



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

Washington State Energy Code Development
Standard Energy Code Proposal Form

May 2018

Log No. 19-WSEC-R31

Code being amended: Commercial Provisions Residential Provisions

Code Section # **R402.4.1.2, R403.3.7, R405.3, R406, Chapter 6**

Brief Description: **This proposal differs from similar proposals being submitted in that it *further* increases the proposed number of additional energy efficiency credits required.**

This proposal updates Section R406 and requires additional energy efficiency credits. It also amends portions of the prescriptive code, as required, to support proposed revisions to Section R406.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

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). 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 ft² 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. 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.

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 one of 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.
 - a) Metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic.
 - b) 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

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 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 shall be less than or equal to ~~80~~ **67** percent of the annual energy consumption of the *standard reference design*.
2. For structures 1,500 to 5,000 square feet of conditioned floor area, the annual energy consumption 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 shall be no more than ~~66~~ **50** percent of the *standard reference design*.
4. **Exception:** For structures serving Group R-2 occupancies, the annual energy consumption shall be less than or equal to ~~85~~ **70** percent of the annual energy consumption of the *standard reference design*.

**SECTION R406
ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS**

~~**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.~~

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

R406.2 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~~ **4.5** 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.
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. Additions less than 500 square feet: 0.5 credits~~
4. Dwelling units serving R-2 occupancies: 4.5 credits (from Group R-2 Credit column in Table R406.2)
5. Additions less than or equal to 500 square feet: ... 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

TABLE 406.2 ENERGY CREDITS

OPTION	DESCRIPTION	CREDIT(S) (Single family and townhouse)	CREDIT(S) (Group R-2 Only)
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 <u>conductive</u> ^a UA by 5%.	0.5	<u>N/A</u>

1b	<p>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 <u>int</u> plus R-4 <u>ci</u> 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</p> <p>or Compliance based on Section R402.1.4: Reduce the Total <u>conductive</u>^a UA by 15%.</p>	1.0	<u>1.0</u>
1c	<p>EFFICIENT BUILDING ENVELOPE 1c: 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</p> <p>or Compliance based on Section R402.1.4: Reduce the Total <u>conductive</u>^a UA by 30%.</p>	2.0	<u>1.5</u>
1d ^{AD}	<p>EFFICIENT BUILDING ENVELOPE 1d: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.24</p>	0.5	<u>0.5</u>
<u>1e</u>	<p><u>EFFICIENT BUILDING ENVELOPE 1e:</u> <u>Prescriptive compliance is based on Table R402.1.1 with the following modifications:</u> <u>Vertical fenestration U = 0.18</u> <u>Ceiling and single-rafter or joist-vaulted R-60 advanced</u> <u>Wood frame wall R-21 int plus R-16 ci</u> <u>Floor R-48</u> <u>Basement wall R-21 int plus R-16 ci</u> <u>Slab on grade R-20 perimeter and under entire slab</u> <u>Below grade slab R-20 perimeter and under entire slab</u></p> <p><u>or</u> <u>Compliance based on Section R402.1.4: Reduce the Total <u>conductive</u>^a UA by 40%.</u></p>	<u>3.0</u>	<u>2.0</u>
<u>1f</u> ^C	<p><u>EFFICIENT BUILDING ENVELOPE 1f:</u> <u>Prescriptive compliance is based on Table R402.1.1 with the following modifications:</u> <u>Vertical fenestration U = 0.20</u></p>	<u>1.0</u>	<u>1.0</u>
2a	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2a: Compliance based on R402.4.1.2: Reduce the tested air leakage to 3.0 air changes per hour maximum <u>at 50 pascals</u></p> <p><u>Or</u> <u>For R-2 occupancies, optional compliance based on Section R402.4.1.2: Reduce the</u> <u>tested air leakage to 0.3 cfm/ft² maximum at 50 pascals</u></p> <p>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 (maximum 0.35 watts/cfm), not interlocked with the furnace fan (<u>if present</u>). 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 qualifying ventilation system and its control sequence of operation.</p>	0.5	<u>1.0</u>

