ADDENDA

ANSI/ASHRAE/IES Addendum bx to
ANSI/ASHRAE/IES Standard 90.1-2019

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE and the American National Standards Institute on July 29, 2022, and by the Illuminating Engineering Society on July 26, 2022.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (https://www.ashrae.org/continuous-maintenance).

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FOREWORD

In Addendum bo to Standard 90.1-2016, published as part of ASHRAE Standard 90.1-2019, changes were implemented to update the requirements for warm-air furnace efficiency requirements to align with U.S. Department of Energy (DOE) changes and to separate the requirements for <225,000 Btu/h (66 kW) furnaces that are controlled directly by DOE. Like other changes for DOE-controlled products, the requirements for the DOE-regulated <225,000 Btu/h (66 kW) furnace products were moved to Appendix F in a new Table F-4.

Addendum bx to Standard 90.1-2019 corrects or clarifies several issues in the 2019 table:

- *Requirements for three-phase <225,000 Btu/h (66 kW) products sold in the U.S. that are not covered by DOE were not specified in the current 2019 table.*
- *The table lacked clarity regarding the >65,000 Btu/h (19 kW) cooling capacity combination unit requirements.*
- *For a long time, three-phase products <225,000 Btu/h (66 kW) were allowed to be rated with AFUE or thermal efficiency to permit manufacturers that produce single- and three-phase products to test only the gas section once using a common test procedure. The referenced 10 CFR 430, Appendix N, test and rating procedure scope is limited to single-phase products, which aligns with the DOE definition for a residential furnace, but the phase of the power supply voltage has no impact on the gas section performance and is why Standard 90.1 has used it and proposes to continue to use it in the table. 10 CFR 430 does reference ASHRAE Standard 103-1999, but it also is limited to single- phase products and has been replaced by ASHRAE Standard 103-2017, which is not referenced by 10 CFR 430, Appendix N, and would require different testing procedures.*
- *Z21.47 is utilized for thermal efficiency, but in Canada it is limited to 400,000 Btu/h (117 kW) input, and there is an alternative ANSI Z83.3 that is used.*
- *Table 6.8.1.-5 was reformatted, and minor editorial corrections made for usability.*

This is a technical update for clarification of requirements and has no impact on energy savings and cost effectiveness.

Background Information on Furnace Definitions

Definition of a Furnace in 10 CFR 430

"Furnace" means a product that utilizes only single-phase electric current, or single-phase electric current or DC current in conjunction with natural gas, propane, or home heating oil, and which

a. is designed to be the principal heating source for the living space of a residence;
b. is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu/h;
c. is an electric central furnace, electric boiler, forced-air central furnace, gravity central furnace, or low-pressure steam or hot-water boiler; and
d. has a heat input rate of less than 300,000 Btu/h for electric boilers and low-pressure steam or hot-water boilers and less than 225,000 Btu/h for forced-air central furnaces, gravity central furnaces, and electric central furnaces.

Definition of a Furnace in 10 CFR 431.72

"Commercial warm air furnace" means a warm-air furnace that is industrial equipment and that has a capacity (rated maximum input) of 225,000 Btu/h or more.

"Warm air furnace" means a self-contained oil-fired or gas-fired furnace designed to supply heated air through ducts to spaces that require it and includes combination warm air furnace/ electric air conditioning units but does not include unit heaters and duct furnaces.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum bx to Standard 90.1-2019

Delete existing Table 6.8.1-5 (I-P) as shown, and replace it with the following reformatted and revised table.

