

**From:** Eric Vander Mey <ericv@rushingco.com>

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**To:** Braaksma, Krista (DES) <krista.braaksma@des.wa.gov>; DES SBCC <sbcc@des.wa.gov>

**Subject:** Public Comment - 2018 WSEC - C404.2

Krista:

Below is public comment on C404.2.1 and C404.2.2.

These sections need cleanup to have consistent language. See editorial corrections below.

Since there are no air-source heat pumps (except pool heaters) in Table C404.2 there is no way to be 125% more efficient than the equipment in this table.

**C404.2 Service water-heating equipment performance efficiency.** Water-heating equipment and hot water storage tanks shall meet the requirements of Table C404.2. The efficiency shall be verified through certification and *listed* under an *approved* certification program, or if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Water-heating equipment intended to be used to provide space heating shall meet the applicable provisions of Table C404.2.

**C404.2.1 High input-rated service water heating systems.** All water-heating equipment installed in new buildings, for other than Group R-1 and R-2 occupancies, shall be in compliance with this section. Where a singular piece of water-heating equipment serves the entire building and the input rating of the equipment is 1,000,000 Btu/h (293 kW) or greater, such equipment shall be a heat pump water heater or have no less than an  $E_t$  or  $E_f$  of 90 percent as determined by the applicable test procedures in Table C404.2.

Where multiple pieces of water-heating equipment serve the building and the combined input rating of the water-heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average shall be no less than the following for each water heating fuel source:

1. A rated COP of not less than 2.0. For air-source heat pump equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (15.6°C) or less.
2. A rated  $E_t$  of not less than 90 percent as determined by the applicable test procedures in Table C404.2.

**Exception:** Where not less than 25 percent of the annual service water-heating requirement is provided from any of the following sources:

1. Renewable energy generated on site that is not being used to satisfy another requirement of this code, or
2. Heat recovered on site from the building's wastewater, or from air that would otherwise be exhausted to the outdoors without heat recovery, that is not being used to satisfy other requirements of this code.

**C404.2.2 High input-rated service water heating system for Group R-1 and R-2 occupancies.** In new construction with over 1,000,000 Btu/h installed service water heating capacity serving Group R-1 and R-2 occupancies, at least 25 percent of annual water heating energy shall be provided from any combination of the following water heating sources:

1. Renewable energy generated on site that is not being used to satisfy other requirements of this code, or
2. Heat recovered on site from the building's wastewater, air-source heat pumps, or from air that would otherwise be exhausted to the outdoors without heat recovery, that is not being used to satisfy other requirements of this code.

**Exception:** Compliance with this section is not required if the combined input-capacity-weighted average equipment rating for each service water heating fuel source type is not less than the following:

1. ~~A heat pump water heater or a~~An electric water heater water with a rating of 125% of the rated efficiency of Table C404.2.
2. A rated COP of not less than 2.0. For air-source heat pump equipment the COP rating will be reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (15.6°C) or ~~less~~lower.
3. A rated  $E_t$  or  $E_f$  of not less than 90 percent as determined by the applicable test procedures in Table C404.2.

