

(Effective until March 15, 2024)

WAC 51-11C-404021 Table C404.2—Minimum performance of water-heating equipment.

**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
Storage water heaters, electric	≤ 12 kW <sup>d</sup>	Tabletop <sup>e</sup> ≥ 20 gal and ≥ 120 gal	0.93 - 0.00132V, EF	DOE 10 C.F.R. 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 <sup>d</sup>	Resistance	(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 C.F.R. Part 430
Instantaneous water heaters, electric	All	Resistance	0.93 - 0.00132V, EF	DOE 10 C.F.R. Part 430
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gal and ≤ 55 gal	0.675 - 0.0015V, EF	DOE 10 C.F.R. Part 430
		> 55 gal and ≤ 100 gal	0.8012 - 0.00078V, EF	
	> 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 C.F.R. 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 C.F.R. 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 C.F.R. 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 146
Unfired storage tanks	All	—	Minimum insulation requirement R-12.5 (h • ft <sup>2</sup> • °F)/Btu	(none)

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.  
<sup>a</sup>Energy factor (EF) and thermal efficiency (E<sub>t</sub>) are minimum requirements. In the EF equation, V is the rated volume in gallons.  
<sup>b</sup>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.  
<sup>c</sup>Instantaneous water heaters with input rates below 200,000 Btu/h shall comply with these requirements if the water heater is designed to heat water to temperatures 180°F or higher.  
<sup>d</sup>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).  
<sup>e</sup>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.  
<sup>f</sup>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 nonwater 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."  
 e%/h is the energy consumed to replace the heat loss from the tank while on standby, expressed as a percentage of the total energy in the stored water per hour.

[Statutory Authority: RCW 19.27A.025, 19.27A.045 and chapter 19.27 RCW. WSR 20-21-080, § 51-11C-404021, filed 10/19/20, effective 2/1/21. Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-404021, filed 11/26/19, effective 7/1/20. Statutory Authority: RCW 19.27A.025, 19.27A.045, 19.27A.160, and 19.27.074. WSR 16-13-089, § 51-11C-404021, filed 6/15/16, effective 7/16/16. Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-404021, filed 1/19/16, effective 7/1/16. Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-056, § 51-11C-404021, filed 2/1/13, effective 7/1/13.]

**Reviser's note:** The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

**(Effective March 15, 2024)**

**WAC 51-11C-404021 Table C404.2—Minimum performance of water-heating equipment.**

**Table C404.2  
 Minimum Performance of Water-Heating Equipment**

<b>Equipment Type</b>	<b>Size Category (input)</b>	<b>Subcategory or Rating Condition</b>	<b>Draw Pattern</b>	<b>Performance Required<sup>a,j</sup></b>	<b>Test Procedure<sup>b</sup></b>
Electric table-top water heaters <sup>k</sup>	≤ 12 kW <sup>c</sup>	≥ 20 gal ≤ 120 gal	Very small Low Medium High	UEF ≥ 0.6323 - (0.0058 × V <sub>r</sub> ) UEF ≥ 0.9188 - (0.0031 × V <sub>r</sub> ) UEF ≥ 0.9577 - (0.0023 × V <sub>r</sub> ) UEF ≥ 0.9884 - (0.0016 × V <sub>r</sub> )	DOE 10 C.F.R. Part 430 App. E
Electric storage water heaters <sup>g,i</sup> resistance and heat pump	≤ 12 kW <sup>c</sup>	≥ 20 gal ≤ 55 gal	Very small Low Medium High	UEF ≥ 0.8808 - (0.0008 × V <sub>r</sub> ) UEF ≥ 0.9254 - (0.0003 × V <sub>r</sub> ) UEF ≥ 0.9307 - (0.0002 × V <sub>r</sub> ) UEF ≥ 0.9349 - (0.0001 × V <sub>r</sub> )	DOE 10 C.F.R. Part 430 App. E
	≤ 12 kW	> 55 gal ≤ 120 gal	Very small Low Medium High	UEF ≥ 1.9236 - (0.0011 × V <sub>r</sub> ) UEF ≥ 2.0440 - (0.0011 × V <sub>r</sub> ) UEF ≥ 2.1171 - (0.0011 × V <sub>r</sub> ) UEF ≥ 2.2418 - (0.0011 × V <sub>r</sub> )	DOE 10 C.F.R. Part 430 App. E
Electric storage water heaters <sup>g</sup>	> 12 kW			(0.3 + 27/V <sub>m</sub> ), % <sup>h</sup>	DOE 10 C.F.R. 431.106 App B.
Grid-enabled water heaters <sup>g,l</sup>		> 75 gal	Very small Low Medium High	UEF ≥ 1.0136 - (0.0028 × V <sub>r</sub> ) UEF ≥ 0.9984 - (0.0014 × V <sub>r</sub> ) UEF ≥ 0.9853 - (0.0010 × V <sub>r</sub> ) UEF ≥ 0.9720 - (0.0007 × V <sub>r</sub> )	10 C.F.R. 430 Appendix E
Electric instantaneous water heater <sup>h</sup>	≤ 12 kW	< 2 gal	Very small Low Medium High	UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.92	DOE 10 C.F.R. Part 430
	> 12 kW & ≤ 58.6 kW <sup>c</sup>	≤ 2 gal ≤ 180°F	All	UEF ≥ 0.80	DOE 10 C.F.R. Part 430