~~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 U.S.[g]~~	~~<225,000 Btu/h~~	~~Maximum capacity[e]~~	~~80% *AFUE* (nonweatherized) or 81% *AFUE* (weatherized) or 80% E_t[b,d]~~	~~10 CFR 430 Appendix N or Section 2.39, Thermal *Efficiency*, ANSI Z21.47~~
~~Warm-air furnace, gas fired~~	~~≥225,000 Btu/h~~	~~Maximum capacity[e]~~	~~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 U.S.[g]~~	~~<225,000 Btu/h~~	~~Maximum capacity[e]~~	~~83% *AFUE* (nonweatherized) or 78% *AFUE* (weatherized) or 80% E_t[b,d]~~	~~10 CFR 430 Appendix N or Section 42, Combustion, UL 727~~
~~Warm-air furnace, oil fired~~	~~≥225,000 Btu/h~~	~~Maximum capacity[e]~~	~~81% E_t[d] before 1/1/2023 82% E_t[d] after 1/1/2023~~	~~Section 42, Combustion, UL 727~~
~~Electric furnaces for applications outside the U.S.[g]~~	~~<225,000 Btu/h~~	~~All~~	~~96% *AFUE*~~	~~10 CFR 430 Appendix N~~
~~Warm-air duct furnaces, gas fired~~	~~All capacities~~	~~Maximum capacity[e]~~	~~80% E_e[e]~~	~~Section 2.10, *Efficiency*, ANSI Z83.8~~
~~Warm-air unit heaters, gas fired~~	~~All capacities~~	~~Maximum capacity[e]~~	~~80% E_e[e,f]~~	~~Section 2.10, *Efficiency*, ANSI Z83.8~~
~~Warm-air unit heaters, oil fired~~	~~All capacities~~	~~Maximum capacity[e]~~	~~80% E_e[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 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 greater than 225,000 Btu/h sold in the U.S. must meet the *AFUE* standards for consumer products and test using USDOE'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_e = 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 U.S. applications of federal covered <225,000 Btu/h products, see Informative Appendix F, Table F-4.~~

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								
Description	Fuel	Electric Power Phase	Application Location	Heating Capacity (input), Btu/h[b]	Combo-Unit Cooling Capacity, Btu/h	Subtype	Minimum Efficiency[b]	Test Procedure[a]
Warm-air furnace	Gas	1	Inside U.S.	<225,000	<65,000	See Informative Appendix F, Table F-4[f]		
Warm-air furnace	Gas	1	Inside U.S.	<225,000	≥65,000	Nonweatherized	80% *AFUE*	Appendix N[g]
						Weatherized	81% *AFUE* or	Appendix N[g]
							80% E_t[c]	ANSI Z21.47
Warm-air furnace	Gas	1	Outside U.S.	<225,000	All	Nonweatherized	80% *AFUE*	Appendix N[g]
						Weatherized	81% *AFUE* or	Appendix N[g]
							80% E_t[c]	ANSI Z21.47
Warm-air furnace	Gas	3	All	<225,000	All	Nonweatherized	80% *AFUE*	Appendix N[g]
						Weatherized	81% *AFUE* or	Appendix N[g]
							80% E_t[c]	ANSI Z21.47
Warm-air furnace	Gas	All	All	≥ 225,000 and ≤ 400,000	All	All	80% E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	ANSI Z21.47
Warm-air furnace	Gas	All	Inside U.S.	> 400,000	All	All	80% E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	ANSI Z21.47
Warm-air furnace	Gas	All	Outside U.S.	> 400,000	All	All	80% E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	ANSI Z21.47 or ANSI Z83.8
Warm-air furnace	Oil	1	Inside U.S.	<225,000	<65,000	See Informative Appendix F, Table F-4[f]		
Warm-air furnace	Oil	1	Inside U.S.	<225,000	≥65,000	Nonweatherized	83% *AFUE*	Appendix N[g]
						Weatherized	78% *AFUE* or	Appendix N[g]
							80% E_t[d]	Section 42 UL 727
Warm-air furnace	Oil	1	Outside U.S.	<225,000	All	Nonweatherized	83% *AFUE*	Appendix N[g]
						Weatherized	78% *AFUE* or	Appendix N[g]
							80% E_t[d]	Section 42 UL 727

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. For this table, the following applies:
- Appendix N = 10 CFR 430 Appendix N
- ANSI Z21.47 = Section 2.39, Thermal *Efficiency*, ANSI Z21.47
- ANSI Z83.3 = Section 2.10, *Efficiency*, ANSI Z83.3
- UL 727 = Section 42, Combustion, UL 727
- UL 731 = Section 40, Combustion, UL 731

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

c. 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*.

d. E_c = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.

e. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

f. Includes combination units with cooling capacity <65,000 Btu/h. For U.S. applications of federally covered <225,000 Btu/h products, see Informative Appendix F, Table F-4.

g. 10 CFR 430 is limited to-single phase equipment that is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu/h but for the test and rating procedures are not impacted for three-phase and can be used for *AFUE* ratings for ASHRAE/IES Standard 90.1 three-phase products and single-phase products with a cooling capacity greater than 65,000 Btu/h.

