	0.066	0.68
R-11 Interior w/TB	0.070	0.60
R-19 Interior	0.043	0.69
R-19 Interior w/TB	0.045	0.61
R-10 Exterior	0.070	0.60
R-12 Exterior	0.061	0.60
3.5 Foot Depth Below-Grade		
Uninsulated	0.278	0.53
R-11 Interior	0.062	0.63
R-11 Interior w/TB	0.064	0.57
R-19 Interior	0.041	0.64
R-19 Interior w/TB	0.042	0.57
R-10 Exterior	0.064	0.57
R-12 Exterior	0.057	0.57
7 Foot Depth Below-Grade		
Uninsulated	0.193	0.46
R-11 Interior	0.054	0.56
R-11 Interior w/TB	0.056	0.42
R-19 Interior	0.037	0.57
R-19 Interior w/TB	0.038	0.43
R-10 Exterior	0.056	0.42
R-12 Exterior	0.050	0.42))
	<u>Below Grade Wall U-factor</u>	<u>Below Grade Slab F-factor</u>
<u>2 Foot Depth Below-Grade</u>		
<u>Uninsulated</u>	<u>0.331</u>	<u>0.58</u>
<u>R-11 Interior</u>	<u>0.063</u>	<u>0.67</u>
<u>R-11 Interior w/TB</u>	<u>0.065</u>	<u>0.59</u>

	<u>Below Grade Wall U-factor</u>	<u>Below Grade Slab F-factor</u>
<u>R-19 Interior</u>	<u>0.042</u>	<u>0.68</u>
<u>R-19 Interior w/TB</u>	<u>0.045</u>	<u>0.59</u>
<u>R-21 Interior</u>	<u>0.040</u>	<u>0.68</u>
<u>R-21 Interior w/TB</u>	<u>0.042</u>	<u>0.59</u>
<u>R-21+R-5 ci Interior</u>	<u>0.031</u>	<u>0.68</u>
<u>R-21+R-5 Interior w/TB</u>	<u>0.032</u>	<u>0.59</u>
<u>R-21 plus R-7 ci Interior</u>	<u>0.029</u>	<u>0.68</u>
<u>R-21+R-7 Interior w/TB</u>	<u>0.030</u>	<u>0.59</u>
<u>R-10 Exterior</u>	<u>0.089</u>	<u>0.56</u>
<u>R-12 Exterior</u>	<u>0.061</u>	<u>0.60</u>
3.5 Foot Depth Below Grade		
<u>Uninsulated</u>	<u>0.271</u>	<u>0.51</u>
<u>R-11 Interior</u>	<u>0.058</u>	<u>0.61</u>
<u>R-11 Interior w/TB</u>	<u>0.061</u>	<u>0.55</u>
<u>R-19 Interior</u>	<u>0.041</u>	<u>0.62</u>
<u>R-19 Interior w/TB</u>	<u>0.042</u>	<u>0.55</u>
<u>R-21 Interior</u>	<u>0.038</u>	<u>0.63</u>
<u>R-21 Interior w/TB</u>	<u>0.040</u>	<u>0.56</u>
<u>R-21+R-5 Interior</u>	<u>0.030</u>	<u>0.632</u>
<u>R-21+R-5 Interior w/TB</u>	<u>0.031</u>	<u>0.56</u>
<u>R-21 plus R-7 ci</u>	<u>0.027</u>	<u>0.63</u>
<u>R-21 plus R-7 ci w/TB</u>	<u>0.029</u>	<u>0.56</u>
<u>R-10 Exterior</u>	<u>0.075</u>	<u>0.52</u>
<u>R-12 Exterior</u>	<u>0.057</u>	<u>0.57</u>
7 Foot Depth Below Grade		
<u>Uninsulated</u>	<u>0.185</u>	<u>0.43</u>
<u>R-11 Interior</u>	<u>0.051</u>	<u>0.541</u>
<u>R-11 Interior w/TB</u>	<u>0.053</u>	<u>0.49</u>
<u>R-19 Interior</u>	<u>0.036</u>	<u>0.54</u>
<u>R-19 Interior w/TB</u>	<u>0.037</u>	<u>0.50</u>
<u>R-21 Interior</u>	<u>0.035</u>	<u>0.56</u>
<u>R-21 Interior w/TB</u>	<u>0.035</u>	<u>0.50</u>
<u>R-21+R-5 Interior</u>	<u>0.027</u>	<u>0.56</u>
<u>R-21+R-5 Interior w/TB</u>	<u>0.028</u>	<u>0.51</u>
<u>R-21+R-7 Interior</u>	<u>0.025</u>	<u>0.57</u>
<u>R-21+R-7 Interior w/TB</u>	<u>0.026</u>	<u>0.51</u>
<u>R-10 Exterior</u>	<u>0.058</u>	<u>0.47</u>
<u>R-12 Exterior</u>	<u>0.050</u>	<u>0.42</u>

TB = R-5 Thermal Break