2b	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2b: Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum <u>at 50 pascals</u> <u>Or</u> For R-2 occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 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 0.70 <u>0.65</u>.</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	<u>1.5</u>
2c	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2c: Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum <u>at 50 pascals</u> <u>Or</u> 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 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 0.85 <u>0.75</u>.</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	<u>2.0</u>
2d	<p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2d: Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.6 air changes per hour maximum at 50 pascals <u>Or</u> 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. 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>	<u>2.0</u>	<u>2.5</u>
3a ^{b,d,e}	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3a: Energy Star Rated (U.S. North) Gas or propane or oil-fired furnace with minimum AFUE of 94% <u>95%</u>, or Energy Star Rated Gas or propane or oil-fired boiler with minimum AFUE of 92% <u>90%</u></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	<u>1.0</u>
3b ^{b,d,e}	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3b: Air-source, centrally ducted heat pump with minimum HSPF of 9.09 <u>5</u></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 <u>0.5</u>	<u>N/A</u>
3c ^{b,d,e}	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3c: 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	<u>1.0</u>

3d b d	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3d: Ductless Split System Heat Pumps, Zonal Control: In homes where the primary space heating system is zonal electric heating, a ductless heat pump system <u>with a minimum HSPF of 10.0</u> 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	<u>2.0</u>
3e d ,e	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3e: Air-source, centrally ducted heat pump with minimum HSPF of 11.0 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>	<u>1.0</u>	<u>0.5</u>
3f d ,e	<p>HIGH EFFICIENCY HVAC EQUIPMENT 3f: 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>	<u>1.5</u>	<u>2.5</u>
4	<p>HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM: 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> <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>HVAC equipment and associated duct system(s) installation shall comply with 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	<u>N/A</u>
5a	<p>EFFICIENT WATER HEATING 5a: All showerhead 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.⁶</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> <p>EFFICIENT WATER HEATING 5a: 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 CSA B55.1 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	<u>0.5</u>

5b	<p>EFFICIENT WATER HEATING 5b: Water heating system shall include one of the following: <u>Energy Star Rated Gas or propane or oil water heater with a minimum EF UEF of 0.74 0.8</u> or Water heater heated by ground source heat pump meeting the requirements of <u>Option 3c.</u> or 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. 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>	<u>1.00.5</u>	<u>0.5</u>
5c	<p>EFFICIENT WATER HEATING 5c: Water heating system shall include one of the following: <u>Energy Star Rated Gas or propane or oil water heater with a minimum EF UEF of 0.91</u> or Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems. or Water heater heated by ground source heat pump meeting the requirements of <u>Option 3c.</u> or 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. 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>	<u>1.51.0</u>	<u>1.0</u>
5d	<p>EFFICIENT WATER HEATING 5d: 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 CSA B55.1 and be so labeled. To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it and labels or other documentation shall be provided that demonstrates that the unit complies with the standard. Water heating system shall include one of the following: <u>Electric heat pump water heater meeting the standards for Tier I of NEEA's Advanced Water Heating Specification.</u> or 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. 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>	<u>0.51.5</u>	<u>2.0</u>

5e	<p><u>EFFICIENT WATER HEATING 5e:</u> <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> <u>or</u> <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></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>	2.0	2.5
5f	<p><u>EFFICIENT WATER HEATING 5f:</u> <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.</u> <u>Equipment shall meet the standards of NEEA's Advanced Water Heating Specification.</u> <u>or</u> <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></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>	2.5	3.0
6	<p><u>RENEWABLE ELECTRIC ENERGY:</u> <u>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:</u> <u>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 Authority Having Jurisdiction.</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>	0.5	0.5
7	<p><u>APPLIANCE PACKAGE:</u> <u>All of the following appliances shall be provided with the dwelling unit and shall meet the following standards:</u> <u>Dishwasher – Energy Star Rated</u> <u>Refrigerator – Energy Star Rated</u> <u>Washing Machine – Energy Star Rated</u> <u>Dryer – Energy Star Rated, ventless dryer with a minimum CEF rating of 5.2</u></p> <p><u>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.</u></p>	0.5	1.0