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Warm-air furnace	Oil	3	All	<225,000	All	Nonweatherized	83% *AFUE*	Appendix N[g]
						Weatherized	78% *AFUE* or	Appendix N[g]
							80% E_t[d]	Section 42 UL 727
Warm-air furnace	Oil	All	All	≥225,000	All	All	81% E_t[d] before 1/1/2023 82% E_t[d] after 1/1/2023	Section 42 UL 727
Warm-air furnace	Electric	1	Inside U.S.	<225,000	≤65,000	See Informative Appendix F Table F-4[f]		
Warm-air furnace	Electric	1	Inside U.S.	<225,000	≥65,000	All	96% *AFUE*	Appendix N[g]
Warm-air furnace	Electric	1	Outside U.S.	<225,000	All	All	96% *AFUE*	Appendix N[g]
Warm-air furnace	Electric	3	All	<225,000	All	All	96% *AFUE*	Appendix N[g]
Warm-air duct furnaces	Gas	All	All	All	All	All	80% E_c[d]	ANSI Z83.8
Warm-air unit heaters	Gas	All	All	All	All	All	80% E_c[d,e]	ANSI Z83.8
Warm-air unit heaters	Oil	All	All	All	All	All	80% E_c[d,e]	Section 40 UL 731

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

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d. E_c = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.

e. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

f. Includes combination units with cooling capacity <65,000 Btu/h. For U.S. applications of federally covered <225,000 Btu/h products, see Informative Appendix F, Table F-4.

g. 10 CFR 430 is limited to-single phase equipment that is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu/h but for the test and rating procedures are not impacted for three-phase and can be used for *AFUE* ratings for ASHRAE/IES Standard 90.1 three-phase products and single-phase products with a cooling capacity greater than 65,000 Btu/h.

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~~*Equipment* Type~~	~~Size Category (Input)~~	~~Subcategory or Rating Condition~~	~~Minimum *Efficiency*~~	~~Test Procedure[a]~~
~~Warm-air furnace, gas fired for application outside the U.S.[g]~~	~~<66 *kW*~~	~~Maximum capacity[e]~~	~~80% *AFUE* (nonweatherized) or 81% *AFUE* (weatherized) or 80% E_t[b,d]~~	~~10 CFR 430 Appendix N or Section 2.39, Thermal *Efficiency*, ANSI Z21.47~~
~~Warm-air furnace, gas fired~~	~~≥66 *kW*~~	~~Maximum capacity[e]~~	~~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 U.S.[g]~~	~~<66 *kW*~~	~~Maximum capacity[e]~~	~~83% *AFUE* (nonweatherized) or 78% *AFUE* (weatherized) or 80% E_t[b,d]~~	~~10 CFR 430 Appendix N or Section 42, Combustion, UL 727~~
~~Warm-air furnace, oil fired~~	~~≥66 *kW*~~	~~Maximum capacity[e]~~	~~81% E_t[d] before 1/1/2023 82% E_t[d] after 1/1/2023~~	~~Section 42, Combustion, UL 727~~
~~Electric furnaces for applications outside the U.S.[g]~~	~~<66 *kW*~~	~~All~~	~~96% *AFUE*~~	~~10 CFR 430 Appendix N~~
~~Warm-air duct furnaces, gas fired~~	~~All capacities~~	~~Maximum capacity[e]~~	~~80% E_e[e]~~	~~Section 2.10, *Efficiency*, ANSI Z83.8~~
~~Warm-air unit heaters, gas fired~~	~~All capacities~~	~~Maximum capacity[e]~~	~~80% E_e[e,f]~~	~~Section 2.10, *Efficiency*, ANSI Z83.8~~
~~Warm-air unit heaters, oil fired~~	~~All capacities~~	~~Maximum capacity[e]~~	~~80% E_e[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 10 CFR 430 (i.e., three-phase power or with cooling capacity greater than or equal to 19 *kW*) may comply with either rating. All other units greater than 66 *kW* sold in the U.S. must meet the *AFUE* standards for consumer products and test using USDOE's *AFUE* test procedure at 10 CFR 430, Subpart B, Appendix N.~~

