

R403.5.5 Water heater installation location. Service hot water systems shall be installed within the building thermal envelope.

Exceptions:

1. ~~Where the hot water system efficiency is greater than or equal to 2.0 UEF.~~
2. ~~Tankless water heaters.~~
3. ~~Gas heat pump water heaters intended for exterior installation.~~
4. ~~Atmospheric vented gas water heaters.~~

R403.5.6 Electric Water heater insulation. All ~~electric tank-type~~ water heaters in unconditioned spaces, or on concrete floors in conditioned spaces, shall be placed on an insulated surface with a minimum thermal resistance of R-10, and a minimum compressive strength of 40 psi or engineered to support the appliance.

R403.5.7 Heat pump water heating. Service hot water in one- and two-family dwellings and multiple single-family dwellings (townhouses) shall be provided by a heat pump system. The heat pump water heating system shall be sized to provide 100 percent of peak hot water demand. Where the heat pump is located in unconditioned space, the heat pump water heating system shall be sized to provide 100 percent of peak hot water demand at an entering source dry bulb (or wet bulb if rated for wet bulb temperatures) air temperature of 40°F (4°C).

Exceptions:

1. ~~Resistance heating elements integrated into heat pump equipment.~~
2. ~~Electric water heaters with a rated water storage volume of no greater than 20 gallons.~~
3. ~~Dwelling units with no more than 1,000 square feet of conditioned floor area.~~
4. ~~Supplementary water heating systems in accordance with Section R403.5.7.1, provided the system capacity does not exceed the capacity of the heat pump water heating system.~~
5. ~~Solar water heating systems.~~
6. ~~Waste heat and energy recovery systems.~~
7. ~~Heat trace freeze protection systems.~~
8. ~~Snow and ice melt systems.~~

R403.5.7.1 Supplementary heat for heat pump water heating systems. Heat pumps used for water heating and having supplementary water heating equipment shall have controls that limit supplementary water heating equipment operation to only those times when one of the following applies:

1. The heat pump water heater cannot meet hot water demand.
2. For heat pumps located in unconditioned space, the outside air temperature is below 40°F (4°C).
3. The heat pump is operating in defrost mode.
4. The vapor compression cycle malfunctions or loses power.

Exception: Heat trace temperature maintenance systems, provided the system capacity does not exceed the capacity of the heat pump water heating system.

R403.13 Heat pump space heating. ~~Space heating shall be provided by a heat pump system.~~

Exceptions:

1. ~~Detached one- and two-family dwellings and multiple single-family dwellings (townhouses up to three stories in height above grade having an installed HVAC heating capacity no greater than 1.5 watts of electric resistance heating per square foot of dwelling unit conditioned floor area, or up to 500 watts, whichever is greater.~~
2. ~~Group R-2 dwelling or sleeping units having an installed HVAC heating capacity no greater than 750 watts in Climate Zone 4, and 1,000 watts in Climate Zone 5, in any separate habitable room with exterior fenestration are permitted to be heated using electric resistance appliances. For buildings in location with exterior design conditions below 4°F (-15.6°C), an additional 250~~

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watts above that allowed for Climate Zone 5 is permitted.

2.1. A room within a dwelling or sleeping unit that has two primary walls facing different cardinal directions, each with exterior fenestration, is permitted to have an installed HVAC heating capacity no greater than 1,000 watts in Climate Zone 4, and 1,300 watts in Climate Zone 5. Bay windows and other minor offsets are not considered primary walls. For buildings in location with exterior design conditions below 4°F (-15.6°C), an additional 250 watts above that allowed for Climate Zone 5 is permitted.

