CEPI-126-21

IECC®: TABLE C404.2

Proponents:

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2021 International Energy Conservation Code

Revise as follows:

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	DRAW PATTERN	PERFORMANCE REQUIRED[a, b]	TEST PROCEDURE
Water heaters, electric	≤ 12 kW[d]	Tabletop[e], ≥ 20 gallons and ≤ 120 gallons		~~0.93 – 0.00132*V*, EF~~ Very Small 0.6323 – (0.0058 × Vr), UEF Low 0.9188 – (0.0031 × Vr), UEF Medium 0.9577 – (0.0023 × Vr), UEF High 0.9884 – (0.0016 × Vr), UEF	DOE 10 CFR Part 430
		Resistance ≥ 20 gallons and ≤ 55 gallons		~~0.960 – 0.0003*V*, EF~~ Very Small 0.8808 – (0.0008 × Vr), UEF Low 0.9254 – (0.0003 × Vr), UEF Medium 0.9307 – (0.0002 × Vr), UEF High 0.9349 – (0.0001 × Vr), UEF	
		Grid-enabled[f] > 75 gallons and ≤ 120 gallons		~~1.061 – 0.00168V, EF~~ Very Small 1.0136 – (0.0028 × V_r), UEF Low 0.9984 – (0.0014 × V_r), UEF Medium 0.9853 – (0.0010 × V_r), UEF High 0.9720 – (0.0007 × V_r) , UEF	
	> 12 kW	Resistance		(0.3 + 27/V_m), %/h	ANSI Z21.10.3
	≤ 24 amps and ≤ 250 volts	Heat pump > 55 gallons and ≤ 120 gallons		~~2.057 – 0.00113V, EF~~ Very Small 1.9236 – (0.0011 × V_r), UEF Low 2.0440 – (0.0011 × V_r), UEF	DOE 10 CFR Part 430

			Medium 2.1171 − (0.0011 × Vr), UEF High 2.24R18E Q− U(I0.R0E0D1a1, ×b Vr) , UEF	
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gallons and > 55 gallons	~~0.675 − 0.0015V, EF~~ Very Small 0.3456 – (0.0020 × V_r), UEF Low 0.5982 – (0.0019 × V_r), UEF Medium 0.6483 – (0.0017 × V_r), UEF High 0.6920 – (0.0013 × V_r), UEF	DOE 10 CFR Part 430
		> 55 gallons and ≤ 100 gallons	~~0.8012 − 0.00078V, EF~~ Very Small 0.6470 – (0.0006 × V_r), UEF Low 0.7689 – (0.0005 × V_r), UEF Medium 0.7897 – (0.0004 × V_r), UEF High 0.8072 – (0.0003 × V_r), UEF	
	> 75,000 Btu/h and ≤ 155,000 Btu/h	< 4,000 Btu/h/gal	80% E_t $(Q/800 + 110\sqrt{V})SL$, Btu/h	ANSI Z21.10.3
	> 155,000 Btu/h	< 4,000 Btu/h/gal	80% E_t $(Q/800 + 110\sqrt{V})SL$, Btu/h	
Instantaneous water heaters, gas	> 50,000 Btu/h and < 200,000 Btu/h[c]	≥ 4,000 Btu/h/gal and < 2 gal	~~0.82 − 0.00 19V, EF~~ Very Small 0.80 UEF Low 0.81 UEF Medium 0.81 UEF High 0.81 UEF	DOE 10 CFR Part 430
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E_t	ANSI Z21.10.3
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	80% E_t $(Q/800 + 110\sqrt{V})SL$, Btu/h	
Storage water heaters, oil	≤ 105,000 Btu/h	≥ 20 gal and ≤ 50 gallons	~~0.68 − 0.0019V, EF~~ Very Small 0.2509 – (0.0012 × V_r), UEF Low 0.5330 – (0.0016 × V_r), UEF Medium 0.6078 – (0.0016 × V_r), UEF High 0.6815 – (0.0014 × V_r), UEF	DOE 10 CFR Part 430
	≥ 105,000 Btu/h	< 4,000 Btu/h/gal	80% E_t $(Q/800 + 110\sqrt{V})SL$, Btu/h	ANSI Z21.10.3
Instantaneous	≤ 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 2 gal	0.59 – 0.0019V, EF	DOE 10 CFR Part 430
		≥ 4,000 Btu/h/gal and		

water heaters, oil	> 210,000 Btu/h	< 10 gal	80% E_t	ANSI Z21.10.3
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	78% E_t, $(Q/800 + 110\sqrt{V})$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_t	
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_t $(Q/800 + 110\sqrt{V})$SL, Btu/h	ANSI Z21.10.3
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_t $(Q/800 + 110\sqrt{V})$SL, Btu/h	
Pool heaters, gas and oil	All	—	82% E_t	ASHRAE 146
Heat pump pool heaters	All	—	4.0 COP	AHRI 1160
Unfired storage tanks	All	—	Minimum insulation requirement R-12.5 (h × ft^2 × °F)/Btu	(none)

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 W, 1 gallon = 3.785 L, 1 British thermal unit per hour per gallon = 0.078 W/L.

a. Uniform Energy factor (EF) and thermal efficiency *(E_t)* are minimum requirements. In the UEF equation, V_r is the rated volume in gallons.

b. 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 equations for electric water heaters, V is the rated volume in gallons and V_m 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.

c. Instantaneous water heaters with input rates below 200,000 Btu/h shall comply with these requirements where the water heater is designed to heat water to temperatures 180°F or higher.

d. Electric water heaters with an input rating of 12 kW (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 (40,950 Btu/h).

e A tabletop water heater is a water heater that is enclosed in a rectangular cabinet with a flat top surface not more than 3 feet 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. Was manufactured on or after April 16, 2015.

3. Is equipped at the point of manufacture with an activation lock.

f. 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 nonwater-soluble adhesive.

4.

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 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.”

CEPI-127-21 proposes changes to Table C404.2 as well.

Reason Statement:

In the United States, residential water heaters are now rated with a new metric known as Uniform Energy Factor, which replaces Energy Factor. In addition, there are different UEF's for different draw patterns, which are listed in federal regulations.

This proposal updates the water heater tables to reflect the new metric and values that have been in place since 2017.

Bibliography:

U.S. Department of Energy, *Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Test Procedures for Consumer and Commercial Water Heaters,* Federal Register Volume 81, Number 250, pages 96,204 - 96,239, December 29, 2016,

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal just updates the requirements in the table to reflect the updated metric of UEF.

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