- a. Compliance with the conductive UA targets is demonstrated using R402.1.4 Total UA alternative where: $[1 - (\text{Proposed UA} / \text{Target UA})] >$ the required % UA reduction.
- b. Projects using this option may not use Option 1a, 1b, ~~1c~~, 1e or 1f.
- c. Projects using this option may not use Option 1a, 1b, 1c, 1d or 1e.
- d. Projects may only include credit from one space heating option, 3a, 3b, 3c, ~~or 3d~~, 3e or 3f. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.
- e. ~~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.~~
- e. 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

Chapter 6 REFERENCED STANDARDS

CSA

Canadian Standards Association 5060
Spectrum Way
Mississauga, Ontario, Canada L4W 5N6

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	R402.4.3
CSA B55.1: 2015	Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Units	Table R406.2

NEEA

Northwest Energy Efficiency Alliance 421 SW 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
NEEA 2016	Advanced Water Heating Specification, Vers. 6.0	Table R406.2

Purpose of code change:

Incremental Improvements in Energy Efficiency consistent with RCW 19.27a.160.

SBCB has been directed by the Governor in Executive Order 14-4 to move the energy code forward more rapidly. Since these additional efficiency options have been shown to be cost effective, they should be adopted without further delay.

Change in Scope: New to 2018, low-rise multifamily now has dedicated credit values that more appropriately honor the energy savings potential for any given measure. For instance, domestic hot water energy consumption in multifamily represents a bigger portion of the total energy use compared to detached single family housing (20-25% compared to 14-18%, respectively), therefore a more efficient water heating system installed in the low-rise multifamily building will earn more credits under Table 406.2 than single family. Because this code covers low-rise multifamily, additions, as well as single family homes, energy conservation targets are specific to each of these unique construction types and credit values are representative of each building type. We have also added a few prescriptive code changes to strengthen and clarify the requirements set out in Section R406.

Consider clarifications and implementation changes: To provide clear enforceable code language, several editorial changes have been included. We have moved most of the language under option 4 into the base code to clarify requirements and make this section referable in other sections of the code. Low flow fixtures have been mandated through the legislature, therefore cannot be awarded as an energy credit under R406 – this has been eliminated from the table. Low-rise multifamily is now addressed as a unique building type, instead of being rolled up with single-family construction. Appliances are a newly proposed option in the table. As the total energy consumption of the residential sector drops with

each code cycle and since appliances have not been addressed in previous code cycles, this end-use represents a larger portion of the total energy consumption and as such, needs to be targeted as we approach 2031 goals.

Add New Efficiency Options: To continue to provide a diverse set of options for implementation, several new options have been added.

- Option 1e provides credit for 40% UA reduction
- Option 1f provides credit for higher performing triple pane glazing
- Option 2d allows credit for tighter envelope construction and highly efficient ERVs
- Option 3e provides credit for inverter-driven, variable speed compressors in central heat pumps
- Option 3f allows credit for homes with minisplit heat pump heating. Eliminating the majority of electric resistance heating leads to increased energy savings
- Options 5d, e, f are meant to more thoroughly cover available heat pump water heating technologies
- Option 7 gives credit for Energy Star rated appliances (primarily to ventless dryers)

Calculate Building Energy Use for the base code and section 406 options: The base code (prescriptive) changes made in 2015 and by the 2018 IECC additions, along with WA state law, are first assessed to determine the base energy use of the seven, modeled prototype buildings (representing the wide range of residential construction within the state). Based on this, the value of each credit is reassessed and if needed, reassigned. For example, WA state law now mandating low-flow fixtures reduces the savings potential from water heating equipment efficiencies – thus lowering their effective value, compared to previous years. The savings attributed to low-flow fixtures are not ‘lost’ in the analysis however, as the energy savings is now reflected in the 2018 baseline (prescriptive) energy use of the residential sector. Changes in prescriptive lighting requirements also lead to changes in the energy use between code cycles.