3. Resistance heating elements integrated into heat pump equipment.

4. Solar thermal systems.

5. Waste heat, radiant heat exchanger, and energy recovery systems.

6. Supplementary heat in accordance with Section R403.1.2.

7. Where there is no electric utility service available at the building site.

8. Heating systems that rely primarily on biomass are allowed in Climate Zone 5.

SECTION R405 TOTAL BUILDING PERFORMANCE

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

R405.2 Performance-based compliance. Compliance based on *total building performance* requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2(1).
2. For structures less than 1,500 square feet of conditioned floor area, the annual carbon emissions site energy shall be less than or equal to 64 percent of the annual carbon emissions site energy of the *standard reference design*.
3. For structures 1,500 to 5,000 square feet of conditioned floor area, the annual carbon emissions site energy shall be no more than 47 percent of the *standard reference design*.
4. For structures over 5,000 square feet of conditioned floor area, the annual carbon emissions site energy shall be no more than 41 percent of the *standard reference design*.
5. For structures serving Group R-2 occupancies, the annual carbon emissions site energy shall be less than or equal to 61 percent of the annual carbon emissions of the *standard reference design*. See Section R401.1 and *residential building* in Section R202 for Group R-2 scope.

Carbon emissions for both the *standard reference design* and the *proposed design* shall be calculated using Table R405.2(2). Energy use derived from simulation analysis shall be expressed in pounds of carbonkBtu per square foot of *conditioned floor area* per year.

R405.3 Documentation. Documentation of the software used for the performance design and the parameters for the building shall be in accordance with Sections R405.3.1 through R405.3.3.

R405.3.1 Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the *code official*.

R405.3.2 Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* complies with Section R405.2. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a confirmed compliance report based on the confirmed condition of the building shall be submitted to the code official before a certificate of occupancy is issued.

Compliance reports shall include information in accordance with Sections R405.3.2.1 and R405.3.2.2.

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R405.3.2.1 Compliance report for permit application. A compliance report submitted with the application for building permit shall include all of the following:

1. Building street address, or other *building site* identification.
2. The name, organization and contact information of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the *proposed design* complied with Section R405.2. The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation *R*-values or *U*-factors; duct system and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system. Additional documentation reporting estimated annual energy production shall be provided.
6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

TABLE R405.2(1)
MANDATORY COMPLIANCE MEASURES FOR TOTAL BUILDING PERFORMANCE

Section ^a	Title	Comments
General		
R401.3	Certificate	
Envelope		
R402.1.1	Vapor retarder	
R402.2.3	Eave baffle	
R402.2.4.1	Access hatches and doors	
R402.2.10.1	Crawlspace wall insulation installations	
R402.4	Air leakage	
R402.5	Maximum fenestration U-factor	
Systems		
R403.1	Controls	
R403.3	Ducts	Except for R403.3.2 and R403.3.3
R403.4	Mechanical system piping insulation	
R403.5.1	Heated water circulation and temperature maintenance system	
R403.5.3	Drain water heat recovery units	
R403.5.7	Heat-pump-water-heating	
R403.6	Mechanical ventilation	
R403.7	Equipment sizing and efficiency rating	
R403.8	Systems serving multiple dwelling units	
R403.9	Snow melt system controls	
R403.10	Energy consumption of pools and spas	
R403.11	Portable spas	
R403.12	Residential pools and permanent residential spas	
R403.13	Heat-pump-space-heating	
Electrical Power and Lighting		
R404.1	Lighting equipment	
R404.2	Interior lighting controls	

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a. Reference to a code section includes all the relative subsections except as indicated in the table.

**TABLE R405.2(2)
CARBON EMISSIONS FACTORS**

TYPE	CO₂e (lb/unit)	UNIT
Electricity	0.44	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.~~

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R405.3.2.2 Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include all of the following:

1. Building street address, or other building site identification
2. Declaration of the total building performance path on the title page of the energy report and the title page of the building plans.
3. A statement, bearing the name of the individual performing the analysis and generating the report, along with their organization and contact information, indicating that the as-built building complies with Section R405.2.
4. The name and version of the compliance software tool.
5. A site-specific energy analysis report that is in compliance with Section R405.2.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the confirmed rated design of the built home complies with Section R405.2. The certificate shall report the energy features that were confirmed to be in the home, including component level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation and service water-heating equipment installed.
7. Where on-site renewable energy systems have been installed, the certificate shall report the type and production size of the installed system. Additional documentation reporting estimated annual energy production shall be provided.

