SEATTLE RESIDENTIAL ENERGY CODE UPDATE - PLUMBING

INCLUDES SEATTLE RESIDENTIAL 2015 ENERGY CODE
COMMERCIAL VS RESIDENTIAL ENERGY CODE; WHICH TO USE?
MANDATORY HW RECIRCULATION REQUIREMENT
INSULATION INSPECTION REQUIREMENT
ENERGY EFFICIENCY CREDITS

THURSDAY, OCTOBER 5, 2017
5:30 - 6:00 PM NETWORKING
6:00 PRESENTATION

PRESENTER:
MICHAEL CURTRIGHT, PLUMBING ENGINEER
MACDONALD - MILLER FACILITY SOLUTIONS
V.P. LEGISLATIVE - SEATTLE ASPE CHAPTER
IAPMO - NATIONAL MEMBER
PHCC - WASHINGTON STATE MEMBER
R104.2 Required inspections. The code official or his or her designated agent, upon notification, shall make the inspections set forth in Sections R104.2.1 through R104.2.5.

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

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

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

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

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

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

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

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

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

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

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

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

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

SECTION R105 VALIDITY

R105.1 General. If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code.

SECTION R106 REFERENCED STANDARDS

R106.1 Referenced codes and standards. The codes and standards referenced in this code shall be those listed in Chapter 6, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections R106.1.1 and R106.1.2.

R106.1.1 (Conflicts. Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.) Referenced to other codes. Whenever an International, National or Uniform Code is referenced in this code, it means the Seattle edition of that code, including local amendments.

R106.1.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

R106.2 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

R106.3 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

In addition to the requirements of this code, all occupancies shall conform to the provisions included in the state building code (chapter 19.27 RCW). In case of conflicts among codes enumerated in RCW 19.27.031 (1) through (4) and this code,
ners, and each opening is framed by two studs. Headers shall be insulated to R-10.

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

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

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

Manual. Capable of being operated by personal intervention (see "Automatic").

Proposed design. A description of the proposed building used to estimate annual energy use for determining compliance based on total building performance.

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

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

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

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

Roof assembly. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, underlayment, roof deck, insulation, vapor retarder and interior finish.

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

Roof repair. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

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

R-value (thermal resistance). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area (h ft2 °F/Btu) (m2 K/W).

Service water heating. Supply of hot water for purposes other than comfort heating.

Slab-on-grade floor. That portion of a slab floor of the building envelope that is in contact with the ground and that is either above grade or is less than or equal to 24 inches below the final elevation of the nearest exterior grade.

Small business. Any business entity (including a sole proprietorship, corporation, partnership or other legal entity) which is owned and operated independently from all other businesses, which has the purpose of making a profit, and which has fifty or fewer employees.

Solar heat gain coefficient (SHGC). The ratio of the solar heat gain entering the space through the fenestration assembly to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation that is then reradiated, conducted or convected into the space.

Standard framing. All framing practices not defined as "intermediate" or "advanced" shall be considered standard. (See Advanced Framed Wall, Intermediate Framed Wall).

Standard reference design. A version of the proposed design that meets the minimum requirements of this code and is used to determine the maximum annual energy use requirement for compliance based on total building performance.

Thermal isolation. Physical and space conditioning separation from conditioned space(s). The conditioned space(s) shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.

Thermostat. An automatic control device used to maintain temperature at a fixed or adjustable set point.

U-factor (thermal transmittance). The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h ft2 °F) (W/m2 K).

Unheated slab-on-grade floor. A slab-on-grade floor that is not a heated slab-on-grade floor.

Ventilation. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

Ventilation air. That portion of supply air that comes from outside (indoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.
R403.3.3 Duct testing (Mandatory). Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified.

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

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

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

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

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

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

**PIPE SIZE:** 1/2" & 3/4"
**USE 1/2" THICK FIBERGLASS**
**PIPE SIZES:** 1" AND UP
**USE 1" THICK FIBERGLASS**

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

R403.5 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5.

R403.5.1 Heated water circulation and temperature maintenance system (Mandatory). Heated water circulation systems shall be in accordance with Section R403.5.1.1.

Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. Automatic controls, temperature sensors and pumps shall be accessible. Manual controls shall be readily accessible.

R403.5.1.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosiphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and there is no demand for hot water.

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

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

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

2. The control shall limit the temperature of the water entering the cold water piping to 104°F (40 °C).

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

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

R403.5.4 Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2. Drain water heat recovery units shall be in accordance with CSA 55.1. Potable water-side pressure loss of drain water heat...
**MINIMUM REQUIREMENTS**

**R403.5.5** Electric water heater insulation. All electric water heaters in unheated spaces or on concrete floors shall be placed on an incompressible, insulated surface with a minimum thermal resistance of R-10.

