



**BSR/ASHRAE/IES Addendum bo  
to ANSI/ASHRAE/IES Standard 90.1-2016**

**Public Review Draft**

# **Proposed Addendum bo to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings**

**First Public Review (November 2018)  
(Draft Shows Proposed Changes to Current Standard)**

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## **FOREWORD**

*The following changes will be made as part of this addendum*

- 1. As part of the ASRAC negotiations for commercial rooftops it was agreed that the efficiency of >225,000 Btu/h weatherized gas fired furnaces would be increased from 80% thermal efficiency to 81% thermal efficiency effective 1/1/2023*
- 2. As part of the ASRAC negotiations for commercial rooftops it was agreed that the efficiency of >225,000 Btu/h weatherized oil fired furnaces would be increased from 81% thermal efficiency to 82% thermal efficiency effective 1/1/2023*
- 3. Higher efficiencies can be obtained with condensing gas furnaces, but for weatherized applications this can result in issues with heat exchanger corrosion, freezing of condensate, and issues with disposal of condensate in commercial buildings which can require passivation systems. Also studies have shown that the added pressure drop of condensing furnace secondary heat exchangers increase pressure drop and for commercial applications where the fan runs continuously for ventilation in the occupied mode and the load profiles are cooling dominated that added savings due to the reduced gas use is offset by the increased fan power due to the pressure drop of the secondary heat exchangers.*
- 4. The economic justification for the more stringent efficiency levels was addressed in the DOE rulemaking documents for the applicable energy conservation standards rulemaking*
- 5. The current federal AFUE standards (with compliance date in 2015) are more stringent for residential gas and oil furnaces (ie, <225 kBtu/h). These levels have been updated to the DOE levels and/or the existing levels in this table have been designated for outside US only.*
- 6. Added requirements for <225,000 Btu/h electric furnaces*
- 7. Added requirements for <225,000 Btu/h standby power mode consumption  $P_{W,SB}$  and off mode power consumption  $P_{W,OFF}$*
- 8. To be consistent with other changes the <225,000 Btu/hr furnace requirements for sales in the US will be moved to a new table F-4 in appendix F*

***[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (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 bo to 90.1-2016

Add the following definition to chapter 3

Standby Power Mode Consumption ( $P_{W,SB}$ ) – Is the power used by an product or appliance when enabled but in the standby operating mode (Refer 10 CFR 430)

Modify the IP table 6.8.1-5 as show below.

**Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements**

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure <sup>a</sup>
Warm-air furnace, gas fired <u>for application outside the US<sup>d</sup></u>	<225,000 Btu/h	Maximum capacity <sup>c</sup>	<del>78</del> 80% AFUE (non-weatherized) or 81% AFUE (weatherized) or 80% $E_t$ <sup>b,d</sup>	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
<u>Warm-air furnace, gas fired</u>	≥225,000 Btu/h	Maximum capacity <sup>c</sup>	80% $E_t$ <sup>b,d</sup> before 1/1/2023 81% $E_t$ <sup>d</sup> after 1/1/2023	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, oil fired <u>for application outside the US<sup>d</sup></u>	<225,000 Btu/h	Maximum capacity <sup>c</sup>	<del>78</del> 83% AFUE (non-weatherized) or 78% AFUE (weatherized) or 80% $E_t$ <sup>b,d</sup>	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
<u>Warm-air furnace, oil fired</u>	≥225,000 Btu/h	Maximum capacity <sup>c</sup>	81% $E_t$ <sup>d</sup> before 1/1/2023 82% $E_t$ <sup>d</sup> after 1/1/2023	Section 42, Combustion, UL 727
<u>Electric Furnaces for application outside the US<sup>d</sup></u>	<225,000 Btu/h	all	78% AFUE $P_{W,SB} \leq 10$ W $P_{W,OFF} \leq 10$ W	Section 42, Combustion, UL 727
Warm-air duct furnaces, gas fired	All capacities	Maximum capacity <sup>c</sup>	80% $E_c$ <sup>e</sup>	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, gas fired	All capacities	Maximum capacity <sup>c</sup>	80% $E_c$ <sup>e,f</sup>	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, oil fired	All capacities	Maximum capacity <sup>c</sup>	80% $E_c$ <sup>e,f</sup>	Section 40, Combustion, UL 731

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

b. Combination units not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (three-phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating. Combination units (i.e., furnaces contained within the same cabinet as an air conditioner) not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (i.e., three-phase power or with cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating. All other units <225 kBtu/h sold in the US must meet the AFUE standards for consumer products and test using DOE's AFUE test procedure at 10 CFR 430 Subpart B Appendix N.

c. Compliance of multiple firing rate units shall be at the maximum firing rate.

d. For US sales of federal covered <225,000 Btu/h products see appendix F table F-4

- d.  $E_t$  = thermal *efficiency*. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a *flue damper*. A *vent damper* is an acceptable alternative to a *flue damper* for those furnaces where combustion air is drawn from the *conditioned space*.
- e.  $E_c$  = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.
- f. ~~As of August 8, 2008, according to the Energy Policy Act of 2005, U~~units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

Add a new table F-4 IP for residential federal covered furnaces

**Table F-4 Residential Warm Air Furnaces – Minimum Efficiency Requirements for sale in the US**  
 (see 10 CFR Part 430)