R405.4 Calculation procedure. Calculations of the performance design shall be in accordance with Sections R405.4.1 and R405.4.2.

R405.4.1 General. Except as specified by this section, the *standard reference design* and *proposed design* shall be configured and analyzed using identical methods and techniques.

R405.4.2 Residence specifications. The *standard reference design* and *proposed design* shall be configured and analyzed as specified by Table R405.4.2(1). Table R405.4.2(1) shall include by reference all notes contained in Table R402.1.3.

TABLE R405.4.2(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 R402.1.2 Solar absorptance = 0.75 Emittance = 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 R402.1.2, 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 R402.1.2	As proposed As proposed As proposed
Ceilings	Type: Wood frame Gross area: Same as proposed U-factor: From Table R402.1.2	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 R402.1.2.	As proposed As proposed As proposed
Vertical fenestration other than opaque doors ^a	Total area ^b = (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 R402.1.2	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
Air exchange rate	Air leakage rate of 4 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 - The mechanical ventilation system type shall be the	As proposed ^d . The mechanical ventilation rate ^b shall be in addition to the air leakage rate and shall be as proposed.

	same as in the proposed design. Energy recovery shall not be assumed for mechanical ventilation.																		
Mechanical ventilation	None, except where mechanical ventilation is specified by the proposed design, in which case: Annual vent fan energy use: $kWh/yr = (1e_f) \times (0.0876 \times CFA + 65.7 \times (N_{br} + 1))$ where: e_f = the minimum fan efficacy from Table R403.6.1 corresponding to the system type at 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 R402.1.2 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}	The standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the WSEC—Commercial Provisions. 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}	The standard reference design shall be a heat pump water heating-heater meeting the standards for Tier 1 of NEEA's Advanced Water Heating Specifications. Use, in units of gal/day = $25.5 + (8.5 \times N_{br})$ Where N_{br} = number of bedrooms	As proposed Use, in units of gal/day = $25.5 + (8.5 \times N_{br}) \times (1 - HWDS)$ Where: N_{br} = number of bedrooms $HWDS$ = factor for the compactness of the hot water distribution system																	
		<table border="1"> <thead> <tr> <th colspan="2">Compactness ratioⁱ factor</th> <th rowspan="2">HWDS</th> </tr> <tr> <th>1 story</th> <th>2 or more stories</th> </tr> </thead> <tbody> <tr> <td>>60%</td> <td>>30%</td> <td>0</td> </tr> <tr> <td>>30% to ≤60%</td> <td>>15% to ≤30%</td> <td>0.05</td> </tr> <tr> <td>>15% to ≤30%</td> <td>>7.5% to ≤15%</td> <td>0.10</td> </tr> <tr> <td>>15%</td> <td>>7.5%</td> <td>0.15</td> </tr> </tbody> </table>	Compactness ratio ⁱ factor		HWDS	1 story	2 or more stories	>60%	>30%	0	>30% to ≤60%	>15% to ≤30%	0.05	>15% to ≤30%	>7.5% to ≤15%	0.10	>15%	>7.5%	0.15
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>15%	>7.5%	0.15																	
Thermal distribution	Duct insulation: From Section R403.3.3.	Duct insulation: As																	

systems	Duct location: Same as proposed design. 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 (DSE) shall be 1.	proposed. Duct location: As proposed. 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 CFA are in the same units.

- i. The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the "hot water rectangle") divided by the floor area of the dwelling.
 1. Sources of hot water include water heaters, or in multifamily buildings with central water heating systems, circulation loops, or electric heat traced pipes.
 2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
 3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.
 4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
 5. The basement or attic shall be counted as a story when it contains the water heater.
 6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and HWDS factor.

**SECTION R406
ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS**

R406.1 Scope. This section establishes 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 unless specifically exempted in Section R406. Credit 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.

