



**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

**Second Public Review (February 2019)
(Draft Shows Proposed Independent Substantive
Changes to Previous Public Review Draft)**

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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~~ applications will be moved to a new table F-4 in appendix F*

The following is a summary of the ISC Changes

1. *Standardized the wording use for US and Non-US requirements to “US applications” and “applications outside the US”*
2. *Corrected the $P_{w,off}$ and $P_{w,SB}$ for gas fired furnaces in the SI table*
3. *Eliminated in the SI table the equipment subcategory of gas fired warm air furnaces designated “Non-weatherized” to align with DOE requirements and the IP table*
4. *In the IP and SI versions of Table F-4, changed the referenced test procedure from specific sections of 10 CFR 430.23(n) to a broader reference to 10 CFR 430 Appendix N. This broader reference would prevent the 90.1 test procedure reference from needing to change if the section numbering in 10 CFR 430.23 changes in the future.*

5. *Made corrections to footnote c and d in table 6.8.1-5*
6. *The test procedure for <225K Btu/h electric furnaces was changed from UL 727 to DOE 10 CFR Part 430*
7. *The efficiency requirements defined by DOE for electric furnaces was set to 78% which was based on gas furnaces. Electric furnaces are much more efficient than 78% so for applications outside the US the efficiency has been set to 96%*

[Note to Reviewers: This public review draft makes proposed independent substantive changes to the previous public review draft. 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 previous draft 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 substantive changes.]

Addendum BO to 90.1-2016

Make the following changes to the modified 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 ^a
Warm-air furnace, gas fired for application outside the US ^{dg}	<225,000 Btu/h	Maximum capacity ^c	80% AFUE (non-weatherized) or 81% AFUE (weatherized) or 80% E_t ^{b,d}	DOE 10 CFR Part 430 Appendix N or Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, gas fired	≥225,000 Btu/h	Maximum capacity ^c	80% E_t ^{b,d} before 1/1/2023 81% E_t ^d after 1/1/2023	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, oil fired for application outside the US ^{dg}	<225,000 Btu/h	Maximum capacity ^c	83% AFUE (non-weatherized) or 78% AFUE (weatherized) or 80% E_t ^{b,d}	DOE 10 CFR Part 430 Appendix N or Section 42, Combustion, UL 727
Warm-air furnace, oil fired	≥225,000 Btu/h	Maximum capacity ^c	81% E_t ^d before 1/1/2023 82% E_t ^d after 1/1/2023	Section 42, Combustion, UL 727
Electric Furnaces for application outside the US ^{dg}	<225,000 Btu/h	all	78 96% AFUE	Section 42, Combustion, UL 727 DOE 10 CFR Part 430 Appendix N
Warm-air duct furnaces, gas fired	All capacities	Maximum capacity ^c	80% E_c ^e	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, gas fired	All capacities	Maximum capacity ^c	80% E_c ^{e,f}	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, oil fired	All capacities	Maximum capacity ^c	80% E_c ^{e,f}	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 (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 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. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper.

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

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~~ applications (see 10 CFR Part 430)

Product Class	Size Category (input)	Subcategory or rating condition	Minimum Efficiency	Test Procedure ^a
Furnace, gas fired	<225,000 Btu/h	Non-weatherized excluding mobile home	80% AFUE	40 CFR 430.23(n)(2) 10 CFR 430 Appendix N
		Non-weatherized mobile home	80% AFUE	
		Weatherized	81% AFUE	
Furnace oil fired	<225,000 Btu/h	Non-weatherized excluding mobile home	83% AFUE $P_{W,SB} \leq 11 \text{ W}$ $P_{W,OFF} \leq 11 \text{ W}$	40 CFR 430.23(n)(2) and (n)(5) 10 CFR 430 Appendix N
		Non-weatherized mobile home	75% AFUE $P_{W,SB} \leq 11 \text{ W}$ $P_{W,OFF} \leq 11 \text{ W}$	
		Weatherized	78% AFUE	
Electric Furnace	<225,000 Btu/h	All	78% AFUE $P_{W,SB} \leq 10 \text{ W}$ $P_{W,OFF} \leq 10 \text{ W}$	40 CFR 430.23(n)(2) and (n)(5) 10 CFR 430 Appendix N

^a 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

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure^a
Warm-air furnace, gas fired for sale <u>applications outside the US^{d,g}</u>	<66 kW	Maximum capacity ^c	80% AFUE non-weatherized or 81% AFUE (weatherized) or 80% E_t ^{b,d}	DOE 10 CFR Part 430 Appendix N or Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, gas fired	≥66 kW h	Maximum capacity ^e	80% E_t ^d before 1/1/2023 81% E_t ^d after 1/1/2023	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, oil fired for sales <u>applications outside the US^g</u>	<66 kW	Maximum capacity ^c	83% <u>78%</u> AFUE (non-weatherized) or 78% <u>83%</u> AFUE (weatherized) Or 80% E_t ^{b,d}	DOE 10 CFR Part 430 Appendix N or Section 42, Combustion, UL 727
Warm-air furnace, oil fired	≥66 kW	Maximum capacity ^c	81% E_t ^d before 1/1/2023 82% E_t ^d after 1/1/2023	Section 42, Combustion, UL 727
Electric Furnaces for sale <u>applications outside US^g</u>	<66 kW	all	78% <u>96%</u> AFUE	Section 42, Combustion, UL 727 <u>DOE 10 CFR Part 430</u>
Warm-air duct furnaces, gas fired	All capacities	Maximum capacity ^c	80% E_c ^e	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, gas fired	All capacities	Maximum capacity ^c	80% E_c ^{e,f}	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, oil fired	All capacities	Maximum capacity ^c	80% E_c ^{e,f}	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 (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. According to the Energy Policy Act of 2005, units 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 applications 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 applications
 (see 10 CFR Part 430)

Product Class	Size Category (input)	Subcategory or rating condition	Minimum Efficiency	Test Procedure
Warm-air furnace, gas fired	<66 kW	Non-weatherized excluding mobile home	80% AFUE	10 CFR 430.23(n)(2) 10 CFR 430 Appendix N
		Non-weatherized mobile home	80% AFUE	
		Weatherized	81% AFUE	
Warm-air furnace oil fired	<66 kW	Non-weatherized excluding mobile home	83% AFUE $P_{W,SB} \leq 11 \text{ W}$ $P_{W,OFF} \leq 11 \text{ W}$	10 CFR 430.23(n)(2) 10 CFR 430 Appendix N
		Non-weatherized mobile home	75% AFUE $P_{W,SB} \leq 11 \text{ W}$ $P_{W,OFF} \leq 11 \text{ W}$	
		Weatherized	78% AFUE	
Electric Furnace	<66 kW	All	78% AFUE $P_{W,SB} \leq 10 \text{ W}$ $P_{W,OFF} \leq 10 \text{ W}_E$	10 CFR 430.23(n)(2) 10 CFR 430 Appendix N

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