<b>Product Class</b>	<b>Size Category (input)</b>	<b>Subcategory or rating condition</b>	<b>Minimum Efficiency</b>	<b>Test Procedure<sup>a</sup></b>
Furnace, gas fired	<225,000 Btu/h	Non-weatherized excluding mobile home	80% AFUE	10 CFR 430.23(n)(2)
		Non-weatherized mobile home	80% AFUE	
		Weatherized	81% AFUE	
Furnace oil fired	<225,000 Btu/h	Non-weatherized excluding mobile home	83% AFUE $P_{W,SB} \leq 11 W$ $P_{W,OFF} \leq 11 W$	10 CFR 430.23(n)(2) and (n)(5)
		Non-weatherized mobile home	75% AFUE $P_{W,SB} \leq 11 W$ $P_{W,OFF} \leq 11 W$	
		Weatherized	78% AFUE	
Electric Furnace	<225,000 Btu/h	All	78% AFUE $P_{W,SB} \leq 10 W$ $P_{W,OFF} \leq 10 W$	10 CFR 430.23(n)(2) and (n)(5)

<sup>a</sup> Section 12 contains a complete specification of the referenced test procedure.

Modify the SI table 6.8.1-5 as show below

**Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements**

<b>Equipment Type</b>	<b>Size Category (Input)</b>	<b>Subcategory or Rating Condition</b>	<b>Minimum Efficiency</b>	<b>Test Procedure<sup>a</sup></b>
Warm-air furnace, gas fired <u>for sale outside the US<sup>d</sup></u>	<66 kW	Maximum capacity <sup>c</sup>	<del>78</del> 80% AFUE non-weatherized or 81% AFUE (weatherized) or 80% $E_t$ <sup>b,d</sup>	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, gas fired	≥66 kW h	Maximum capacity <sup>c</sup>	80% $E_t$ <sup>d</sup> before 1/1/2023 81% $E_t$ <sup>d</sup> after 1/1/2023	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, oil fired <u>for sales outside the US<sup>d</sup></u>	<66 kW	Maximum capacity <sup>c</sup>	78% AFUE (weatherized) or 83% AFUE (weatherized)  Or 80% $E_t$ <sup>b,d</sup> $P_{W,SB} \leq 11 W$ $P_{W,OFF} \leq 11 W$	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
Warm-air furnace, oil fired	≥66 kW	Maximum capacity <sup>c</sup>	81% $E_t$ <sup>b,d</sup> before 1/1/2023 82% $E_t$ <sup>d</sup> after 1/1/2023	Section 42, Combustion, UL 727
Electric Furnaces for sale outside US <sup>a</sup>	≤66 kW	all	78% AFUE	Section 42, Combustion, UL 727
Warm-air duct furnaces, gas fired	All capacities	Maximum capacity <sup>c</sup>	80% $E_c$ <sup>e</sup>	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, gas fired	All capacities	Maximum capacity <sup>c</sup>	80% $E_c$ <sup>e,f</sup>	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, oil fired	All capacities	Maximum capacity <sup>c</sup>	80% $E_c$ <sup>e,f</sup>	Section 40, Combustion, UL 731

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.  
 b. Combination units not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (three-phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating. Combination units (i.e., furnaces contained within the same cabinet as an air conditioner) not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (i.e., three-phase power or with cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating. All other units <225 kBtu/h sold in the US must meet the AFUE standards for consumer products and test using DOE's AFUE test procedure at 10 CFR 430 Subpart B Appendix N.  
 c. Compliance of multiple firing rate units shall be at the maximum firing rate.  
 d.  $E_t$  = thermal efficiency. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.  
 e.  $E_c$  = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.  
 f. As of August 8, 2008, according to the Energy Policy Act of 2005, units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper.

g. For US sales of federal covered <225,000 Btu/h products see appendix F table F-4

Add a new table F-4 SI for residential federal covered furnaces

**Table F-4 Residential Warm Air Furnaces – Minimum Efficiency Requirements for sale in the US**  
 (see 10 CFR Part 430)

<b>Product Class</b>	<b>Size Category (input)</b>	<b>Subcategory or rating condition</b>	<b>Minimum Efficiency</b>	<b>Test Procedure</b>
Warm air furnace, gas fired	<66 kW	Non-weatherized excluding mobile home	80% AFUE 10 W P <sub>W,SB</sub> 10 W P <sub>W,OFF</sub>	10 CFR 430.23(n)(2)
		Non-weatherized mobile home	80% AFUE 10 W P <sub>W,SB</sub> 10 W P <sub>W,OFF</sub>	
		Non-weatherized sold in states per note a	90% AFUE 10 W P <sub>W,SB</sub> 10 W P <sub>W,OFF</sub>	
		Weatherized	81 AFUE	
Warm-air furnace oil fired	<66 kW	Non-weatherized excluding mobile home	83 AFUE 11 W P <sub>W,SB</sub> 11 W P <sub>W,OFF</sub>	10 CFR 430.23(n)(2)
		Non-weatherized mobile home	75% AFUE 11 W P <sub>W,SB</sub> 11 W P <sub>W,OFF</sub>	
		Weatherized	78% AFUE	
Electric Furnace	<66 kW	All	78% AFUE 10 W P <sub>W,SB</sub> 10 W P <sub>W,OFF</sub>	10 CFR 430.23(n)(2)

a. Section 12 contains a complete specification of the referenced test procedure.