Assess the number of credits required to achieve the objectives of RCW 19.27a.160: This proposal is designed to meet the high-level goal of RCW 19.27a.160. This 2018 Section R406 code change proposal, along with other changes (lighting, low-flow fixtures), is expected to lead a 40% energy reduction over a 2006 WSEC compliant home. These savings are primarily attributed to the credits required to comply with code in Section R406.2.

Adjust the targets for systems analysis approach, section 405.3: The last step is to assess the performance-based approach. The targets have been reduced by an additional percentage.

Your amendment must meet one of the following criteria. Select at least one:

- | | |
|--|--|
| <input type="checkbox"/> Addresses a critical life/safety need. | <input checked="" type="checkbox"/> Consistency with state or federal regulations. |
| <input type="checkbox"/> The amendment clarifies the intent or application of the code. | <input type="checkbox"/> Addresses a unique character of the state. |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.
(Note that energy conservation is a state policy) | <input type="checkbox"/> Corrects errors and omissions. |

Check the building types that would be impacted by your code change:

- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> Single family/duplex/townhome | <input type="checkbox"/> Multi-family 4 + stories | <input type="checkbox"/> Institutional |
| <input checked="" type="checkbox"/> Multi-family 1 – 3 stories | <input type="checkbox"/> Commercial / Retail | <input type="checkbox"/> Industrial |

Your name Duane Jonlin

Your organization City of Seattle

Other contact name [Click here to enter text.](#)

Email address duane.jonlin@seattle.gov

Phone number (206) 233-2781

Economic Impact Data Sheet

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

First cost and energy savings

First cost and energy savings estimates have been developed using an estimating procedure used by the Northwest Power and Conservation Council (NPCC). This method uses 6 prototype single family homes and one multi-family building to assess regional energy impacts. This includes: a 1344 sf rambler (crawl space and slab), a 2200 square foot rambler (crawl space and slab), a 2866 sf home with half basement, a 5000 sf home with a full basement, and a 820 sf multifamily dwelling unit (modeled a 3 story, exterior entry, low-rise building). For each building both cost and energy savings are estimated for each prototype and each measure.

First Cost: The first cost included in Tables 1 and 2 were developed using multiple sources of information:

- NPCC, the Regional Technical Forum (RTF), <http://rtf.nwcouncil.org/> This is a federally mandated multi-state compact that develops the efficiency resources for the region's electric utilities
- Navigant is a business consulting firm which provides resource planning for both gas and electric utilities, including gas utilities in Washington State. <http://www.navigant.com/industries/energy/>
- CEE is the Consortium for Energy Efficiency. CEE is the US and Canadian consortium of gas and electric efficiency program administrators. <http://www.cee1.org/>
- This study also uses cost information provided to the SBCC by Ecotope

The cost of each option is included in Table 1 and 2. Cost are considered for 6 single family and 1 multi-family prototype. For single family prototypes, the crawlspace and slab variations have already been incorporated in the '1344sf' and 2200sf' prototypes – which is why only 4 cost numbers are shown.

