

Table 7.8 Performance Requirements for Water-Heating Equipment—Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Performance Required ^a	Test Procedure ^{b,c}
Electric table-top water heaters	≤12 kW	<4000 (Btu/h)/gal ≥20 gal and ≤120 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
Electric storage water heaters	≤12 kW	<4000 (Btu/h)/gal ≥20 gal and ≤55 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
		<4000 (Btu/h)/gal >55 gal and ≤120 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
	>12 kW ^e	<4000 (Btu/h)/gal	$SL \leq 0.3 + 27/V_m$ %/h	10 CFR 431.106
Electric instantaneous water heaters	≤12 kW	≥4000 (Btu/h)/gal <2 gal	For applications outside US, see footnote (h). For US applications, see footnote (g).	10 CFR 430 Appendix E
	>12 kW and ≤58.6 kW ^c	≥4000 (Btu/h)/gal ≤2 gal ≤180°F	Very Small DP: UEF = 0.80 Low DP: UEF = 0.80 Medium DP: UEF = 0.80 High DP: UEF = 0.80	10 CFR 430 Appendix E
	≤58.6 kW ^c	≥4000 (Btu/h)/gal <10 gal	No requirement	
		≥4000 (Btu/h)/gal ≥10 gal	No requirement	
Gas storage water heaters	≤75,000 Btu/h	<4000 (Btu/h)/gal ≥20 gal and ≤55 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
		<4000 (Btu/h)/gal >55 gal and ≤100 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
	>75,000 Btu/h and ≤105,000 Btu/h ^d	<4000 (Btu/h)/gal ≤120 gal ≤180°F	Very Small DP: UEF = $0.2674 - (0.0009 \times V_p)$ Low DP: UEF = $0.5362 - (0.0012 \times V_p)$ Medium DP: UEF = $0.6002 - (0.0011 \times V_p)$ High DP: UEF = $0.6597 - (0.0009 \times V_p)$	10 CFR 430 Appendix E
	>105,000 Btu/h ^{d,f}	<4000 (Btu/h)/gal	80% E_f	10 CFR 431.106
			$SL \leq (Q/800 + 110/\sqrt{V})$, Btu/h	

a. Thermal efficiency (E_f) 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 "SL," 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_p refers to the rated volume in gallons.

b. Section 12 contains a complete specification, including the year version, of the referenced test procedure.

c. Electric instantaneous water heaters with input capacity >12 kW and ≤58.6 kW must comply with the requirements for the 58.6 kW if the water heater either (1) has a storage volume >2 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.

d. 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.

e. 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.

f. Refer to Section 7.5.3 for additional requirements for gas storage and instantaneous water heaters and gas hot-water supply boilers.

g. Water heaters or gas pool heaters in this category or subcategory are regulated as consumer products by the USD OE as defined in 10 CFR 430.

h. Where this standard is being applied to a building outside the U.S. and Canada and water heaters in this subcategory are being installed in that building, those water heaters shall meet the local efficiency requirements. If there are no local efficiency standards for residential water heaters, consideration should be given to using the USD OE efficiency requirements shown in Appendix F, Table F-2.

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Table 7.8 Performance Requirements for Water-Heating Equipment—Minimum Efficiency Requirements (Continued)

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Performance Required ^a	Test Procedure ^{b,c}
Gas instantaneous water heaters	>50,000 Btu/h and ≤200,000 Btu/h	≥4000 (Btu/h)/gal <2 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
	≥200,000 Btu/h ^{d,f}	≥4000 (Btu/h)/gal <10 gal	80% E_t	10 CFR 431.106
	≥200,000 Btu/h ^f	≥4000 (Btu/h)/gal ≥10 gal	80% E_t $SL \leq (Q/800 + 110 \sqrt{V})$, Btu/h	
Oil storage water heaters	≤105,000 Btu/h	<4000 (Btu/h)/gal ≤50 gal	For applications outside U.S., see footnote (h). For U.S. applications, see footnote (g).	10 CFR 430 Appendix E
	≥105,000 Btu/h and ≤140,000 Btu/h ^e	≤120 gal <4000 (Btu/h)/gal ≤180°F	Very Small DP: $UEF = 0.2932 - (0.0015 \times V_r)$ Low DP: $UEF = 0.5596 - (0.0018 \times V_r)$ Medium DP: $UEF = 0.6194 - (0.0016 \times V_r)$ High DP: $UEF = 0.6740 - (0.0013 \times V_r)$	10 CFR 430 Appendix E
	>140,000 Btu/h	<4000 (Btu/h)/gal	80% E_t $SL \leq (Q/800 + 110 \sqrt{V})$, Btu/h	10 CFR 431.106
Oil instantaneous water heaters	≤210,000 Btu/h	≥4000 (Btu/h)/gal <2 gal	80% E_t $EF \geq 0.59 - 0.0005 \times V$	10 CFR 430 Appendix E as it appeared as of 1/1/2014
	>210,000 Btu/h	≥4000 (Btu/h)/gal <10 gal	80% E_t	10 CFR 431.106
	>210,000 Btu/h	≥4000 (Btu/h)/gal ≥10 gal	78% E_t $SL \leq (Q/800 + 110 \sqrt{V})$, Btu/h	
Hot-water supply boilers, gas and oil ^f	≥300,000 Btu/h and <12,500,000 Btu/h	≥4000 (Btu/h)/gal <10 gal	80% E_t	10 CFR 431.106
Hot-water supply boilers, gas ^f	≥300,000 Btu/h and <12,500,000 Btu/h	≥4000 (Btu/h)/gal ≥10 gal	80% E_t $SL \leq (Q/800 + 110 \sqrt{V})$, Btu/h	10 CFR 431.106
Hot-water supply boilers, oil	≥300,000 Btu/h and <12,500,000 Btu/h	≥4000 (Btu/h)/gal ≥10 gal	78% E_t $SL \leq (Q/800 + 110 \sqrt{V})$, Btu/h	10 CFR 431.106
Pool heaters, gas	All		82% E_t for commercial pool heaters and for applications outside U.S. For U.S. applications, see footnote (g).	10 CFR 430 Appendix P
Heat pump pool heaters	All	50°F db 44.2°F wb outdoor air 80.0°F entering water	4.0 COP	10 CFR 430 Appendix P
Unfired storage tanks	All		R-12.5	(none)

