ERRATA SHEET FOR
ANSI/ASHRAE/IES STANDARD 90.1-2010 (I-P edition)
Energy Standard for Buildings Except Low-Rise Residential Buildings

April 9, 2025

The corrections listed in this errata sheet apply to ANSI/ASHRAE/IES Standard 90.1-2010, I-P edition. The first printing is identified on the outside back cover of the standard as "Product Code: 86267 10/10", the second printing as "Product code: 86267 6/11 *Errata noted in the list dated 4/14/11 have been corrected.*", the third printing as "Product Code: 86276 7/12 *Errata noted in the list dated 4/2/12 have been corrected."* , and the fourth printing as "Product code: 86267 8/13 *Errata noted in the list dated 4/17/13 have been corrected."* The shaded items have been added since the previously published errata sheet dated March 18, 2019 was distributed. Highlighted items apply only to the first printing and have already been incorporated into the second printing (included in 4/14/2011 errata). Items identified with an asterisk "*" apply to both the first and second printing. Items identified with two asterisk "**" apply only to the first printing. Items identified with three asterisks "***" apply only to the second printing. Items identified with four asterisks "****" apply to the first, second and third printing of the standard.

NOTICE: ASHRAE now has a list server for Standing Standards Project Committee 90.1 (SSPC 90.1). Interested parties can now subscribe and unsubscribe to the list server and be automatically notified via e-mail when activities and information related to the Standard and the User's Manual is available. To sign up for the list server please visit **Project Committee List Servers for Standard** on the Technology / Standards section of the ASHRAE website at http://www.ashrae.org/resources--publications/periodicals/listserves.

Page(s)	Erratum
Table of Contents**	**Contents.** Change "Informative Appendix G" to "Normative Appendix G".
9*	**3.2 Definitions.** In the definition of ***essential facility***, second column on page 9 immediately following "8. Buildings and other structures having critical national defense functions.", delete the sentence "Buildings and other structures having critical national defense functions." This sentence is a duplicate of item 8 under the definition of ***essential facility***.
12	**3.2 Definitions.** Change the definition of ***multiscene control:*** to ***multi-scene control:***.
13	**3.2 Definitions.** In the definition of ***primary sidelighted area***, in the 2nd item number 1, change window "heat" height to window "head" height.
15	**3.2 Definitions.** In the definition of ***room cavity ration (RCR)*** delete "...as follows:" from the end of the definition.
29*	**TABLE 5.5-4 Building Envelope Requirements for Climate Zone 4 (A, B, C).** In Table 5.5-4, for *Opaque Doors*, Nonswinging, Nonresidential, change the Assembly Maximum from "U-1.500" to "U-0.500".
34	**5.5.3.1.1 Roof Solar Reflectance and Thermal Emittance.** In Section 5.5.3.1.1b change the convection coefficient from "2.1 BTU/h·ft^2" to "2.1 BTU/h·ft^2·°F".

35* **5.5.4.2.3 Minimum Skylight Fenestration Area.** In Section 5.5.4.2.3 Exception f change "Section 9.4.1.3" to "Section 9.4.1.4" in two (2) places.

35* **5.5.4.4 Fenestration Solar Heat Gain Coefficient (SHGC).** In the title of Section 5.5.4.4 delete the "a" in front of "aGain".

36 **5.5.4.4.2 SHGC of Skylights.** Change exception d to Section 5.5.4.4.2 as shown below.
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

d. For *dynamic glazing*, the minimum SHGC shall be used to demonstrate compliance with this section. *Dynamic glazing* shall be considered separately from other skylights ~~*vertical fenestration*~~, and area-weighted averaging with other skylights ~~*vertical fenestration*~~ that is not *dynamic glazing* shall not be permitted.

