BSR/ASHRAE/IES Addendum bs
to ANSI/ASHRAE/IES Standard 90.1-2016

Public Review Draft

Proposed Addendum bs to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings

First Public Review (November 2017)
(Draft Shows Proposed Changes to Current Standard)

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FOREWORD

This addendum updates table F-2 to reflect the new water heater requirements that were adopted by DOE for residential water heaters effective December 2015

This addendum also make updates to table7.8 for water heaters to clarify requirements for products applications outside the US that are not covered by the DOE requirements that are referenced in the normative appendix F table F-2. For these non-US applications the efficiency requirements will be aligned with the DOE requirements in the normative appendix F-2

Also there are some editorial corrections made to table F-2 to move the pool heat pump water heater requirements to the table F-2 instead of listing them in a text requirement. Heat Pump water heaters are now rated the same as storage water heaters by DOE

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by <u>underlining</u> (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum bs to 90.1-2016

Revise table 7.8 as shown below IP

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	~~Resistance ≥20 gal~~ ≥20 gal and ≤120 gal and <4000 (Btu/h)/gal	For applications outside US[g] Very Small DP: UEF = 0.6323 − (0.0058 × V_r) Low DP: UEF = 0.9188 − (0.0031 × V_r) Medium DP: UEF = 0.9577 − (0.0023 × V_r) High DP: UEF = 0.9884 − (0.0016 × V_r) For US Applications See footnote (g).	10 CFR 430 Appendix E
Electric Storage *water heaters*	≤12 kW[e]	Resistance ~~≥20 gal~~ and heat pump ≤55 gal <4000 (Btu/h)/gal	For applications outside US Very Small DP: UEF = 0.8808 − (0.0008 × V_r) Low DP: UEF = 0.9254 − (0.0003 × V_r) Medium DP: UEF = 0.9307 − (0.0002 × V_r) High DP: UEF = 0.9349 − (0.0001 × V_r) For US Applications See footnote (g).	10 CFR 430 Appendix E
		Resistance and heat pump >55 gal <4000 (Btu/h)/gal	For applications outside US[g] Very Small DP UEF =1.9236 − (0.0011 × Vr) Low DP UEF = 2.0440 − (0.0011 × Vr) Medium DP UEF = 2.1171 − (0.0011 × Vr) High DP UEF = 2.2418 − (0.0011 × Vr) For US Applications See footnote (g).	10 CFR 430 Appendix E
	>12 kW[e]	Resistance ≥20 gal <4000 Btu/h/gal	SL≤0.3 + 27/Vm %/h	~~Section G.2 of ANSI Z21.10.3~~ 10 CFR 431.106
	~~≤24 Amps and ≤250 Volts~~	~~Heat pump~~	~~See footnote (g).~~	
Electric instantaneous *water heaters*	>12 kW[e]	≥4000 (Btu/h)/gal <2 gal	For applications outside US[g] Very Small DP: UEF = 0.91 Low DP: UEF = 0.91 Medium DP: UEF = 0.91 High DP: UEF = 0.92 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	For applications outside US[g] Very Small DP: UEF = 0.80 Low DP: UEF = 0.80 Medium DP: UEF = 0.80 High DP: UEF = 0.80 For US applications see footnote (g)	10 CFR 430 Appendix E
	>58.6 kW[c]	≥4000 (Btu/h)/gal	SL ≤ 0.3 + 27/V_m, %/h	10 CFR 431.106
Gas storage *water heaters*	≤75,000 Btu/h	~~≥20 gal≤~~55 gal <4000 (Btu/h)/gal	For applications outside US[g] Very Small DP: UEF = 0.3456 − (0.0020 × V_r) Low DP: UEF = 0.5982 − (0.0019 × V_r) Medium DP: UEF = 0.6483 − (0.0017 × V_r) High DP: UEF = 0.6920 − (0.0013 × V_r) For US applications See footnote (g).	10 CFR 430 Appendix E
		>55 gal <4000 (Btu/h)/gal	For applications outside US[g] Very Small DP: UEF = 0.6470 − (0.0006 × V_r)	10 CFR 430 Appendix E