**TABLE R406.2
FUEL NORMALIZATION ENERGY EQUALIZATION CREDITS**

System Type	Description of Primary Heating Source	Credits	
		All Other	Group R-2 ^a
1	For combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(5) or C403.3.2(6)	-3.0	0
2	For an initial heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) and supplemental heating provided by electric resistance or a combustion furnace meeting minimum standards listed in Table C403.3.2(5) ^b	0 1.5	0
3	For heating system based on electric resistance only (either forced air or Zonal)	-1.0 0.5	-0.5
4 ^c	For heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) or C403.3.2(9)	-1.5 3.0	2.0

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System Type	Description of Primary Heating Source	Credits	
		All Other	Group R-2 ^a
	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		
5	For heating system based on electric resistance with: <ol style="list-style-type: none"> Inverter-driven ductless mini-split heat pump system installed in the largest zone in the dwelling, With 2kW or less total installed heating capacity per dwelling 	0.5 2.0	0

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- See Section R401.1 and residential building in Section R202 for Group R-2 scope.
- The gas back-up furnace will operate as fan-only when the heat pump is operating. The heat pump shall operate at all temperatures above 38°F (3.3°C) (or lower). Below that “changeover” temperature, the heat pump would not operate to provide space heating. The gas furnace provides heating below 38°F (3.3°C) (or lower).
- Additional points for the HVAC system are included in Table R406.3.

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

- Small Dwelling Unit: 2.5 5.0 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 greater than 500 square feet of heated floor area but less than 1500 square feet.
- Medium Dwelling Unit: 5.0 8.0 credits
 All dwelling units that are not included in #1, #3 or #4.
- Large Dwelling Unit: 6.0 9.0 credits
 Dwelling units exceeding 5000 square feet of conditioned floor area.
- Dwelling units serving Group R-2 occupancies: 4.5 6.5 credits
 See Section R401.1 and *residential building* in Section R202 for Group R-2 scope.
- Additions 150 square feet to 500 square feet: 2.0 credits

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

**TABLE R406.3
ENERGY CREDITS**

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
1. EFFICIENT BUILDING ENVELOPE OPTIONS			
Only one option from Items 1.1 through 1.4 may be selected in this category. Compliance with the conductive UA targets is demonstrated using Section R402.1.5, Total UA alternative, where [1-(Proposed UA/Target UA)] > the required %UA reduction			
1.1	Prescriptive compliance is based on Table R402.1.3 with the following modifications:	0.5	0.5

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	Vertical fenestration U = 0.22.		
1.2	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.25 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 R402.1.5: Reduce the Total conductive UA by 15%.	0.5 1.0	1.0
1.3	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced 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 R402.1.5: Reduce the Total conductive UA by 22.5%.	1.0 1.5	0.5
1.4	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced Wood frame wall R-21 int plus R-16 ci Floor R-48 Basement wall R-21 int plus R-16 ci Slab on grade R-20 perimeter and under entire slab Below grade slab R-20 perimeter and under entire slab or Compliance based on Section R402.1.5: Reduce the Total conductive UA by 30%.	1.5 2.5	2.0
2. AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION OPTIONS Only one option from Items 2.1 through 2.3 may be selected in this category.			
2.1	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum at 50 Pascals, or for R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft ² maximum at 50 Pascals and All whole house ventilation requirements as determined by Section M1505.3 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	0.5 1.0	1.0

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	specify the option being selected, the maximum tested building air leakage, and shall show the qualifying ventilation system and its control sequence of operation.		
2.2	<p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum at 50 Pascals, or for R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.20 cfm/ft² maximum at 50 Pascals</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1505.3 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.</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 1.5	1.5
2.3	<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, or 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 M1505.3 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 insulation shall comply with Section R403.3.2.</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>	1.5 2.0	2.0
3. HIGH EFFICIENCY HVAC EQUIPMENT OPTIONS			
Only one option from Items 3.1 through 3.8 may be selected in this category. Item 3.9 may be taken with Items 3.1 or 3.3 ^c only.			
3.1 ^a	<p>For a System Type 1 in Table R406.2: 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>For secondary heating system serving System Type 2 in Table R406.2: Air source centrally ducted heat pump with minimum HSPF of 9.5 Energy Star rated (US North) gas or propane furnace with min.</p>	0.5	0.5