45* **6.4.4.2.2 Duct Leakage Tests.** In the first sentence of Section 6.4.4.2.2 change "750 Pa" to "3 in. w.c.". For the term "C_L" change "250 in. w.c." to "1 in. w.c." **Note: This erratum applies only to the second printing.**

45 **6.4.4.2.2 Duct Leakage Tests.** Correct the equation in Section 6.4.4.2.2 as shown below.
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

$$L_{max} = C_L P^{0.65}$$

where

L_{max} = maximum permitted leakage, cfm~~/~~ per 100 ft^2 of duct surface area

C_L = 4~~6~~, duct leakage class, cfm~~/~~ per 100 ft^2 of duct surface area ~~at 1~~per in. of water$^{0.65}$

P = test pressure, which shall be equal to the design duct pressure class rating, in. of water

50 **TABLE 6.5.3.1.1.B Fan Powered Limitation Pressure Drop Adjustment.** For the Energy Recovery Device, other than Coil Runaround Loop, replace the dash "—" in the Adjustment equation with a minus "-" sign so it reads as follows:

(2.2 x Energy Recovery Effectiveness) - 0.5 in w.c. for each airstream

53 **TABLE 6.5.6.1.** Change the title of Table 6.5.6.1 as follows:
(Note: Additions are shown in underline)

TABLE 6.5.6.1 Exhaust Air Energy Recovery Requirements

56 **TABLE 6.8.1A.** The following was removed from Table 6.8.1A by Addendum f to 90.1-2004 and was corrected in 90.1-2007 by a 3/12/2008 erratum and should not be included in 90.1-2010. (*Note: Deletions shown in ~~strikethrough~~.*)

~~Small duct high velocity, (air cooled)~~	~~<65,000 Btu/h[e]~~	~~All~~	~~Split system~~	~~10.0 SEER~~

56** **TABLE 6.8.1A.** In Table 6.8.1A for Air conditioners, water cooled ≥ 65,000 Btu/h and < 135, 000 Btu/h, Electric resistance (or none), change "12.1 EER (as of 6/1/2001)" to "12.1 EER (as of 6/1/2011)." **Note: This erratum applies only to the first printing.**

58 **TABLE 6.8.1B Electrically Operated Unitary and Applied Heat Pumps – Minimum Efficiency Requirements.** See attached corrections to Table 6.8.1B (in red text).
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

60 **TABLE 6.8.1C Water Chilling Packages – Efficiency Requirements.** Replace Table 6.8.1C with the attached corrected Table 6.8.1C.

60* ** **TABLE 6.8.1C Water Chilling Packages– Efficiency Requirements.** For Equipment Type – Water-cooled, electrically operated, centrifugal: change "≤ 150 tons" to "< 150 tons" and change "≥0.634" to "≤0.634". **Note: This erratum applies only to the second printing.**

62** ** **TABLE 6.8.1D Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air-Conditioner Heat Pumps – Minimum Efficiency Requirements (*continued*).** In the fourth column titled "Test Procedure" change the superscript from "d" to "a" as shown below. Delete duplicate footnote "d" (same as footnote "a").

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[~~d~~a]

[a] Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
[b] Nonstandard size units must be factory *labeled* as follows: "MANUFACTURED FOR NONSTANDARD SIZE APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW STANDARD PROJECTS." Nonstandard size efficiencies apply only to units being installed in existing sleeves having an external *wall* opening of less than 16 in. high or less than 42 in. wide and having a cross-sectional area less than 670 $in.^2$.
[c] *Cap* means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.
~~[d] Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~

70** ** **Section 7.4.3 Service Hot-Water Piping Insulation.** In Section 7.4.3 change "Table 6.8.3" to "Table 6.8.3A".

75 **9.1.3 Installed Lighting Power.** In Section 9.1.3 change the reference to Section "9.4.5" to Section "9.4.3".

76 **9.4.1 Lighting Control.** In the second paragraph of Section 9.4.1 change the reference to "9.4.1.4" to "9.4.1.6" so it now reads as follows:

9.4.1 Lighting Control. Building *controls* shall meet the provisions of 9.4.1.1, 9.4.1.2, 9.4.1.3, 9.4.1.4, 9.4.1.5, 9.4.1.6, and 9.4.1.7.

Any *automatic control device* required in sections 9.4.1.1, 9.4.1.2, and 9.4.1.6 shall either

be *manual* on or shall be controlled to automatically turn the lighting on to not more than 50% power, except in the following *spaces* where full automatic-on is allowed;…

84 **TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method *(continued)*.** In the second column of Table 9.6.1, under Retail Sales Area, change the reference from "Section 9.6.3(c)" to "Section 9.6.2(b)."