			Low DP: UEF = 0.7689 − (0.0005 × V_r) Medium DP: UEF = 0.7897 − (0.0004 × V_r) High DP: UEF = 0.8072 − (0.0003 × V_r) For US applications See footnote (g).	
	>75,000 Btu/h and ≤105,000 Btu/h[d]	≤120 gal <4000 (Btu/h)/gal ≤180 °F	For applications outside US[g] Very Small DP: UEF = 0.2674 − (0.0009 × V_r) Low DP: UEF = 0.5362 − (0.0012 × V_r) Medium DP: UEF = 0.6002 − (0.0011 × V_r) High DP: UEF = 0.6597 − (0.0009 × V_r) For applications outside US[g]	10 CFR 430 Appendix E
	>~~75~~105,000 Btu/h[df]	<4000 (Btu/h)/gal	80% E_t SL ≤ (Q/800 + 110√V) Btu/h ~~SL, Btu/h~~	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430 Appendix E
Gas instantaneous *water heaters*	>50,000 Btu/h and <200,000 Btu/h	≥4000 (Btu/h)/gal ~~and~~ <2 gal	For applications outside US[g] Very Small DP: UEF = 0.80 Low DP: UEF = 0.81 Medium DP: UEF = 0.81 High DP: UEF = 0.81 For US applications See footnote (g).	10 CFR 430 Appendix E
	≥200,000 Btu/h[d,f]	≥4000 (Btu/h)/gal and <10 gal	80% E_t	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430 Appendix E
	≥200,000 Btu/h[f]	≥4000 (Btu/h)/gal and ≥10 gal	80% E_t SL≤ (Q/800 + 110√V) Btu/h ~~SL, Btu/~~h	
Oil storage *water heaters*	≤105,000 Btu/h	~~≥20~~ ≤50 gal	For applications outside US[g] Very Small DP: UEF = 0.2509 − (0.0012 × V_r) Low DP: UEF = 0.5330 − (0.0016 × V_r) Medium DP: UEF = 0.6078 − (0.0016 × V_r) High DP: UEF = 0.6815 − (0.0014 × V_r) For US 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	For applications outside US[g] Very Small DP: UEF = 0.2932 − (0.0015 × V_r) Low DP: UEF = 0.5596 − (0.0018 × V_r) Medium DP: UEF = 0.6194 − (0.0016 × V_r) High DP: UEF = 0.6740 − (0.0013 × V_r) For US applications See footnote (g).	10 CFR 430 Appendix E
	>~~105,000~~ 140,000 Btu/h[e]	<4000 (Btu/h)/gal	80% E_t SL≤ (Q/800 + 110√V) Btu/h ~~SL, Btu/h~~	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 431.106
Oil instantaneous *water heaters*	≤210,000 Btu/h	≥4000 (Btu/h)/gal and <2 gal	80% E_t ~~See footnote (g).~~	Sections G.1 and G.2 of ANSI Z21.10.3
	>210,000 Btu/h	≥4000 (Btu/h)/gal and <10 gal	80% E_t	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 431.106
	>210,000 Btu/h	≥4000 (Btu/h)/gal and ≥10 gal	78% E_t SL ≤ (Q/800 + 110√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 and <10 gal	80% E_t	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430.106
Hot-water supply *boilers*, gas[f]	≥300,000 Btu/h and <12,500,000 Btu/h	≥4000 (Btu/h)/gal ~~and~~ ≥10 gal	80% E_t SL≤(Q/800 + 110√V) Btu/h ~~SL, Btu/h~~	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430.106
Hot-water supply *boilers*, oil	≥300,000 Btu/h and <12,500,000 Btu/h	≥4000 (Btu/h)/gal and ≥10 gal	78% E_t *SL*≤(Q/800 + 110√V) Btu/h ~~SL, Btu/h~~	Sections G.1 and G.2 of ANSI Z21.10.3
Pool heaters, oil and gas	All		82% E_t for applications outside US[g] For US applications See footnote (g).	ASHRAE 146
Heat pump *pool* heaters	All	50°F db 44.2°F wb *Outdoor air* 80.0°F entering water	4.0 *COP*	AHRI 1160
Unfired storage tanks	All		R-12.5	(none)