Table 1: Total Measure Costs by Single Family Prototypes

			Prototypes Weight % by Floor Area			
			1344	2200	2688	5000
Option-Description	Credit Value	Weighted Measure Cost	15%	72%	11%	2%
1a - 5% UA reduc	0.5	\$ 1,102	\$ 767	\$ 1,097	\$ 1,667	\$ 676
1b - 15% UA reduc	1	\$ 4,311	\$ 2,649	\$ 4,565	\$ 4,582	\$ 6,127
1c - 30% UA reduc	2	\$ 7,947	\$ 4,869	\$ 8,537	\$ 7,609	\$ 11,659
1d - U-.24 Glaze	0.5	\$ 1,583	\$ 907	\$ 1,638	\$ 1,818	\$ 3,375
1e - 40% UA reduc	3	\$ 11,889	\$ 7,641	\$ 12,925	\$ 10,191	\$ 15,828
1f - U-.20 Glaze	1	\$ 3,166	\$ 1,814	\$ 3,276	\$ 3,636	\$ 6,750
2a - 3ACH , fan eff	0.5	\$ 517	\$ 349	\$ 521	\$ 618	\$ 1,081
2b - 2 ACH, HRV	1	\$ 2,727	\$ 1,680	\$ 2,750	\$ 3,360	\$ 6,250
2c - 1.5 ACH, HRV	1.5	\$ 6,108	\$ 3,763	\$ 6,160	\$ 7,526	\$ 14,000
2d - 0.6 ACH, HRV	2	\$ 8,725	\$ 5,376	\$ 8,800	\$ 10,752	\$ 20,000
3a - Furnace	1	\$ 230	\$ 230	\$ 230	\$ 230	\$ 230
3b - 9.5 HSPF HP	0.5	\$ 1,270	\$ 1,270	\$ 1,270	\$ 1,270	\$ 1,270
3c - GSHP	1.5	\$ 11,034	\$ 10,900	\$ 10,900	\$ 10,900	\$ 17,600
3d - DHP	1	\$ 1,400	\$ 1,400	\$ 1,400	\$ 1,400	\$ 1,400
3e - 11.0 HSPF HP	1	\$ 5,400	\$ 5,400	\$ 5,400	\$ 5,400	\$ 5,400
3f - DHP (15% elec)	1.5	\$ 5,400	\$ 5,400	\$ 5,400	\$ 5,400	\$ 5,400
4 - HVAC inside	1	\$ 300	\$ 300	\$ 300	---	---
5a - DWR	0.5	\$ 400	\$ 400	\$ 400	\$ 400	\$ 400
5b - 0.80 gas DHW	0.5	\$ 586	\$ 586	\$ 586	\$ 586	\$ 586
5c - 0.91 gas DHW, GSHP	1	\$ 923	\$ 923	\$ 923	\$ 923	\$ 923
5d - Tier I HPWH	1.5	\$ 874	\$ 874	\$ 874	\$ 874	\$ 874
5e - Tier III HPWH	2	\$ 874	\$ 874	\$ 874	\$ 874	\$ 874
5f - Tier III HPWH Split	2.5	\$ 3,500	\$ 3,500	\$ 3,500	\$ 3,500	\$ 3,500
6 - Solar pV	0.5	\$ 5,040	\$ 5,040	\$ 5,040	\$ 5,040	\$ 5,040
7 - ES Appl+ventless Dryer	0.5	\$ 462	\$ 462	\$ 462	\$ 462	\$ 462

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Table 2: Total Measure Costs for Multifamily prototype

Option-Description	Credit Value	Measure Cost
1a - 5% UA reduc	---	---
1b - 15% UA reduc	1	\$ 1,359
1c - 30% UA reduc	1.5	\$ 2,615
1d - U-.24 Glaze	0.5	\$ 554
1e - 40% UA reduc	2	\$ 3,773
1f - U-.20 Glaze	1	\$ 1,107
2a - 3ACH, fan eff	1	\$ 245
2b - 2 ACH, HRV	1.5	\$ 1,025
2c - 1.5 ACH, HRV	2	\$ 2,296
2d - 0.6 ACH, HRV	2.5	\$ 3,280
3a - Furnace	1	---
3b - 9.5 HSPF HP	---	---
3c - GSHP	1	---
3d - DHP	2	\$ 2,800
3e - 11.0 HSPF HP	0.5	---
3f - DHP (15% elec)	2.5	\$ 4,800
4 - HVAC inside	---	---
5a - DWR	0.5	\$ 133
5b - 0.80 gas DHW	0.5	---
5c - 0.91 gas DHW, GSHP	1	---
5d - Tier I HPWH	2	\$ 291
5e - Tier III HPWH	2.5	\$ 291
5f - Tier III HPWH Split	3	\$ 1,167
6 - Solar pV	0.5	\$ 5,040
7 - HP dryers, ES Appl	1	\$ 462

Energy Savings Estimates

The energy savings estimates below have been developed using 6 single family and one multi-family prototype. For each building prototype, each predominant HVAC system (gas furnace, gas furnace with AC, central heat pump and Ductless heat pumps with zonal electric) was modeled and located in various weather climates within the state. The energy savings attributed to each option listed in Table 406.2 were then weighted to consolidate energy savings estimates for the 4 primary categories of homes in Section R406.2 (small, medium, large, and R-2 dwelling units). As shown in Table 1, large homes (greater than 5000sf) only compromise 2% of the total building stock – therefore energy savings estimates used for the Life Cycle Cost Analysis have been omitted from this economic analysis.