92 **TABLE 11.3.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget.**
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

Table 11.3.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Proposed Design (Column A) Design Energy Cost (DEC)

1. Design Model

…

b. All conditioned spaces in the proposed design shall be simulated as being both heated and cooled, even if no cooling or heating system is being installed. Temperature and humidity control set points and schedules, as well as temperature control throttling range, shall be the same for *proposed* and ~~*baseline building designs*~~ *budget building designs*.
…

Table 11.3.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Budget Building Design (Column B) Energy Cost Budget (ECB)

11. Service Water Heating

…
Exceptions
… c. For 24-hour facilities that meet the prescriptive criteria for use of condenser heat recovery systems described in Section 6.5.6.2, a system meeting the requirements of that section shall be included in the ~~*baseline building design*~~ *budget building design*, regardless of the exceptions to Section 6.5.6.2. If a condenser heat recovery system meeting the requirements described in Section 6.5.6.2 cannot be modeled, the requirement for including such a system in the actual building shall be met as a prescriptive requirement in accordance with Section 6.5.6.2 and no heat recovery system shall be included in the proposed design or *budget building design*.

96 **11.3.2 HVAC Systems.**
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

11.3.2 HVAC Systems

…

i.…Unmet load hours for the proposed design or ~~*baseline building designs*~~ *budget building design* shall not exceed 300. The unmet load hours for the proposed design shall not exceed

the unmet load hours for the budget building design. Alternatively, unmet load hours exceeding approved by the building official, provided that sufficient justification is given indicating that the accuracy of the simulation is not significantly compromised by these unmet loads.

…

k. Kitchen Exhaust. For kitchens with a total exhaust hood airflow rate greater than 5000 cfm, use a demand ventilation system on 75% of the exhaust air. The system shall reduce exhaust and replacement air system airflow rates by 50% for one half of the kitchen occupied hours in the ~~baseline design~~ *budget building design*. If the proposed design uses demand ventilation, the same airflow rate schedule shall be used. The maximum exhaust flow rate allowed for the hood or hood section shall meet the requirements of Section 6.5.7.1.3 for the numbers and types of hoods and appliances provided in the proposed design.

146**** **C5. MODELING ASSUMPTIONS.** Revise the text of Section C5 as shown below:
(Note: Additions are shown in underline.)

The following are modeling assumptions for the purposes of this appendix only and are not requirements for building operation.

199* **Informative Appendix E Informative References.** In the first paragraph of Informative Appendix E change the reference to "90.1-2007" to "90.1-2010".

209**** **Normative Appendix G Performance Rating Method.** Correct the note immediately preceding Normative Appendix G as shown below.
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

~~(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)~~

(This is a normative appendix and is part of this standard).

213 **TABLE G 3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance *(continued).*** For No. 5 Building Envelope, under the Baseline Building Performance column, make the following corrections:
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

d. **Skylights and Glazed Smoke Vents.** Skylight area shall be equal to that in the proposed building design or 5% of the gross roof area that is part of the *building envelope*, whichever is smaller. If the skylight area of the proposed building design is greater than 5% of the gross roof area, baseline skylight area shall be decreased by an identical percentage in all roof components in which skylights are located to reach the 5% skylight-to-roof ratio. Skylight orientation and tilt shall be the same as in the proposed building design. Skylight U-factor and SHGC properties shall match the appropriate requirements in Tables 5.5-1 through 5.5-8.

~~d.~~e. **Roof Solar *Reflectance* and Thermal *Emittance*.** The exterior *roof* surfaces shall be modeled with a solar *reflectance* and thermal *emittance* as required in Section 5.5.3.1.1(a).

All other roofs, including *roofs* exempted from the requirements in Section 5.5.3.1.1, shall be modeled using a solar *reflectance* of 0.30 and a thermal *emittance* of 0.90.

~~e. **Roof albedo.** All roof surfaces shall be modeled with a reflectivity of 0.30.~~

f. **Existing Buildings.** For existing *building envelopes*, the *baseline building design* shall reflect existing conditions prior to any revisions that are part of the scope of work being evaluated.

216* **TABLE G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance.** In item No. 11 Service Hot-Water Systems, under the Baseline Building Performance column, condition i, Exception 3, in the first sentence change "usuage" to "usage".