a. Thermal *efficiency* (E_t) is a minimum requirement, while standby loss (SL) is maximum Btu/h based on a 70°F temperature difference between stored water and ambient requirements. In the SL 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. 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 >58.6 kW if the water heater either (1) has a storage volume >2 gallons; (2) is designed to provide outlet hot water at temperatures greater than 180 °F; or (3) uses 3-phase power. ~~Section G.1 is titled "Test Method for Measuring Thermal Efficiency" and Section G.2 is titled "Test Method for Measuring Standby Loss."~~

d. Gas storage water heaters with input capacity >75,000 Btu/h and ≤105,000 Btu/h must comply with these requirements for >150,000 Btu/h if the water heater either (1) has a storage volume >120 gallons; (2) is designed to provide outlet hot water at temperatures greater than 180 °F; or (3) uses 3-phase power. ~~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 of 180°F or higher.~~

e. Oil storage water heaters with input capacity >105,000 Btu/h and ≤140,000 Btu/h must comply with these requirements for >140,000 Btu/h if the water heater either (1) has a storage volume >120 gallons; (2) is designed to provide outlet hot water at temperatures greater than 180 °F; or (3) uses 3-phase power. ~~Electric water heaters with input rates below 12 kW must comply with these requirements if the water heater is designed to heat water to temperatures of 180°F or higher~~.

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

g. In the U.S., the *efficiency* requirements for *water heaters* or gas *pool* heaters in this category or subcategory are specified by the U.S. Department of Energy. Those requirements and applicable test procedures are found in the Code of Federal Regulations 10 CFR Part 430.

Informative Note: See Informative Appendix F for the U.S. Department of Energy *efficiency* requirements applicable to these *water heaters* and *pool* heaters.

Revise the following text

F2 DOE Minimum Energy Efficiency Requirements for Water Heaters

These standards became effective on ~~April 16, 2015~~ December 29, 2017, and apply to products manufactured on or after that date (Table F-2).

Delete the following text and add the efficiency requirements to table F-2

~~**F3 DOE Minimum Energy Efficiency Requirements for Pool Heaters**~~

~~Gas-fired *pool* heaters manufactured on or after April 16, 2013, shall have a thermal *efficiency* not less than 82%.~~

Replace IP table F-2 with the new revised table;

Table F-2 ~~Minimum *Energy Efficiency* Requirements for *Water Heaters*~~

~~(Source: 10 CFR Part 430, *Energy* Conservation Program: *Energy* Conservation Standards for Water Heating Pumps Heaters)~~

~~Product Class~~	~~Minimum *Energy Factor* (*EF*)~~
~~Gas-fired *water heater*~~	~~For tanks with a Rated Storage Volume at or below 55 gallons: *EF* = 0.675 – (0.0015 × Rated Storage Volume [gal])~~ ~~For tanks with a Rated Storage Volume above 55 gal: *EF* = 0.8012 – (0.00078 × Rated Storage Volume [gal])~~
~~Oil-fired *water heater*~~	~~*EF* = 0.68 – (0.0019 × Rated Storage Volume [gal])~~
~~Electric *water heater*~~	~~For tanks with a Rated Storage Volume at or below 55 gal: *EF* = 0.960 – (0.0003 × Rated Storage Volume [gal])~~ ~~For tanks with a Rated Storage Volume above 55 gal: *EF* = 2.057 – (0.00113 × Rated Storage Volume [gal])~~
~~Tabletop *water heater*~~	~~*EF* = 0.93 – (0.00132 × Rated Storage Volume [gal])~~
~~Instantaneous gas-fired *water heater*~~	~~*EF* = 0.82 – (0.0019 × Rated Storage Volume [gal])~~
~~Instantaneous electric *water heater*~~	~~EF = 0.93 – (0.00132 × Rated Storage Volume [gal])~~