Equipment Type	Size Category (input)	Subcategory or Rating Condition	Draw Pattern	Performance Required <sup>a,j</sup>	Test Procedure <sup>b</sup>
Gas storage water heaters <sup>g</sup>	$\leq 75,000$ Btu/h	$\geq 20$ gal & $\leq 55$ gal <sup>f</sup>	Very small Low Medium High	UEF $\geq 0.3456 - (0.0020 \times V_r)$ UEF $\geq 0.5982 - (0.0019 \times V_r)$ UEF $\geq 0.6483 - (0.0017 \times V_r)$ UEF $\geq 0.6920 - (0.0013 \times V_r)$	DOE 10 C.F.R. Part 430 App. E
	$\leq 75,000$ Btu/h	$> 55$ gal & $\leq 100$ gal <sup>f</sup>	Very small Low Medium High	UEF $\geq 0.6470 - (0.0006 \times V_r)$ UEF $\geq 0.7689 - (0.0005 \times V_r)$ UEF $\geq 0.7897 - (0.0004 \times V_r)$ UEF $\geq 0.8072 - (0.0003 \times V_r)$	DOE 10 C.F.R. Part 430 App. E
	$> 75,000$ Btu/h and $\leq 105,000$ Btu/h <sup>d</sup>	$\leq 120$ gal $\leq 180^\circ\text{F}$	Very small Low Medium High	UEF $\geq 0.2674 - 0.0009 \times V_r$ UEF $\geq 0.5362 - 0.0012 \times V_r$ UEF $\geq 0.6002 - 0.0011 \times V_r$ UEF $\geq 0.6597 - 0.0009 \times V_r$	DOE 10 C.F.R. Part 430 App. E
	$> 105,000$ Btu/h <sup>d,f</sup>			$80\% E_t$ SL $\leq (Q/800 + 110\sqrt{V})$ , Btu/h	DOE 10 C.F.R. 431.106
Gas instantaneous water heater <sup>h</sup>	$> 50,000$ Btu/h and $< 200,000$ Btu/h	$< 2$ gal	Very small Low Medium High	UEF $\geq 0.80$ UEF $\geq 0.81$ UEF $\geq 0.81$ UEF $\geq 0.81$	DOE 10 C.F.R. Part 430 App. E
	$\geq 200,000$ Btu/h <sup>d,f</sup>	$< 10$ gal		$80\% E_t$	DOE 10 C.F.R. 431.106
	$\geq 200,000$ Btu/h <sup>f</sup>	$\geq 10$ gal		$80\% E_t$ SL $\leq (Q/800 + 110\sqrt{V})$ , Btu/h	
Oil storage water heaters <sup>g</sup>	$\leq 105,000$ Btu/h	$\leq 50$ gal	Very small Low Medium High	UEF = $0.2509 - (0.0012 \times V_r)$ UEF = $0.5330 - (0.0016 \times V_r)$ UEF = $0.6078 - (0.0016 \times V_r)$ UEF = $0.6815 - (0.0014 \times V_r)$	DOE 10 C.F.R. Part 430
	$> 105,000$ Btu/h and $\leq 140,000$ Btu/h <sup>e</sup>	$\leq 120$ gal $\leq 180^\circ\text{F}$	Very small Low Medium High	UEF $\geq 0.2932 - 0.0015 \times V_r$ UEF $\geq 0.5596 - 0.0018 \times V_r$ UEF $\geq 0.6194 - 0.0016 \times V_r$ UEF $\geq 0.6740 - 0.0013 \times V_r$	DOE 10 C.F.R. Part 430 App. E
	$> 140,000$ Btu/h			$80\% E_t$ SL $\leq (Q/800 + 110\sqrt{V})$ , Btu/h	DOE 10 C.F.R. 431.106
Oil instantaneous water heater <sup>h</sup>	$\leq 210,000$ Btu/h	$< 2$ gal		$80\% E_t$ EF $\geq 0.59 - 0.0005 \times V$	DOE 10 C.F.R. Part 430 App. E
	$> 210,000$ Btu/h	$< 10$ gal		$80\% E_t$	DOE 10 C.F.R. 431.106
	$> 210,000$ Btu/h	$\geq 10$ gal		$78\% E_t$ SL $\leq (Q/800 + 110\sqrt{V})$ , Btu/h	DOE 10 C.F.R. 431.106
Hot water supply boilers, gas and oil <sup>h</sup>	$\geq 300,000$ Btu/h and $< 12,500,000$ Btu/h	$< 10$ gal		$80\% E_t$	DOE 10 C.F.R. 431.106
Hot water supply boilers, gas <sup>h</sup>	$\geq 300,000$ Btu/h and $< 12,500,000$ Btu/h	$\geq 10$ gal		$80\% E_t$ SL $\leq (Q/800 + 110\sqrt{V})$ , Btu/h	DOE 10 C.F.R. 431.106
Hot water supply boilers, oil <sup>h</sup>	$\geq 300,000$ Btu/h and $< 12,500,000$ Btu/h	$\geq 10$ gal		$78\% E_t$ SL $\leq (Q/800 + 110\sqrt{V})$ , Btu/h	DOE 10 C.F.R. 431.106