218** **TABLE G3.1.1.B Baseline System Descriptions.** For System No. 6 and No. 7 change the System Type as follows: **Note that this change applies only to the first printing.**
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

TABLE G3.1.1B Baseline System Descriptions

System No.	System Type	Fan Control	Cooling Type	Heating Type
6. Packaged VAV with PFP Boxes	Packaged rooftop VAV with parallel fan power boxes and reheat	VAV	Direct expansion	Electric resistance
7. VAV with Reheat	~~Packaged rooftop~~ VAV with reheat	VAV	Chilled water	Hot-water fossil fuel boiler

218*** **TABLE G3.1.1.B Baseline System Descriptions.** For System No. 6 and No. 7 change the System Type as follows: **Note that this change applies only to the second printing.**
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

TABLE G3.1.1B Baseline System Descriptions

System No.	System Type	Fan Control	Cooling Type	Heating Type
6. Packaged VAV with PFP Boxes	Packaged rooftop VAV with parallel fan power boxes and reheat	VAV	Direct expansion	Electric resistance
7. VAV with Reheat	~~Packaged rooftop~~ VAV with reheat	VAV	Chilled water	Hot-water fossil fuel boiler

220 **G3.1.2.11 Exhaust Air Energy Recovery.** Revise Section G3.1.2.11 as shown below.
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

G3.1.2.11 Exhaust Air Energy Recovery. Exhaust air energy recovery shall be modeled for the ~~*budget building design*~~ *baseline building design* in accordance with Section 6.5.6.1.

TABLE 6.8.1 B Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air cooled (cooling mode)	<65,000 Btu/h[c]	All	Split System	13.0 SEER	AHRI 210/240
			Single Packaged	13.0 SEER	
Through-the-wall, (air cooled, cooling mode)	≤30,000 Btu/h[c]	All	Split System	~~13.0~~ 12.0 SEER	
			Single Packaged	~~13.0~~ 12.0 SEER	
~~Small-duct high-velocity (air cooled)~~	~~<65,000 Btu/h[c]~~	~~All~~	~~Split System~~	~~10.0 SEER~~	
Air Cooled (Cooling Mode)	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.2 IEER	AHRI 340/360
		All other	Split System and Single Package	10.8 EER 11.0 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.6 EER 10.7 IEER	
		All other	Split System and Single Package	10.4 EER 10.5 IEER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER 9.6 IEER	
		All other	Split System and Single Package	9.3 EER 9.4 IEER	
Water source (cooling mode)	<17,000 Btu/h	All	86 °F entering water	11.2 EER	ISO 13256-1
	≥17,000 Btu/h and <65,000 Btu/h	All	86 °F entering water	12.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	86 °F entering water	12.0 EER	
Groundwater source (cooling mode)	<135,000 Btu/h	All	59 °F entering water	16.2 EER	
		~~All~~	~~77 F entering water~~	~~13.4 EER~~	
Ground source (cooling mode)	<135,000 Btu/h	All	77 F entering water	13.4 EER	
~~Water source water-to-water (cooling mode)~~	~~<135,000 Btu/h~~	~~All~~	~~86 °F entering water~~	~~10.6 EER~~	~~ISO 13256-2~~
			~~59 °F entering water~~	~~16.3 EER~~	
~~Ground source Brine-to-water (cooling mode)~~	~~<135,000 Btu/h~~	~~All~~	~~77 °F entering water~~	~~12.1 EER~~	

TABLE 6.8.1 B Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements *(continued)*