~~***Note:*** The Rated Storage Volume equals the water storage capacity of a *water heater* in gallons as specified by the *manufacturer*.~~

Insert the following revised IP table

Table F-2 Minimum Energy Efficiency Requirements for Water Heaters
Source: 10 CFR Part 430, *Energy* Conservation Program: *Energy* Conservation Standards for Water Heaters)

Product Class	Rated Storage Volume and input rating (if applicable)	Draw Pattern	Uniform Energy Factor
Gas-fired storage water heater	≥20 gal and ≤55 gal	Very Small	0.3456 − (0.0020 × Vr)
		Low	0.5982 − (0.0019 × Vr)
		Medium	0.6483 − (0.0017 × Vr)
		High	0.6920 − (0.0013 × Vr)
	>55 gal and ≤100 gal	Very Small	0.6470 − (0.0006 × Vr)
		Low	0.7689 − (0.0005 × Vr)
		Medium	0.7897 − (0.0004 × Vr)
		High	0.8072 − (0.0003 × Vr)
Oil-fired storage water heater	≤50 gal	Very Small	0.2509 − (0.0012 × Vr)
		Low	0.5330 − (0.0016 × Vr)
		Medium	0.6078 − (0.0016 × Vr)
		High	0.6815 − (0.0014 × Vr)
Electric Storage Water Heaters	≥20 gal and ≤55 gal	Very Small	0.8808 − (0.0008 × Vr)
		Low	0.9254 − (0.0003 × Vr)
		Medium	0.9307 − (0.0002 × Vr)
		High	0.9349 − (0.0001 × Vr)
	>55 gal and ≤100 gal	Very Small	1.9236 − (0.0011 × Vr)
		Low	2.0440 − (0.0011 × Vr)
		Medium	2.1171 − (0.0011 × Vr)
		High	2.2418 − (0.0011 × Vr)
Instantaneous Gas Fired Water Heater	<2 gal and >50,000 Btu/h	Very Small	0.80
		Low	0.81
		Medium	0.81
		High	0.81
Instantaneous Electric Water Heater	<2 gal	Very Small	0.91
		Low	0.91
		Medium	0.91
		High	0.92
Grid Enabled Water Heaters	>75 gal	Very Small	1.0136 − (0.0028 × Vr)
		Low	0.9984 − (0.0014 × Vr)
		Medium	0.9853 − (0.0010 × Vr)
		High	0.9720 − (0.0007 × Vr)
Pool heater Gas			82% E_t

[a.] V_r is the Rated Storage Volume (in gallons), as determined pursuant to 10 CFR 429.17.
[b]. Standards for electric storage water heaters apply to both electric resistance water heaters and heat pump water heaters.