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	<p><u>AFUE of 95%</u></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>		
3.3 ^{a,c,d}	<p>Air-source, centrally ducted heat pump with minimum HSPF of 9.5.</p> <p>In areas where the winter design temperature as specified in Appendix RC is 23°F or below, a cold climate heat pump found on the NEEP cc ASHP qualified product list shall be used.</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>	0.5	NA
3.4 ^{a,d}	<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
3.5 ^d	<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
3.6 ^a	<p>Air-source, centrally ducted heat pump with minimum HSPF of 11.0.</p> <p>A centrally ducted air source cold climate variable capacity heat pump (cc VHP) found on the NEEP cc VCHP qualified product list with a minimum of 10 HSPF may be used to satisfy this requirement.</p> <p>In areas where the winter design temperature as specified in Appendix RC is 23°F or below, an air source centrally ducted heat pump shall be a cold climate variable capacity heat pump as listed on the NEEP qualified product list.</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
3.7 ^{a,d,e}	<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>Exception: In homes with total heating loads of 24,000 or less using multi-zone mini-split systems with nominal ratings of 24,000 or less, the minimum HSPF to claim this credit shall be 9 HSPF.</p>	2.0	3.0

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	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).		
3.8 ^{a,d}	Air-to-water heat pump with minimum COP of 3.2 at 47°F, rated in accordance with AHRI 550/590 by an accredited or certified testing lab. To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).	1.0	NA
3.9 ^c	Connected thermostat meeting ENERGY STAR Certified Smart Thermostats/EPA ENERGY STAR specifications. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the thermostat model.	0.5	0.5
<u>3.10</u>	<u>Gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15.</u> <u>For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall serve all units.</u>	<u>1.5</u>	<u>1.5</u>
<u>3.11</u>	<u>Combination water heating and space heating system shall include one of the following:</u> <u>Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0.</u> <u>or</u> <u>For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0, shall serve all units.</u> <u>or</u> <u>For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall serve all units.</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 and, for solar water heating systems, the calculation of the minimum energy savings.</u>	<u>2.5</u>	<u>2.5</u>
4. HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM OPTIONS			
4.1	HVAC equipment and associated duct system(s) installation shall comply with the requirements of Section R403.3.2. Electric resistance heat, hydronic heating and ductless heat pumps are not permitted under this option. Direct combustion heating equipment with AFUE less than 80% is not permitted under this option. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and	0.5	N/A

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	cooling equipment and all the ductwork.		
5. EFFICIENT WATER HEATING OPTIONS			
Only one option from Items 5.3 through <u>5-55.8</u> may be selected in this category. Items 5.1 and 5.2 may be combined with any option.			
5.1	<p>A drain water heat recovery unit(s) shall be installed, which captures waste water heat from at least two showers, including tub/shower combinations. It is acceptable, but not required, for sink water to be connected. Unit shall have a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 54% if installed for unequal flow. Such units shall be rated in accordance with CSA B55.1 or IAPMO IGC 346-2017 and be so labeled.</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>For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water between the nearest source of heated water and the termination of the fixture supply pipe where calculated using Section R403.5.2. <i>Construction documents</i> shall indicate the ounces of water in piping between the hot water source and the termination of the fixture supply. When the hot water source is the nearest primed plumbing loop or trunk, this must be primed with an On Demand recirculation pump and must run a dedicated ambient return line from the furthest fixture or end of loop to the water heater.</p> <p>To qualify for this credit, the dwelling must have a minimum of 1.5 bathrooms.</p>	0.5	0.5
<u>5.3</u>	<p><u>Water heating system shall include (one of) the following:</u> <u>Energy Star rated gas or propane water heater with a minimum UEF of 0.80.</u></p> <p><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>	<u>0.5</u>	<u>0.5</u>
<u>5-3.5.4</u>	<p><u>Water heating system shall include one of the following:</u> <u>Energy Star rated gas or propane water heater with a minimum UEF of 0.91</u> <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 System <u>or</u> Water heater heated by ground source heat pump meeting the requirements of Option 3.3. 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</p>	1.0	1.0

