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

March 18, 2019

The corrections listed in this errata sheet apply to ANSI/ASHRAE/IES Standard 90.1-2010, SI edition. The first printing is identified on the outside back cover of the standard as "Product Code: 86269 4/11", the second printing is identified as "Product Code: 86269 8/11 *Errata noted in the list dated 07/20/2011 have been corrected.*", the third printing is identified as "3/12", and the fourth printing is identified as "10/13". Shaded items have been added since the previously published errata sheet dated July 26, 2018 was distributed. Items identified with an asterisk "*" apply only to the first printing and have already been incorporated into the second printing (included in 7/20/2011 errata). The item highlighted in yellow applies only to the third (3/12) and fourth (10/13) printings and are correct in the other printings 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***.
24	**5.4.3.1.3 Acceptable Material and Assemblies.** In the first sentence of Section 5.4.3.1.3a change "0.2 L/s·m^2" to "0.02 L/s·m^2".
24	**5.4.3.1.3 Acceptable Material and Assemblies.** In Section 5.4.3.1.3a and 5.4.3.1.3b delete the redundant text as shown below. *(Note: Deletions are shown in ~~strikethrough~~.)* **5.4.3.1.3 Acceptable Materials and Assemblies.** […] a. Materials that have an air permeance not exceeding 0.02 L/s·m^2 under a pressure differential of ~~0.02 L/s·m^2 at~~ 75 Pa when tested in accordance with ASTM E2178. The following materials meet these requirements: […] b. Assemblies of materials and components (sealants, tapes, etc.) that have an average air leakage not to exceed 0.2 L/s·m^2 under a pressure differential of ~~0.2 L/s·m^2 at~~ 75 Pa when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680, or ASTM E283. The following

assemblies meet these requirements:
[…]

24 **5.4.3.1.3 Acceptable Materials and Assemblies.** In the first sentence of Section 5.4.3.1.3b change "0.02 L/s·m^2" to "0.2 L/s·m^2".

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.

41 **6.4.1.2.1 Water-cooled centrifugal chilling packages.** Change the calculation for Adjusted NPLV in the example in Section 6.4.1.2.1 as follows:
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

Adjusted NPLV = 6.525 x 0.9282 x 1.0009 = 6.062 ~~5.53~~ COP

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~~.)

$$L_{max} = C_L(P^{0.65}/1000)$$

where

L_{max} = maximum permitted leakage, L/s·per m^2 of duct surface area

C_L = ~~6~~ 0.00563, duct leakage class, L/s·per m^2 of duct surface area ~~at 250~~per Pa$^{0.65}$

P = test pressure, which shall be equal to the design duct pressure class rating, Pa

52 **TABLE 6.5.4.5 Piping System Design Maximum Flow Rate in L/s.** Change "1" L/s to "11" L/s for Nominal Pipe Size 90 mm in column 2 (≤2000 Hours/Yr, Other).

61 **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.** In the first and third rows of Table 6.8.1D, in the column titled Minimum Efficiency, replace "EER" with "COP_c" as shown below.
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
PTAC (cooling mode) standard size	All capacities	35.0°Cdb outdoor air	3.66 – (0.213 × Cap/1000)^c COP_c (before 10/08/2012) 4.04 – (0.300 × Cap/1000)^c COP_c ~~EER~~ (as of 10/08/2012)	AHRI 310/380
PTHP (cooling mode) standard size	All capacities	35.0°C db outdoor air	3.60 – (0.213 × Cap/1000)^c COP_c (before 10/08/2012) 4.10 – (0.300 × Cap/1000)^c COP_c ~~EER~~ (as of 10/08/2012)	AHRI 310/380