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

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

**Exception:** Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

<table>
<thead>
<tr>
<th>FAN LOCATION</th>
<th>AIR FLOW RATE MINIMUM (CFM)</th>
<th>MINIMUM EFFICACY (CFM/WATT)</th>
<th>AIR FLOW RATE MAXIMUM (CFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range hoods</td>
<td>Any</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>In-line fan</td>
<td>Any</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>Bathroom, utility room</td>
<td>10</td>
<td>1.4 cfm/watt</td>
<td>&lt;90</td>
</tr>
<tr>
<td>Bathroom, utility room</td>
<td>90</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
</tbody>
</table>

**R403.7** Equipment sizing and efficiency rating (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. The output capacity of heating and cooling equipment shall not be greater than that of the smallest available equipment size that exceeds the loads calculated, including allowable oversizing limits. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

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

**Exception:** Total installed heating capacity of 2Kw per dwelling or less.

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

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

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

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

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

**Exceptions:**

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

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

**Exception:** Where more than 70 percent of the energy for heating, computed over an operating seasons, is from site-recovered energy, such as from a heat pump or solar energy source, covers or other vapor-retardant means shall not be required.

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

**R403.10.4.1** Two-speed capability.

1. Pump motors: Pool pump motors with a capacity of 1 hp or more shall have the capability of operat-
WHAT IF ALL THE MINIMUM REQUIREMENTS CANNOT BE MET?

RESIDENTIAL ENERGY EFFICIENCY

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

R405.4 Documentation. Documentation of the software used for the performance design and the parameters for the building shall be in accordance with Sections R405.4.1 through R405.4.3.

R405.4.1 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.

R405.4.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design complies with Section R405.3. A compliance report for the proposed design shall be submitted with the application for the building permit. Upon completion of the building, a compliance report based on the as-built condition of the building shall be submitted to the code official before a certificate of occupancy is issued. Batch sampling of buildings to determine energy code compliance for all buildings in the batch shall be prohibited.

Compliance reports shall include information in accordance with Sections R405.4.2.1 and R405.4.2.2. Where the proposed design of a building could be built on different sites where the cardinal orientation of the building on each site is different, compliance of the proposed design for the purposes of the application for the building permit shall be based upon the worst-case orientation, worst-case configuration, worst-case building air leakage and worst-case duct leakage. Such worst-case parameters shall be used as inputs to the compliance software for energy analysis.

R405.4.2.1 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. A statement indicating that the proposed design complies with Section R405.3.

3. An inspection checklist documenting the building component characteristics of the proposed design as indicated in Table R405.5.2(1). The inspection checklist shall show results for both the standard reference design and the proposed design with all user inputs to the compliance software to generate the results.

4. A site-specific energy analysis report that is in compliance with Section R405.3.

SECTION R404
ELECTRICAL POWER AND LIGHTING SYSTEMS

R404.1 Lighting equipment (Mandatory). A minimum of 75 percent of lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

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

SECTION R405
SIMULATED PERFORMANCE ALTERNATIVE
(PERFORMANCE)

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

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

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 percent of the annual energy consumption of the standard reference design.
### TABLE R405.5.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS

<table>
<thead>
<tr>
<th>DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION</th>
<th>DISTRIBUTION SYSTEM EFFICIENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution system components located in unconditioned space</td>
<td>0.88</td>
</tr>
<tr>
<td>Distribution systems entirely located in conditioned space</td>
<td>0.93</td>
</tr>
<tr>
<td>Zonal systemsc</td>
<td>1.00</td>
</tr>
</tbody>
</table>

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m², 1 pound per square inch = 6895 Pa, 1 inch water gauge = 1250 Pa.

a. Values given by this table are for distribution systems, which must still meet all prescriptive requirements for duct and pipe system insulation and leakage.

b. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space. All components must be located on the interior side of the thermal envelope (inside the insulation) and also inside of the air barrier.

Refrigerant compressors and piping are allowed to be located outside.

c. Zonal systems are systems where the heat source is located within each room. Systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer's air-handler enclosure. Hydronic systems do not qualify.

### R405.6 Calculation software tools

Calculation software, where used, shall be in accordance with Sections R405.6.1 through R405.6.3.

#### R405.6.1 Minimum capabilities

Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

1. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with Section R404.6.

2. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.

3. Printed code official inspection checklist listing each of the proposed design component characteristics from Table R405.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g., R-value, U-factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

#### R405.6.2 Specific approval

Performance analysis tools meeting the applicable provisions of Section R405 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.