Revise table 7.8 as shown below SI

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*	~~Resistance ≥75.7 L~~ ≥76 L and ≤450 L <309.75 W/L	For applications outside US[g] Very Small DP: UEF = 0.6323 − (0.0220 × V_r) Low DP: UEF = 0.9188 − (0.0117 × V_r) Medium DP: UEF = 0.9577 − (0.0087 × V_r) High DP: UEF = 0.9884 − (0.0061 × V_r) For US Applications See footnote (g).	10 CFR 430 Appendix E
Electric Storage *water heaters*	≤12 *kW*[e]	Resistance ~~≥75.7 L~~ and heat Pump ≤76 L <309.75 W/L	For applications outside US[g] Very Small DP: UEF = 0.8808 − (0.0030 × V_r) Low DP: UEF = 0.9254 − (0.0011 × V_r) Medium DP: UEF = 0.9307 − (0.0008 × V_r) High DP: UEF = 0.9349 − (0.0004 × V_r) For US Applications See footnote (g).	10 CFR 430 Appendix E
		Resistance ~~≥75.7 L~~ and heat Pump ≤76 L <309.75 W/L	For applications outside US[g] Very Small DP: UEF = 1.9236 − (0.0011 × V_r) Low DP: UEF = 2.0440 − (0.0041 × V_r) Medium DP: UEF = 2.1171 − (0.0030 × V_r) High DP: UEF = 0.2.2418 − (0.0015 × V_r) For US Applications See footnote (g).	10 CFR 430 Appendix E
	>12 *kW*[e]	Resistance ~~≥75.7 L~~ ≥76 L and ≤450 L <310 W/L	SL≤0.3 + 27/Vm %/h	~~Section G.2 of ANSI Z21.10.3~~ 10 CFR 431.106
	~~≤24 Amps and ≤250 Volts~~	~~Heat pump~~	~~See footnote (g).~~	
	>12 *kW*[e]	≥309.75 W/L <7.6 L	For applications outside US[g] Very Small DP: UEF = 0.91 Low DP: UEF = 0.91 Medium DP: UEF = 0.91 High DP: UEF = 0.92 For US applications see footnote (g)	10 CFR 430 Appendix E
Electric instantaneous *water heaters*	>12 kW and ≤58.6 kW[c]	≥309.75 W/L ≤7.6 L ≤82 °C	For applications outside US[g] Very Small DP: UEF = 0.80 Low DP: UEF = 0.80 Medium DP: UEF = 0.80 High DP: UEF = 0.80 For US applications see footnote (g)	10 CFR 430 Appendix E
	>58.6 *kW*[c]	≥309.75 W/L	SL ≤ 0.3 + 27/V_m, %/h	10 CFR 431.106
Gas storage *water heaters*	≤22 kWh	~~≥75.7~~ L≤208 L <309.75 W/L	For applications outside US[g] Very Small DP: UEF = 0.3456 − (0.0076 × V_r) Low DP: UEF = 0.5982 − (0.0072 × V_r) Medium DP: UEF = 0.6483 − (0.0064 × V_r) High DP: UEF = 0.6920 − (0.0049 × V_r) For US applications See footnote (g).	10 CFR 430 Appendix E
		≤208 L <309.75 W/L	For applications outside US[g] Very Small DP: UEF = 0.6470 − (0.0023 × V_r) Low DP: UEF = 0.7689 − (0.0019 × V_r) Medium DP: UEF = 0.7897 − (0.0015 × V_r)	10 CFR 430 Appendix E

			High DP: UEF = 0.8072 − (0.0011 × V_r) For US applications See footnote (g).	
	>22 kW and ≤82 kW[d]	<309.75 W/L ≤7.6 L ≤82 °C	Very Small DP: UEF = 0.2674 − (0.0009 × V_r) Low DP: UEF = 0.5362 − (0.0012 × V_r) Medium DP: UEF = 0.6002 − (0.0011 × V_r) High DP: UEF = 0.6597 − (0.0009 × V_r)	10 CFR 430 Appendix E
	>~~75~~82 kW[f]	<309.75 W/L	80% E_t SL ≤ (Q/~~800~~0.234 + ~~110~~208.2√V) kWh ~~SL, kW~~	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430 Appendix E
Gas instantaneous *water heaters*	>14.6 kW and <58.6 kW	≥309.75 W/L ~~and~~ <7.57 L	For applications outside US Very Small DP: UEF = 0.80 Low DP: UEF = 0.81 Medium DP: UEF = 0.81 High DP: UEF = 0.81 For US applications See footnote (g).	10 CFR 430 Appendix E
	≥58.6 kW[d,f]	≥309.75 W/L and <37.8 L	80% E_t	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430 Appendix E
	≥58.6 kW[d,f]	≥309.75 W/L and <37.8 L	SL ≤ (Q/~~800~~0.234 + ~~110~~208.2√V) kW ~~SL, kW~~	
Oil storage *water heaters*	≤14.6 kW	~~>20~~ ≤189 L	For applications outside US Very Small DP: UEF = 0.2509 − (0.0045 × V_r) Low DP: UEF = 0.5330 − (0.0061 × V_r) Medium DP: UEF = 0.6078 − (0.0061 × V_r) High DP: UEF = 0.6815 − (0.0053 × V_r) For US applications See footnote (g).	10 CFR 430 Appendix E
	>8.75 kW and ≤11.7 kW[e]	<309.75 W/L ≤7.6 L ≤82 °C	Very Small DP: UEF = 0.2932 − (0.0015 × V_r) Low DP: UEF = 0.5596 − (0.0018 × V_r) Medium DP: UEF = 0.6194 − (0.0016 × V_r) High DP: UEF = 0.6740 − (0.0013 × V_r)	10 CFR 430 Appendix E
	>~~105,000~~ 11.7 kW[e]	<309.75 W/L	80% E_t SL ≤ (Q/~~800~~0.234 + ~~110~~208.2√V) kW ~~SL, kW~~	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 431.106
Oil instantaneous *water heaters*	≤41 kW	≥309.75 W/L and <7.6 L	~~80% E_t See footnote (g).~~	Sections G.1 and G.2 of ANSI Z21.10.3
	>61 kW	≥309.75 W/L and <7.6 L	80% E_t	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 431.106
	>61 kW	≥309.75 W/L and ≥7.6 L	78% E_t SL ≤ (Q/~~800~~0.234 + ~~110~~208.2√V) kW ~~SL, kW~~	
Hot-water supply *boilers*, gas and oil[f]	≥88 kW <3663 kW	≥309.75 W/L and <7.6 L	80% E_t	~~Sections G.1 and G.2 of ANSI Z21.10.3~~ 10 CFR 430.106
Hot-water supply *boilers*, gas[f]	≥88 kW <3663 kW	≥309.75 W/L ~~and~~ ≥7.6 L	80% E_t SL ≤ (Q/~~800~~0.234 + ~~110~~208.2√V) kW ~~SL, kW~~	~~Sections G.1 and G.2 of ANSI Z21.10.3~~