61 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 –

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
PTAC (cooling mode) standard size	All capacities	35.0°Cdb outdoor air	3.66 – (0.213 × Cap/1000)[c] COP_c (before 10/08/2012) 4.04 – (0.300 × Cap/1000)[c] COP_c (as of 10/08/2012)	AHRI 310/380
PTAC (cooling mode) nonstandard size[b]	All capacities	35.0°C db outdoor air	3.19 – (0.213 × Cap/1000)[c] COPc	
PTHP (cooling mode) standard size	All capacities	35.0°C db outdoor air	3.60 – (0.213 × Cap/1000)[c] COP_c (before 10/08/2012) 4.10 – (0.300 × Cap/1000)[c] COP_c (as of 10/08/2012)	
PTHP (cooling mode) nonstandard size[b]	All capacities	35.0°C db outdoor air	3.16 – (0.213 × Cap/1000)[c] COPc	
PTHP (heating mode) standard size	All capacities	--	3.2 – (0.026 × Cap/1000)[c] COP_H (before 10/08/2012) 3.7 – (0.052 × Cap/1000)[c] COP_H (as of 10/08/2012)	
PTHP (heating mode) nonstandard size[b]	All capacities	--	2.9 – (0.026 × Cap/1000)[c] COP_H	

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").

(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

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.~~

69 **Table 6.8.3B Minimum Piping Insulation Thickness Cooling Systems (Chilled Water, Brine, and Refrigerant).** Change the insulation thickness requirement from "15 mm" to "13 mm" in three places.

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".

72 **TABLE 7.8 Performance Requirements for Water Heating Equipment.**
The 2010 SI edition of Standard 90.1 incorrectly included the I-P version of Table 7.8. See Table 7.8 for changes (attached). Table changed to reflect SI units.
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

79 **Table 9.4.3B Individual Lighting Power Allowance for Building Exteriors.** For Nontradable Surfaces, Building facades, change "66 W/linear meter for each illuminated wall or surface length" to "8.2 W/linear meter for each illuminated wall or surface length".

83 **TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method.** In the first column on Table 9.6.1 change the space type as follows:
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

Common Space Types[a]	**LPD, W/m²**	**RCR Threshold**
Atrium		
First 13 m height	1.059 ~~0.10~~ per m (height)	NA
Height above 13 m	0.706 ~~0.07~~ per m (height)	NA

83 **TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method.** In the second column of Table 9.6.1 on page 83 change the column heading from "**LPD W/ft²**" to "**LPD W/m²**".

83 **TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method.** In the second column of Table 9.6.1 on page 83, under Building – Specific Space Types: Hospital – Corridor/Transition, change "Width < 8 ft" to "Width < 2.4 m".

84 **TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method.** In the first and second columns of Table 9.6.1 on page 84 change column headings from "**LPD W/ft²**" to "**LPD W/m²**".

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)."

84 **TABLE 9.6.1 Lighting Power Densities Using the Space-by-Space Method.** In the second column of Table 9.6.1 on page 84 under the space type "Sports Arena" add the following:
(Note: Additions are shown in underline.)

Building - Specific Space Types	LPD W/m²	RCR Threshold
Sports Arena		
Audience Seating	4.6	4
Court Sports Arena – Class 4	7.8	4
Court Sports Arena – Class 3	12.9	4
Court Sports Arena – Class 2	20.7	4
Court Sports Arena – Class 1	32.4	4
Ring Sports Arena	28.8	4

112 **Table A3.1C Assembly U-Factors, C-Factors, *Ru, Rc*, and *HC* for Concrete Block Walls (*Continued*).** In Table A3.1C for 200 mm block, Density 1,680 kg/m³, Partly Grouted, Cells Empty, change *HC* from "0.8" to "208".

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).

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: 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

219-220 **G3.1.2.10 System Fan Power.** Change the equations in Section G3.1.2.10 as follows:
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

G3.1.2.10 System Fan Power. *System* fan electrical power for supply, return, exhaust, and relief (excluding power to fan-powered VAV boxes) shall be calculated using the following formulas:

For Systems 1 and 2,

$P_{fan} = CFMs \times 0.64$ ~~0.3~~

For systems 3 through 8,

P_{fan} = input kW_i ~~× 746~~ / Fan Motor Efficiency

Efficiency For systems 9 and 10 (supply fan),

$P_{fan} = CFMs \times 0.64$ ~~0.3~~

For Systems 9 and 10 (*non-mechanical cooling* fan if required by Section G3.1.2.8.2)

$P_{fan} = CFM_{nmc} \times 0.114$ ~~0.054~~

where

P_{fan} = electric power to fan motor (watts)

and

input kW_i = input kilowatts of baseline fan motor from Table G3.1.2.9

Fan Motor Efficiency = the efficiency from Table 10.8B for the next motor size greater than the input kW using a totally enclosed fan cooled motor at 1800 rpm.