#### R405.6.3 Input values

When calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from an approved source.
### Table R405.5.2(1)
**Specifications for the Standard Reference and Proposed Designs**

<table>
<thead>
<tr>
<th>Building Component</th>
<th>Standard Reference Design</th>
<th>Proposed Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating systems&lt;sup&gt;a&lt;/sup&gt;, &lt;sup&gt;b&lt;/sup&gt;</td>
<td>Where the proposed design utilizes electric heating without a heat pump the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the WSEC—Commercial Provisions. For all other systems, the same system type as proposed, and the same system efficiency required by prevailing minimum federal standard. Capacity: Sized in accordance with Section R403.6</td>
<td>As proposed</td>
</tr>
<tr>
<td>Cooling systems&lt;sup&gt;a&lt;/sup&gt;, &lt;sup&gt;c&lt;/sup&gt;</td>
<td>Same system type as proposed. Same system efficiency as required by prevailing minimum federal standard. Capacity: Sized in accordance with Section R403.6.</td>
<td>As proposed</td>
</tr>
<tr>
<td>Service water heating&lt;sup&gt;a&lt;/sup&gt;, &lt;sup&gt;d&lt;/sup&gt;, &lt;sup&gt;e&lt;/sup&gt;, &lt;sup&gt;f&lt;/sup&gt;, &lt;sup&gt;g&lt;/sup&gt;</td>
<td>Same system type as proposed. Same system efficiency as required by prevailing minimum federal standard. Use: Same as proposed design</td>
<td>As proposed gal/day = 30 + (10 × Nbr)</td>
</tr>
<tr>
<td>Thermal distribution systems</td>
<td>Duct insulation: From Section R403.3.3 A thermal distribution system efficiency (DSE) of 0.93 shall be applied to both the heating and cooling system efficiencies for all systems.</td>
<td>As specified in Table R405.5.2(2)</td>
</tr>
<tr>
<td>Thermostat</td>
<td>Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F</td>
<td>Same as standard reference</td>
</tr>
</tbody>
</table>

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For SI: 1 square foot = 0.093 m<sup>2</sup>, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m<sup>2</sup>, 1 gallon (US) = 3.785 L,

<sup>a</sup>C = (°F·32)/1.8, 1 degree = 0.79 rad.

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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.


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 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.

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2015 Seattle Energy Code

R-31
## ADDITIONAL MINIMUM REQUIREMENTS...

### TABLE R406.2—continued

<table>
<thead>
<tr>
<th>ENERGY CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HIGH EFFICIENCY HVAC EQUIPMENT 3b:</strong></td>
</tr>
<tr>
<td>Ductless Split System Heat Pumps, Zonal Control: In homes where the primary space heating system is zonal electric heating, a ductless heat pump system shall be installed and provide heating to the largest zone of the housing unit.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>1.0</td>
</tr>
<tr>
<td><strong>HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM:</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Ducts located outside the conditioned space must be insulated to a minimum of R-8. Locating system components in conditioned crawl spaces is not permitted under this option. Electric resistance heat 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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>1.0</td>
</tr>
<tr>
<td><strong>EFFICIENT WATER HEATING 5a:</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>0.5</td>
</tr>
<tr>
<td><strong>EFFICIENT WATER HEATING 5b:</strong></td>
</tr>
<tr>
<td>Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.74 or Water heater heated by ground source heat pump meeting the requirements of Option 3c. 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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>1.0</td>
</tr>
</tbody>
</table>
## TABLE R406.2—continued
### ENERGY CREDITS

<table>
<thead>
<tr>
<th>5c</th>
<th>EFFICIENT WATER HEATING 5c:</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water heating system shall include one of the following:</td>
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<tr>
<td></td>
<td>Gas, propane or oil water heater with a minimum EF of 0.91</td>
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<td>or</td>
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<td></td>
<td>or</td>
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<tr>
<td></td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5d</th>
<th>EFFICIENT WATER HEATING 5d:</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>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.</td>
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</tr>
<tr>
<td></td>
<td>To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery unit(s) 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.</td>
<td></td>
</tr>
</tbody>
</table>

### Diagram
- **Hot Water**
- **80°F**
- **Cold Water**
- **100°F Shower**
- **Example Using Model Y3-48**
- **Cold Water 50°F**
- **Drain Water 75°F**
- **All Temperature Values Approximate**
- A drain water heat recovery system with tankless water heater.
R502.1.1.3 Service hot water systems. New service hot water systems that are part of the addition shall comply with Section R403.5.

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

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

SECTION R503 ALTERATIONS

SDCI Informativne Note: For landmark buildings, see Section R101.6.

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

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

Alterations shall be such that the existing building or structure uses no more energy than the existing building or structure prior to the alteration.

Alterations to existing buildings shall comply with Section R503.1.1 through R503.2

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

1. The alteration improves the energy efficiency of the building; or
2. The alteration is energy efficient and is necessary for the health, safety, and welfare of the general public.

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

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

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that cavity fills with insulation. 2x4 framed walls shall be insulated to a minimum of R-15 and 2x6 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 recovery.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during re roofing shall be insulated either above or below the sheathing.
6. Surface applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing fenestration to be replaced.

R503.1.1.1 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for U-factor and SHGC in Table R402.1.1.

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

Exceptions:

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

R503.1.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section R403.5. See Page R-26

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

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

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

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

R-38

2015 SEATTLE ENERGY CODE