				10 CFR 430.106
Hot-water supply *boilers*, oil	≥88 kW and <3663 kW	≥309.75 W/L ~~and~~ ≥7.6 L	78% E_t SL ≤ (Q/~~8000~~.234 + ~~110~~208.2√V) kW ~~SL, kW~~	Sections G.1 and G.2 of ANSI Z21.10.3
Pool heaters, oil and gas	All		82% E_t for applications outside US For US applications See footnote (g).	ASHRAE 146
Heat pump *pool* heaters	All	10°C db 5.55°C wb *Outdoor air* 26.7°C entering water	4.0 *COP*	AHRI 1160
Unfired storage tanks	All		R-2.2	(none)

[a.] Thermal *efficiency* (E_t) is a minimum requirement, while standby loss (SL) is maximum Btu/h based on a 38.9°C temperature difference between stored water and ambient requirements. In the SL 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. 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 if the water heater for >56 kW either (1) has a storage volume >7.6 L; (2) is designed to provide outlet hot water at temperatures greater than 180 °F; or (3) uses 3-phase power. ~~Section G.1 is titled "Test Method for Measuring Thermal Efficiency" and Section G.2 is titled "Test Method for Measuring Standby Loss."~~

[d.] Gas storage water heaters with input capacity >22 kW Btu/h and ≤31 kW must comply with the requirements for >30.7 kW.if the water heater either (1) has a storage volume >454 L; (2) is designed to provide outlet hot water at temperatures greater than 82 °C; or (3) uses 3-phase power. ~~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 of 180°F or higher.~~

[e.] Oil storage water heaters with input capacity >31 kW Btu/h and ≤41 kW must comply with these requirements for > 41 kW if the water heater either (1) has a storage volume >454 L; (2) is designed to provide outlet hot water at temperatures greater than 82 °C; or (3) uses 3-phase power. ~~Electric water heaters with input rates below 12 kW must comply with these requirements if the water heater is designed to heat water to temperatures of 82° C or higher~~.

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

[g.] In the U.S., the *efficiency* requirements for *water heaters* or gas *pool* heaters in this category or subcategory are specified by the U.S. Department of Energy. Those requirements and applicable test procedures are found in the Code of Federal Regulations 10 CFR Part 430.

Informative Note: See Informative Appendix F for the U.S. Department of Energy *efficiency* requirements applicable to these *water heaters* and *pool* heaters.