**TABLE C404.2  
MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT**

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED <sup>a, b</sup>	TEST PROCEDURE
Water heaters, electric	≤ 12 kW	Tabletop <sup>e</sup> , ≥20 gal and <120 gal	0.93 – 0.00132V, EF	DOE 10 CFR Part 430
		Resistance ≥20 gal and ≤55 gal	0.960 - 0.0003V, EF	
	Grid-enabled <sup>f</sup> >75 gal and ≤120 gal	1.06-0.00168V, EF		
	> 12 kW	Resistance ≥20 gal	0.3 + 27/V <sub>m</sub> %/h <sup>g</sup>	Section G.2 of ANSI Z21.10.3
	≤ 24 amps and ≤250 volts	Heat pump	2.057 – 0.00113V, EF	DOE 10 CFR Part 430
Instantaneous water heaters, electric	All	Resistance	0.97 - 0.00132V, EF	DOE 10 CFR Part 430
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gal and ≤ 55 gal >55 gal and ≤100 gal	0.675 - 0.0015V, EF 0.8012 – 0.00078V, EF	DOE 10 CFR Part 430
	> 75,000 Btu/h	< 4,000 Btu/h/gal	80% E <sub>t</sub> (Q/800 + 110√V)SL, Btu/h	Section G.1 and G.2 of ANSI Z21.10.3
Instantaneous water heaters, gas	> 50,000 Btu/h and < 200,000 Btu/h	≥ 4,000 (Btu/h)/gal and < 2 gal	0.82 - 0.0019V, EF	DOE 10 CFR Part 430
	≥ 200,000 Btu/h <sup>c</sup>	≥ 4,000 Btu/h/gal and < 10 gal	80% E <sub>t</sub>	Section G.1 and G.2 of ANSI Z21.10.3
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and ≥10 gal	80% E <sub>t</sub> (Q/800 + 110√V)SL, Btu/h	
Storage water heaters, oil	≤ 105,000 Btu/h	≥20 gal	0.68 - 0.0019V, EF	DOE 10 CFR Part 430
	> 105,000 Btu/h	< 4,000 Btu/h/gal	80% E <sub>t</sub> (Q/800 + 110√V)SL, Btu/h	Section G.1 and G.2 of ANSI Z21.10.3
Instantaneous water heaters, oil	≤ 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 2 gal	0.59 - 0.0019V, EF	DOE 10 CFR Part 430
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E <sub>t</sub>	Section G.1 and G.2 of ANSI Z21.10.3
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and ≥10 gal	78% E <sub>t</sub> (Q/800 + 110√V)SL, Btu/h	
Hot water supply boilers, gas and oil	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E <sub>t</sub>	Section G.1 and G.2 of ANSI Z21.10.3
Hot water supply boilers, gas	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥4,000 Btu/h/gal and ≥ 10 gal	80% E <sub>t</sub> (Q/800 + 110√V)SL, Btu/h	
Hot water supply boilers, oil	≥300,000 Btu/h and < 12,500,000 Btu/h	≥ 4,000 Btu/h/gal and > 10 gal	78% E <sub>t</sub> (Q/800 + 110√V)SL, Btu/h	
Pool heaters, gas and oil	All	—	82% E <sub>t</sub>	ASHRAE 146
Heat pump pool heaters	All	—	4.0 COP	AHRI 1160
Unfired storage tanks	All	—	Minimum insulation requirement R-12.5 (h x ft <sup>2</sup> x °F)/Btu	(none)

= 3.785 L, 1 British thermal unit per hour per gallon = 0.078 W/L.

- Energy factor (EF) and thermal efficiency (E<sub>t</sub>) are minimum requirements. In the EF equation, V is the rated volume in gallons.
- Standby loss (SL) is the maximum Btu/h based on a nominal 70°F temperature difference between stored water and ambient requirements. In the SL equation, Q is the nameplate input rate in Btu/h. In the SL equation for electric water heaters, V is the rated volume in gallons and V<sub>m</sub> is the measured volume in gallons. In the SL equation for oil and gas water heaters and boilers, V is the rated volume in gallons.
- Instantaneous water heaters with input rates below 200,000 Btu/h must comply with these requirements if the water heater is designed to heat water to temperatures 180°F or higher.
- Electric water heaters with an input rating of 12kW (40,950 Btu/h) or less that are designed to heat water to temperatures of 180°F or greater shall comply with the requirements for electric water heaters that have an input rating greater than 12 kW.
- A tabletop water heater is a water heater that is enclosed in a rectangular cabinet with a flat top surface not more than three feet (0.91 m) in height.
- A grid-enabled water heater is an electric resistance water heater that meets all of the following:

1. Has a rated storage tank volume of more than 75 gallons.
  2. Is manufactured on or after April 16, 2015.
  3. Is equipped at the point of manufacture with an activation lock.
  4. Bears a permanent label applied by the manufacturer that complies with all of the following:
    - 4.1 Is made of material not adversely affected by water.
    - 4.2 Is attached by means of non-water soluble adhesive.
    - 4.3 Advises purchasers and end-users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font: "IMPORTANT INFORMATION: This water heater is intended only for use as a part of an electric thermal storage or demand response program. It will not provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this product."
- g. %/h is the energy consumed to replace the heat lost from the tank while on standby, expressed as a percentage of the total energy in the stored water per hour.

**Eric Vander Mey - PE, LEED®AP**

*Principal - Director, Mechanical Engineering*

**RUSHING** | D 206-285-7114 | C 206-321-1677

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