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Table 3: Savings All Climates, All Systems

Savings are positive	Small Single Family (less than 1500sf)				Medium Single Family				Multifamily (R-2 occ)
	Gas Home		Central HP	Zonal Elec	Gas Home		Central HP	Zonal Elec	Zonal Elec
Option-Description	kWh	Therm	kWh	kWh	kWh	Therm	kWh	kWh	kWh
1a - 5% UA reduc	-5	25	212	477	-5	41	355	810	135
1b - 15% UA reduc	-6	57	516	1034	-5	100	908	1884	517
1c - 30% UA reduc	-11	99	891	1787	-12	169	1519	3194	898
1d - U-.24 Glaze	-2	17	150	315	-1	36	325	689	228
1e - 40% UA reduc	-27	135	1193	2419	-30	229	2024	4316	1172
1f - U-.20 Glaze	-6	29	253	541	-7	62	546	1185	391
2a - 3ACH, fan eff	52	14	177	313	52	43	440	905	475
2b - 2 ACH, HRV	-313	20	-92	-4	-313	56	231	767	939
2c - 1.5 ACH, HRV	-203	33	137	331	-204	75	520	1239	1284
2d - 0.6 ACH, HRV	-205	46	253	560	-205	100	737	1708	1533
3a - Furnace	0	41	---	---	0	77	---	---	---
3b - 9.5 HSPF HP	---	---	180	---	---	---	343	---	---
3c - GSHP	---	---	729	---	---	---	1301	---	---
3d - DHP	---	---	---	1835	---	---	---	3526	1132
3e - 11.0 HSPF HP	---	---	407	---	---	---	784	---	---
3f - DHP (15% elec)	---	---	---	1928	---	---	---	3700	1193
4 - HVAC inside	11	46	517	---	13	60	638	---	---
5a (5g) - DWR	0	17	322	322	0	19	368	368	265
5b - 0.74 gas DHW	0	22	---	---	0	24	---	---	---
5c - 0.91 gas DHW, GSHP	0	32	---	---	0	36	---	---	---
5d - Tier I HPWH	---	---	1236	1236	---	---	1393	1393	1038
5e - Tier III HPWH	---	---	1623	1623	---	---	1823	1823	1369
5f - Tier III HPWH Split	---	---	1836	1836	---	---	2064	2064	1547
6 - Solar pV	1262	---	1262	1262	1262	---	1262	1262	1262
7 - Appliances	840	---	840	840	840	---	840	840	612

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

See Table 3 for kWh/dwelling unit or therm/dwelling unit savings (savings values are positive)

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

This process is consistent with the current code. We do not anticipate additional enforcement cost.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal?

See Table 4 for square foot cost of various measures. Also, see Table 1 and 2 for per dwelling unit cost of each measure, by prototype.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Table 4: Measure cost estimates (\$/component area, SF or housing unit)