a. 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 "SL," 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.

b. Section 12 contains a complete specification, including the year version, of the referenced test procedure.

c. Electric instantaneous water heaters with input capacity >12 kW and ≤58.6 kW must comply with the requirements for the 58.6 kW if the water heater either (1) has a storage volume >2 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.

d. 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.

e. 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.

f. Refer to Section 7.5.3 for additional requirements for gas storage and instantaneous water heaters and gas hot-water supply boilers.

g. Water heaters or gas pool heaters in this category or subcategory are regulated as consumer products by the USDOE as defined in 10 CFR 430.

h. Where this standard is being applied to a building outside the U.S. and Canada and water heaters in this subcategory are being installed in that building, those water heaters shall meet the local efficiency requirements. If there are no local efficiency standards for residential water heaters, consideration should be given to using the USDOE efficiency requirements shown in Appendix F, Table F-2.

Service Water Heating Compliance Report

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Project Name:		
Project Address:		Date:
Designer of Record:	Email:	Telephone:
Contact Person:	Email:	Telephone:
City:		

Mandatory Provisions Checklist

- ☐ Yes ☐ N/A Load calculations have been provided for sizing of systems and equipment (Section 7.4.1).
- ☐ Yes ☐ N/A Equipment efficiencies meet or exceed the requirements of Table 7.8 (Section 7.4.2).
- ☐ Yes ☐ N/A Circulating systems are fully insulated (per Table 6.8.3-1) and have automatic pump controls (Sections 7.4.3 and 7.4.4.2).
- ☐ Yes ☐ N/A Noncirculating systems have heat traps (Section 7.4.6) and outlet piping insulation (per Table 6.8.3-1) for 8 ft (2.4 m) from the storage tank (Section 7.4.3).
- ☐ Yes ☐ N/A All water heating systems have temperature controls that are adjustable to 120°F (49°C) or lower (Section 7.4.4.1).
- ☐ Yes ☐ N/A Systems designed with pipe heating systems such as heat trace have temperature or time controls (Section 7.4.4.2).
- ☐ Yes ☐ N/A Public lavatories have outlet temperature controls that limit the discharge temperature to 110°F (43°C) (Section 7.4.4.3).
- ☐ Yes ☐ N/A Tanks with remote heaters have circulation pump controls (Section 7.4.4.4).
- ☐ Yes ☐ N/A Pool heaters have readily accessible controls and gas-fired heaters do not have standing pilot lights (Section 7.4.5.1).
- ☐ Yes ☐ N/A Heated swimming pools have vapor-retardant covers (Section 7.4.5.2).
- ☐ Yes ☐ N/A Pool heaters and circulation pumps have time switches (Section 7.4.5.3).
- ☐ Yes ☐ N/A Construction documents require record documents (Section 7.7.3.1) and manuals (Section 7.7.3.2).
- ☐ Yes ☐ N/A Verification and testing performed and documented (Section 7.9.1).
- ☐ Yes ☐ N/A Commissioning performed and documented (Section 7.9.2)..

Equipment Efficiency Worksheet (Section 7.4.1)

System Tag	Equipment Type (from Table 7.8 or Table L-2)	Subcategory or Rating Condition (from Table 7.8 or Table L-2)	Input Rating (Btu/h or kW)	Volume (gal or L)	Uniform Energy Factor (UEF) or thermal efficiency (E_t) Rated \geq Required	Standby Loss Specified \leq Nameplate
					\geq	\leq
					\geq	\leq
					\geq	\leq

Combination Space and Water Heating Worksheet (Section 7.5.1)

System Tag	Standby Loss Method Equipment \leq Requirement	or Energy Use Exception (attach calculations) Equipment $<$ Requirement	or Size Exception Equipment $<$ Requirement
	\leq	$<$	$< 150,000 \text{ Btu/h (44 kW)}$
	\leq	$<$	$< 150,000 \text{ Btu/h (44 kW)}$
	\leq	$<$	$< 150,000 \text{ Btu/h (44 kW)}$