Equipment Type	Size Category (input)	Subcategory or Rating Condition	Draw Pattern	Performance Required <sup>a,j</sup>	Test Procedure <sup>b</sup>
Pool heaters, gas	All			82% $E_t$	DOE 10 C.F.R. Part 430 App. P
Heat pump pool heaters	All	50°F db 44.2°F wb outdoor air 80.0°F entering water		4.0 COP	DOE 10 C.F.R. Part 430 App. P
Unfired storage tanks	All			Minimum insulation requirement R-12.5 (h-ft <sup>2</sup> -°F)/Btu	(none)

- <sup>a</sup> Thermal efficiency ( $E_t$ ) is a minimum requirement, while standby loss is a maximum requirement. In the standby loss equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h.  $V_m$  is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term "S," and standby loss for gas and oil water heaters is in terms of Btu/h and denoted by the term "SL" Draw pattern (DP) refers to the water draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations,  $V_r$  refers to the rated volume in gallons.
- <sup>b</sup> Chapter 6 contains a complete specification, including the year version, of the referenced test procedure.
- <sup>c</sup> Electric instantaneous water heaters with input capacity > 12 kW and ≤ 58.6 kW that have either (1) a storage volume > 2 gal; or (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power has no efficiency standard.
- <sup>d</sup> Gas storage water heaters with input capacity > 75,000 Btu/h and ≤ 105,000 Btu/h must comply with the requirements for the > 105,000 Btu/h if the water heater either (1) has a storage volume > 120 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.
- <sup>e</sup> Oil storage water heaters with input capacity > 105,000 Btu/h and ≤ 140,000 Btu/h must comply with the requirements for the > 140,000 Btu/h if the water heater either (1) has a storage volume > 120 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.
- <sup>f</sup> Water heaters or gas pool heaters in this category are regulated as consumer products by the USDOE as defined in 10 C.F.R. Part 430.
- <sup>g</sup> Storage water heaters have a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.
- <sup>h</sup> Instantaneous water heaters and hot water supply boilers have an input capacity (Btu/h) divided by storage volume (gal) ≥ 4000 Btu/h-gal.
- <sup>i</sup> There are no minimum efficiency requirements for electric heat pump water heaters greater than 12 kW or for gas heat pump water heaters.
- <sup>j</sup> Refer to Section C404.2.1 for additional requirements for service water heat system equipment.
- <sup>k</sup> A tabletop water heater is a storage water heater that is enclosed in a rectangular cabinet with a flat top surface not more than three feet (0.91 m) in height and have a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.
- <sup>l</sup> 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 nonwater 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."

[Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapters 19.27A and 19.27 RCW. WSR 22-14-091, 23-12-101, and 23-20-021, § 51-11C-404021, filed 7/1/22, 6/7/23, and 9/25/23, effective 3/15/24. Statutory Authority: RCW 19.27A.025, 19.27A.045 and chapter 19.27 RCW. WSR 20-21-080, § 51-11C-404021, filed 10/19/20, effective 2/1/21. Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-404021, filed 11/26/19, effective 7/1/20. Statutory Authority: RCW 19.27A.025, 19.27A.045, 19.27A.160, and 19.27.074. WSR 16-13-089, § 51-11C-404021, filed 6/15/16, effective 7/16/16. Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-404021, filed 1/19/16, effective 7/1/16. Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-056, § 51-11C-404021, filed 2/1/13, effective 7/1/13.]

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