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Water source water to water (cooling mode)	<135,000 Btu/h	All	86 °F entering water	10.6 EER	ISO-13256-2
Groundwater source water to water (Cooling Mode)	<135,000 Btu/h	All	59 °F entering water	16.3 EER	
Ground source Brine to water (cooling mode)	<135,000 Btu/h	All	77 °F entering water	12.1 EER	
Air cooled (heating mode)	<65,000 Btu/h[c]	–	Split System	7.7 HSPF	AHRI 210/240
		–	Single Package	7.7 HSPF	
Through-the-wall, (air cooled, heating mode)	≤30,000 Btu/h[c] (cooling capacity)	–	Split System	7.4 HSPF	
		–	Single Package	7.4 HSPF	
Air Cooled (Heating Mode)	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	–	47ºF db/43ºF wb Outdoor Air	3.3 COP	AHRI 340/360
			17ºF db/15ºF wb Outdoor Air	2.25 COP	
	≥135,000 Btu/h (Cooling Capacity)	–	47ºF db/43ºF wb Outdoor Air	3.2 COP	
			17ºF db/15ºF wb Outdoor Air	2.05 COP	
Water source (heating mode)	<135,000 Btu/h (cooling capacity)	–	68 °F entering water	4.2 COP	ISO 13256-1
Ground water source (heating mode)	<135,000 Btu/h (cooling capacity)	–	50 °F entering water	3.6 COP	
Ground source (heating mode)	<135,000 Btu/h (cooling capacity)	–	32 °F entering fluid	3.1 COP	
Water-source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	–	68 °F entering water	3.7 COP	ISO 13256-2
		–	~~50 °F entering water~~	~~3.1 COP~~	
Groundwater source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	–	50 °F entering water	3.1 COP	
Ground source brine to water (heating mode)	<135,000 Btu/h (cooling capacity)	–	32 °F entering fluid	2.5 COP	

[a] IPLV and part load rating conditions are only applicable to equipment with capacity modulation.

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

[c] Single phase, air cooled air conditioners <65,000 Btu/hr are regulated by NAECA, SEER valves are those set by NAECA.

TABLE 6.8.1C Water Chilling Packages—Efficiency Requirements[a]

Equipment Type	Size Category	Units	Path A		Path B		Test Procedure[b]
			Full Load	IPLV	Full Load	IPLV	
Air-Cooled Chillers	< 150 tons	EER	≥9.562	≥12.500	NA[d]	NA[d]	AHRI 550/590
	≥ 150 tons	EER	≥9.562	≥12.750	NA[d]	NA[d]	
Air-Cooled without Condenser, Electrical Operated	All Capacities	EER	Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller *efficiency* requirements.				
Water Cooled, Electrically Operated, Reciprocating	All Capacities	kW/ton	Reciprocating units must comply with water-cooled positive displacement *efficiency* requirements.				
Water Cooled, Electrically Operated, Positive Displacement	< 75 tons	kW/ton	≤0.780	≤0.630	≤0.800	≤0.600	
	≥ 75 tons and < 150 tons	kW/ton	≤0.775	≤0.615	≤0.790	≤0.586	
	≥ 150 tons and < 300 tons	kW/ton	≤0.680	≤0.580	≤0.718	≤0.540	
	≥ 300 tons	kW/ton	≤0.620	≤0.540	≤0.639	≤0.490	
Water Cooled, Electrically Operated, Centrifugal	< 150 tons	kW/ton	≤0.634	≤0.596	≤0.639	≤0.450	
	≥ 150 tons and < 300 tons	kW/ton	≤0.634	≤0.596	≤0.639	≤0.450	
	≥ 300 tons and < 600 tons	kW/ton	≤0.576	≤0.549	≤0.600	≤0.400	
	≥ 600 tons	kW/ton	≤0.570	≤0.539	≤0.590	≤0.400	
Air Cooled Absorption Single Effect	All Capacities	COP	≥0.600	NR[e]	NA[d]	NA[d]	AHRI 560
Water-Cooled Absorption Single Effect	All Capacities	COP	≥0.700	NR[e]	NA[d]	NA[d]	
Absorption Double Effect Indirect-Fired	All Capacities	COP	≥1.000	≥1.050	NA[d]	NA[d]	
Absorption Double Effect Direct-Fired	All Capacities	COP	≥1.000	≥1.000	NA[d]	NA[d]	

[a] The centrifugal chiller *equipment* requirements after adjustment per 6.4.1.2 do not apply to chillers where the design leaving evaporator temperature is < 36°F. The requirements do not apply to positive displacement chillers with design leaving fluid temperatures ≤ 32°F. The requirements do not apply to absorption chillers with design leaving fluid temperatures < 40°F.

[b] Compliance with this standard can be obtained by meeting the minimum requirements of Path A or Path B. However, both the full load and *IPLV* must be met to fulfill the requirements of Path A or Path B.

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

[d] *NA* means that this requirement is not applicable and cannot be used for compliance.

[e] *NR* means that there are no minimum requirements for this category.