Replace IP table F-2 with the new revised table;

Table F-2 Minimum *Energy Efficiency* Requirements for *Water Heaters*
(Source: 10 CFR Part 430, *Energy* Conservation Program: *Energy* Conservation Standards for Water Heating Pumps Heaters)

Product Class	**Minimum *Energy Factor* (*EF*)**
Gas-fired *water heater*	For tanks with a Rated Storage Volume at or below 55 gallons: *EF* = 0.675 – (0.0004 × Rated Storage Volume [L]) For tanks with a Rated Storage Volume above 208.2 L: *EF* = 0.8012 – (0.0002 × Rated Storage Volume [L])
Oil-fired *water heater*	*EF* = 0.68 – (0.0005 × Rated Storage Volume [L])
Electric *water heater*	For tanks with a Rated Storage Volume at or below 208.2 L: *EF* = 0.960 – (0.0003 × Rated Storage Volume [L]) For tanks with a Rated Storage Volume above 55 gal: *EF* = 2.057 – (0.0003 × Rated Storage Volume [L])
Tabletop *water heater*	*EF* = 0.93 – (0.00035 × Rated Storage Volume [L])
Instantaneous gas-fired *water heater*	*EF* = 0.82 – (0.0005 × Rated Storage Volume [L])
Instantaneous electric *water heater*	EF = 0.93 – (0.00035 × Rated Storage Volume [L]).

Note: The Rated Storage Volume equals the water storage capacity of a *water heater* in gallons as specified by the *manufacturer*.

Insert the following revised SI table

Table F-2 Minimum Energy Efficiency Requirements for Water Heaters
Source: 10 CFR Part 430, *Energy* Conservation Program: *Energy* Conservation Standards for Water Heating Pumps Heaters)

Product Class	Rated Storage Volume and input rating (if applicable)	Draw Pattern	Uniform Energy Factor
Gas-fired storage water heater	≥75.7 L and ≤208 L	Very Small	0.3456 − (0.0076 × Vr)
		Low	0.5982 − (0.0072 × Vr)
		Medium	0.6483 − (0.0064 × Vr)
		High	0.6920 − (0.0049 × Vr)
	>208 L and ≤378 L	Very Small	0.6470 − (0.0023 × Vr)
		Low	0.7689 − (0.0019 × Vr)
		Medium	0.7897 − (0.0015 × Vr)
		High	0.8072 − (0.0011 × Vr)
Oil-fired storage water heater	≤189 L	Very Small	0.2509 − (0.0045 × Vr)
		Low	0.5330 − (0.0061 × Vr)
		Medium	0.6078 − (0.0061 × Vr)
		High	0.6815 − (0.0053 × Vr)
Electric Storage Water Heaters	≥75.7 L and ≤208 L	Very Small	0.8808 − (0.0030 × Vr)
		Low	0.9254 − (0.0011 × Vr)
		Medium	0.9307 − (0.0008 × Vr)
		High	0.9349 − (0.0004 × Vr)
	>75.7 L and ≤378 L	Very Small	1.9236 − (0.0011 × Vr)
		Low	2.0440 − (0.0041 × Vr)
		Medium	2.1171 − (0.0030 × Vr)
		High	2.2418 − (0.0015 × Vr)
Instantaneous Gas Fired water heater	<7.57 L and >14.6 kW	Very low	0.80
		Low	0.81
		Medium	0.81
		High	0.81
Instantaneous Electric water heater	<7.57 L	Very low	0.91
		Low	0.91
		Medium	0.91
		High	0.92
Grid Enabled Water Heaters	>284 L	Very low	1.0136 − (0.0028 × Vr)
		Low	0.9984 − (0.0014 × Vr)
		Medium	0.9853 − (0.0010 × Vr)
		High	0.9720 − (0.0007 × Vr)
Pool heater Gas			82% E_t

[a.] V_r is the Rated Storage Volume (in L), as determined pursuant to 10 CFR 429.17.
[b]. Standards for electric storage water heaters apply to both electric resistance water heaters and heat pump water heaters.