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	solar water heating systems, the calculation of the minimum energy savings.		
5.5	<p>Water heating system shall include one of the following:</p> <p>Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0.</p> <p>or</p> <p>For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0, shall supply domestic hot water to all units.</p> <p>or</p> <p>For R-2 Occupancy, gas-fired heat pump water heater(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall supply domestic hot water to all units.</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>	1.5	1.5
5.4 5.6	<p>Water heating system shall include one of the following:</p> <p>Electric heat pump water heater meeting the standards for Tier III of NEEA's advanced water heating specification.</p> <p>or</p> <p>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.</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>	2.0	2.5
5.5 5.7	<p>Water heating system shall include one of the following:</p> <p>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</p> <p>or</p> <p>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.</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>	2.5	3.0
5.8	<p>Combination water heating and space heating system shall include</p>	TBD	TBD

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OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	<p><u>one of the following:</u></p> <p><u>Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0.</u></p> <p><u>or</u></p> <p><u>For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. shall supply all units.</u></p> <p><u>or</u></p> <p><u>For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall supply all units.</u></p> <p><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 and, for solar water heating systems, the calculation of the minimum energy savings.</u></p>		
6. RENEWABLE ELECTRIC ENERGY OPTION			
6.1	<p>For each 600 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 4.5 credits. Generation shall be calculated as follows:</p> <p>For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTS or approved alternate by the code official. 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 – 4.5	0.5 – 4.5
7. APPLIANCE PACKAGE OPTION			
7.1	<p>All of the following appliances shall be new and installed in the dwelling unit and shall meet the following standards:</p> <ol style="list-style-type: none"> 1. Dishwasher, standard – Energy Star rated, Most Efficient 2021 or Dishwasher, compact – Energy Star rated (Version 6.0) 2. Refrigerator (if provided) – Energy Star rated (Version 5.1) 3. Washing machine (Residential) – Energy Star rated (Version 8.1) 4. Dryer – Energy Star rated, Most Efficient 2022 <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</p>	0.5	1.5

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
	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 <i>dwelling unit</i> .		

- 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.
- b. See Section R401.1 and *residential building* in Section R202 for Group R-2 scope.
- c. Option 3.9 can only be taken with Options 3.1 and 3.3. To qualify to claim Option 3.8 with 3.3, the system shall be a 1-2 speed heat pump system. Variable capacity heat pumps are ineligible from claiming this option.
- d. This option may only be claimed if serving System Type 4 or 5 from Table R406.2.
- e. Primary living areas include living, dining, kitchen, family rooms, and similar areas.
- e.f. Option 3.11 may only be taken with Efficient Water Heating Options 5.1 or 5.2. Equipment sizing for space heating shall be calculated as provided in Section R403.7 with increase capacity to provide a minimum of 75 percent of peak hot water demand or shall be sized in accordance with approved manufacturers specifications or guidance. Supplementary heat for water heating system shall be in accordance with Section R403.5.7.1.

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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, without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall be such that the existing building or structure is no less conforming to the provisions of this code than the existing building or structure was prior to the *alteration*.

Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Alterations shall be such that the existing building or structure uses no more energy than the existing building or structure prior to the *alteration*. *Alterations* to existing buildings shall comply with 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 *code 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 R402.1.3 or R402.1.5, 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 R402.1.3. 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.

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.
3. ~~Replacements of space heating equipment shall not be required to comply with Section R403.13 where the rated capacity of the new equipment does not exceed the rated capacity of the existing equipment.~~

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

Exceptions:

1. Replacement of water heating equipment shall not be required to comply with Section R403.5.5.
2. ~~Replacement of water heating equipment shall not be required to comply with Section R403.5.7 where the rated capacity of the new equipment does not exceed the rated capacity of the existing equipment.~~

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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 10 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.