

[FSEC Table C404.2 comments for April 2020 Rule Workshop are highlighted in yellow below.]

[Rationale: Commas “,” are added after standby loss equations so “SL” is not mistakenly seen as being part of the equation. Other changes made to clarify table and accurately show various size categories, subcategory/rating conditions and footnotes, as needed.]

COMMERCIAL ENERGY EFFICIENCY

TABLE C404.2  
MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	DRAW PATTERN	PERFORMANCE REQUIRED <sup>a, b, c</sup>	TEST PROCEDURE
Storage water heaters, electric	≤ 12 kW <sup>d</sup>	Tabletop <sup>e</sup> , ≥ 20 gallons and ≤ 120 gallons	Very small Low Medium High	0.6323 - (0.0058 × V), UEF 0.9188 - (0.0031 × V), UEF 0.9577 - (0.0023 × V), UEF 0.9884 - (0.0016 × V), UEF	DOE 10 CFR Part 430
		≥ 20 gallons and ≤ 55 gallons	Very small Low Medium High	0.8808 - (0.0008 × V), UEF 0.9254 - (0.0003 × V), UEF 0.9307 - (0.0002 × V), UEF 0.9349 - (0.0001 × V), UEF	
Storage water heaters, electric	> 12 kW	> 55 gallons and ≤ 120 gallons	Very small Low Medium High	1.9236 - (0.0011 × V), UEF 2.0440 - (0.0011 × V), UEF 2.1171 - (0.0011 × V), UEF 2.2418 - (0.0011 × V), UEF	DOE 10 CFR Part 431
		Grid-enabled <sup>f</sup> ≥ 75 gallons	Very small Low Medium High	1.0136 - (0.0028 × V), UEF 0.9984 - (0.0014 × V), UEF 0.9853 - (0.0010 × V), UEF 0.9720 - (0.0007 × V), UEF	
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gallons and ≤ 55 gallons	Very small Low Medium High	0.3456 - (0.0020 × V), UEF 0.5982 - (0.0019 × V), UEF 0.6483 - (0.0017 × V), UEF 0.6920 - (0.0013 × V), UEF	DOE 10 CFR Part 430
		> 55 gallons and ≤ 100 gallons	Very small Low Medium High	0.6470 - (0.0006 × V), UEF 0.7689 - (0.0005 × V), UEF 0.7897 - (0.0004 × V), UEF 0.8072 - (0.0003 × V), UEF	
	> 75,000 Btu/h	< 4,000 Btu/h/gal		80% E <sub>t</sub> (Q/800 + 110.√V) <sub>2</sub> SL, Btu/h	DOE 10 CFR Part 431
> 75,000 Btu/h <sup>g</sup> and ≤ 105,000 Btu/h	Residential-duty commercial ≤ 120 gal	Very small Low Medium High	0.2674 - (0.0009 × V), UEF 0.5362 - (0.0012 × V), UEF 0.6002 - (0.0011 × V), UEF 0.6597 - (0.0009 × V), UEF		
Instantaneous water heaters, electric	> 12 kW and ≤ 58.6 kW	≤ 2 gal	Very small Low Medium High	0.91, UEF 0.91, UEF 0.91, UEF 0.91, UEF	DOE 10 CFR Part 430
		< 2 gal	Very small Low Medium High	0.80, UEF 0.80, UEF 0.80, UEF 0.80, UEF	
Instantaneous water heaters, gas	≤ 2 gallons and > 50,000 Btu/h and ≤ 200,000 Btu/h <sup>c</sup>	≥ 4,000 (Btu/h)/gal and < 2 gal	Very small Low Medium High	0.80, UEF 0.81, UEF 0.81, UEF 0.81, UEF	DOE 10 CFR Part 430
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal		80% E <sub>t</sub>	DOE 10 CFR Part 431
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal		80% E <sub>t</sub> (Q/800 + 110.√V) <sub>2</sub> SL, Btu/h	

(continued)

TABLE C404.2—continued  
MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	DRAW PATTERN	PERFORMANCE REQUIRED <sup>a, b, c</sup>	TEST PROCEDURE
Storage water heaters, oil	≤ 105,000 Btu/h	≥ 20 gal ≤ 50 gallons	Very small Low Medium High	0.2509 - (0.0012 × V), UEF 0.5330 - (0.0016 × V), UEF 0.6078 - (0.0016 × V), UEF 0.6815 - (0.0014 × V), UEF	DOE 10 CFR Part 430
	≥ 105,000 Btu/h > 105,000 Btu/h	< 4,000 Btu/h/gal		80% E <sub>t</sub> (Q/800 + 110√V) <sub>2</sub> SL, Btu/h	<del>DOE 10 CFR Part 431</del> ANSI Z21.10.3
	≥ 105 kBtu/hr and ≤ 140 kBtu/hr > 105,000 Btu/h and ≤ 140,000 Btu/h	Residential-duty commercial ≤ 120 gal	Very small Low Medium High	0.2932 - (0.0015 × V), UEF 0.5596 - (0.0018 × V), UEF 0.6194 - (0.0016 × V), UEF 0.6740 - (0.0013 × V), UEF	DOE 10 CFR Part 431
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>	DOE 10 CFR Part 431
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal		78% E <sub>t</sub> (Q/800 + 110√V) <sub>2</sub> 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>	DOE 10 CFR Part 431
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) <sub>2</sub> 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) <sub>2</sub> SL, Btu/h	
Pool heaters, gas and oil	All	—		82% E <sub>t</sub>	ASHRAE 146
Heat pump pool heaters	All	—		4.0 COP At low air temperature	AHRI 1160 <del>h.i</del>
Unfired storage tanks	All	—		Minimum insulation requirement R-12.5 (h · ft <sup>2</sup> · °F)/Btu	DOE 10 CFR Part 431

For SI: °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.

- Energy factor (EF), uniform energy factor (UEF) 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 equations 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 shall comply with these requirements where the water heater is designed to heat water to temperatures 180°F or higher.
- 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).
- 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 (0.91 m) in height.
- A grid-enabled water heater is an electric resistance water heater that meets all of the following:
  - Has a rated storage tank volume of more than 75 gallons.
  - Is manufactured on or after April 16, 2015.
  - Is equipped at the point of manufacture with an activation lock.
  - Bears a permanent label applied by the manufacturer that complies with all of the following:
    - Is made of material not adversely affected by water.
    - Is attached by means of non-water-soluble adhesive.
    - 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."
- Water heaters and hot water supply boilers having more than 140 gallons of storage capacity need not meet the standby loss requirement if: (1) The tank surface area is thermally insulated to R-12.5 or more; (2) a standing pilot light is not used; and (3) for gas or oil-fired storage water heaters, they have a fire damper or fan-assisted combustion. (EN7984-R1/CE171-16).
- Test report from independent laboratory is required to verify procedure compliance.
- Geothermal swimming pool heat pumps are not required to meet this standard.