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~~e. E_e = 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 U.S. applications of federal covered <66 kW products, see Informative Appendix F, Table F-4.~~

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								
Description	Fuel	Electric Power Phase	Application Location	Heating Capacity (input), kW[b]	Combo-Unit Cooling Capacity, kW	Subtype	Minimum Efficiency[b]	Test Procedure[a]
Warm-air furnace	Gas	1	Inside U.S.	<66	<19	See Informative Appendix F Table F-4[f]		
Warm-air furnace	Gas	1	Inside U.S.	<66	≥19	Nonweatherized	80% *AFUE*	Appendix N[g]
						Weatherized	81% *AFUE* or	Appendix N[g]
							80% E_t[c]	ANSI Z21.47
Warm-air furnace	Gas	1	Outside U.S.	<66	All	Nonweatherized	80% *AFUE*	Appendix N[g]
						Weatherized	81% *AFUE* or	Appendix N[g]
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Warm-air furnace	Gas	3	All	<66	All	Nonweatherized	80% *AFUE*	Appendix N[g]
						Weatherized	81% *AFUE* or	Appendix N[g]
							80% E_t[c]	ANSI Z21.47
Warm-air furnace	Gas	All	All	≥ 66 and < 117	All	All	80% E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	ANSI Z21.47
Warm-air furnace	Gas	All	Inside U.S.	> 117	All	All	80% E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	ANSI Z21.47
Warm-air furnace	Gas	All	Outside U.S.	> 117	All	All	80% E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	ANSI Z21.47 or ANSI Z83.8
Warm-air furnace	Oil	1	Inside U.S.	<66	<19	See Informative Appendix F Table F-4[f]		
Warm-air furnace	Oil	1	Inside U.S.	<66	≥19	Nonweatherized	83% *AFUE*	Appendix N[g]
						Weatherized	78% *AFUE* or	Appendix N[g]
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Warm-air furnace	Oil	1	Outside U.S.	<66	All	Nonweatherized	83% *AFUE*	Appendix N[g]
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a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. For this table, the following applies:
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- UL 731 = Section 40, Combustion, UL 731

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

c. 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*.

d. E_c = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.

e. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

f. Includes combination units with cooling capacity <19 kW. For U.S. applications of federally covered <66 kW products, see Informative Appendix F, Table F-4.

g. 10 CFR 430 is limited to single-phase equipment that is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 19 kW but for the test and rating procedures are not impacted for three-phase and can be used for *AFUE* ratings for ASHRAE/IES Standard 90.1 three-phase products and single-phase products with a cooling capacity greater than 19 kW.

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Warm-air furnace	Oil	All	All	≥66	All	All	81% E_t[d] before 1/1/2023 82% E_t[d] after 1/1/2023	Section 42 UL 727
Warm-air furnace	Electric	1	Inside U.S.	<66	<19	See Informative Appendix F Table F-4[f]		
Warm-air furnace	Electric	1	Inside U.S.	<66	≥19	All	96% *AFUE*	Appendix N[g]
Warm-air furnace	Electric	1	Outside U.S.	<66	All	All	96% *AFUE*	Appendix N[g]
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Warm-air duct furnaces	Gas	All	All	All	All	All	80% E_c[d]	ANSI Z83.8
Warm-air unit heaters	Gas	All	All	All	All	All	80% E_c[d,e]	ANSI Z83.8
Warm-air unit heaters	Oil	All	All	All	All	All	80% E_c[d,e]	Section 40 UL 731

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- UL 731 = Section 40, Combustion, UL 731

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

c. 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*.

d. E_c = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.

e. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

f. Includes combination units with cooling capacity <19 kW. For U.S. applications of federally covered <66 kW products, see Informative Appendix F, Table F-4.

g. 10 CFR 430 is limited to single-phase equipment that is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 19 kW but for the test and rating procedures are not impacted for three-phase and can be used for *AFUE* ratings for ASHRAE/IES Standard 90.1 three-phase products and single-phase products with a cooling capacity greater than 19 kW.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

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