Component	Base Level	Measures Beyond Base Level	Cost \$/ft2 or \$/unit	Source
Envelope				
Ceiling	R-49	R-49 RH Ceiling Insulation	\$ 0.20	ResSFEStarBuiltGreenHomesWA2014_v2_5.xlsm
Ceiling	R-49	R-60 RH Ceiling Insulation	\$ 0.23	CERF
Wall	R-21 Std	R-21 int Wall + R4 Foam Sheathing	\$ 0.96	RTF RESnew.xls 6th plan
Wall	R-21 Std	R-21 int Wall + R12 Foam Sheathing	\$ 2.25	RTF RESnew.xls passiveHouse Consultant
Wall	R-21 Std	R-21 int Wall + R16 Foam Sheathing	\$ 3.00	passiveHouse Consultant
Floor	R-30	R-38 Floor	\$ 0.38	RTF-ResNCMTHouseID_v_3_0 .xlsm April 4, 2018; ShellCosts tab
Floor	R-30	R-48 Floor	\$ 1.50	Assuming high density foam (R-6.inch) installed in std 12" joists
Slab	R-10 2' perim	Slab R-10 Full	\$ 0.91	6th Plan Appendix G
Slab	R-10 2' perim	Slab R-20 Full	\$ 1.22	NextStepHomes data
Window	U-0.30	Window U-0.28	\$ 0.80	NPCC Standard workbook
Window	U-0.30	Window U-0.25	\$ 4.50	NPCC Standard workbook
Window	U-0.30	Window U-0.24	\$ 4.50	NPCC Standard workbook
Window	U-0.30	Window U-0.22	\$ 6.60	NPCC Standard workbook
Window	U-0.30	Window U-0.18	\$ 9.00	MF bids (tripleglaze-BidPrices.xl)
Air Sealing & Ventilation				
ACH	Tested Infiltration at 5 ACH 50	Tested Infiltration to 3 ACH50	\$ 0.20	RTF Workbook. ResWXSf_FY10v2_1.xls passiveHouse consultant
ACH	Tested Infiltration at 5 ACH 50	Tested Infiltration to 2 ACH50	\$ 0.50	
ACH	Tested Infiltration at 5 ACH 50	Tested Infiltration to 1.5 ACH50	\$ 0.80	
ACH	Tested Infiltration at 5 ACH 50	Tested Infiltration to 0.6 ACH50	\$ 1.50	
Exhaust Fan	Pt Source Exhaust Fan =0.75W/cfm	Pt Source Exhaust Fan <0.35W/cfm	\$ 80.64	navigant 2013
ERV	No ERV	ERV with SHR>= 0.65	\$ 0.75	Whispercomfort and minimal ducting
ERV	No ERV	ERV with SHR>= 0.75	\$ 2.00	renewaire or lifebreath
ERV	No ERV	ERV with SHR>= 0.80	\$ 2.50	high efficiency HRV with ducting (venmar, zhender)

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Component	Base Level	Measures Beyond Base Level	Cost \$/ft2 or \$/unit	Source
HVAC System				
Ducts	Code level is sealed	Ducts Inside	\$ 300.00	NPCC Sixth Power Plan, Support documentation
Furnace	0.8	Furnace Upgrade to 94AFUE	\$ 230.25	Navigant Sept 2011 Report for NEEP
Heat Pump	8.2 HSPF	9.5 HSPF	\$ 1,270.00	NPCC Standard workbook, with linear regression
DHP	Zonal Resistance (MF)	1-ton single zone DHP	\$ 2,800.00	Ecotope analysis of NEEA DHP pilot program database
11.0 DHP	8.2 DHP (SF)	1-ton single zone DHP	\$1,400.00	Ecotope analysis of NEEA DHP pilot program database
Heat Pump	8.2 HSPF	11 HSPF	\$ 5,400.00	3 ton unit. ResSFEExistingHVAC
multizone 11.0 DHP	8.2 HSPF	10 HSPF efficiency with no electric resistance. Reduction in electric heat but higher tonnage	\$5,400	Ecotope analysis of NEEA DHP pilot program database
Domestic Hot Water				
Water Htr	0.59 EF	Gas Water Heater >=0.80 EF	\$ 586.00	NREL, 2013
Water Htr	0.59 EF	Gas Water Heater >=0.91 EF	\$ 923.00	NREL, 2013
Water Htr	0.95 EF	Heat Pump Water Heater 2 EF	\$ 874.00	RTF ResHPWH.xls
DWHR	none	Drain water heat recovery pipe	\$ 400.00	RTF RESDHWDrainWaste.xls
Water Htr	0.95 EF	Tier 3 Water Heater 3 EF	\$ 874.00	RTF ResHPWH.xls
Water Htr	0.95 EF	CO2 Water Heater 4 EF	\$ 3,500.00	RTF ResHPWH.xls
Appliances				
Dryers, refr, dishwasher	Fed pre-empted	ventless dryers, ES appliances	\$ 462.000	RTF-ResClothesDryers, ResRef, HD.com \$420 for HP dryer, +\$40 for Cloth washer, +\$90 for refr

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