CFMs = the baseline *system* maximum design supply fan airflow rate in L/s

CFM_{nmc} = the baseline non-*mechanical cooling* fan airflow in L/s

220* **TABLE G3.1.3.7 Type and Number of Chillers.** Revise Table G3.1.3.7 as follows:
(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)

TABLE G3.1.3.7 Type and Number of Chillers

Building Peak Cooling Load	Number and Type of Chiller(s)
≤ 1055 kW ~~£11,148 m²~~	1 water-cooled screw chiller
> 1055 kW ~~11,148 m²~~ , < 2110 kW ~~22,296 m²~~	2 water-cooled screw chillers sized equally
≥ 2110 kW ~~³22,296 m²~~	2 water-cooled centrifugal chillers minimum with chillers added so that no chiller is larger than 2813 kW, a l sized equally

Table 7.8
Performance Requirements for Water Heating Equipment

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	0.93 - ~~0.00132~~ 0.00035V EF	DOE 10 CFR Part 430
Electric water heaters	≤ 12 kW	Resistance ≥75.7 L	0.97- ~~0.00132~~ 0.00035V EF	DOE 10 CFR Part 430
	>12 kW	Resistance≥75.7 L	~~20 + 35~~ 5.9 + 5.3 $\sqrt{V}$ SL, W	Section G.2 of ANSI Z21.10.3
	≤ 24 Amps and ≤ 250 Volts	Heat Pump	0.93- ~~0.00132~~ 0.00035V EF	DOE 10 CFR Part 430
Gas storage water heaters	≤ 22.98 kW	≥75.7 L	0.67- ~~0.00190~~0.0005V EF	DOE 10 CFR Part 430
	>22.98 kW	<309.75 W/L	80% E_t (Q/~~800 + 110~~799 + 16.6 $\sqrt{V}$) SL, W	Sections G.1 and G.2 of ANSI Z21.10.3
Gas instantaneous water heaters	>14.66 kW and <58.62 kW	≥309.75 W/L and <7.57 L	0.62- ~~0.00190~~0.0005V EF	DOE 10 CFR Part 430
	≥58.62 kW[d]	≥309.75 W/L and <37.85	80% E_t	Sections G.1 and G.2 of ANSI Z21.10.3
	≥58.62 kW	≥309.75 W/L and ≥37.85	80% E_t (Q/~~800 + 110~~799 + 16.6 $\sqrt{V}$) SL, W	
Oil storage water heaters	≤ 30.78 kW	≥75.7 L	0.59- ~~0.00190~~0.0005V EF	DOE 10 CFR Part 430
	>30.78 kW	<309.75 W/L	78% E_t (Q/~~800 + 110~~799 + 16.6 $\sqrt{V}$) SL, W	Sections G.1 and G.2 of ANSI Z21.10.3
Oil instantaneous water heaters	≤ 61.55 kW	≥309.75 W/L and <7.57 L	0.59- ~~0.00190~~0.0005V EF	DOE 10 CFR Part 430
	>61.55 kW	≥309.75 W/L and <37.85	80% E_t	Sections G.1 and G.2 of ANSI Z21.10.3
	>61.55 kW	≥309.75 W/L and ≥37.85	78% E_t (Q/~~800 + 110~~799 + 16.6 $\sqrt{V}$) SL, W	
Hot-water supply boilers, gas and oil	≥61.55 kW and <3663.8 kW	≥309.75 W/L and <37.85	80% E_t	Sections G.1 and G.2 of ANSI Z21.10.3
Hot-water supply boilers, gas		≥309.75 W/L and ≥37.85	80% E_t (Q/~~800 + 110~~799 + 16.6 $\sqrt{V}$) SL, W	
Hot-water supply boilers, oil		≥309.75 W/L and ≥37.85	78% E_t (Q/~~800 + 110~~799 + 16.6 $\sqrt{V}$) SL,W	
Pool heaters oil and gas	All		78% E_t	ASHRAE 146
Heat pump pool heaters	All		4.0 COP	ASHRAE 146

Unfired storage tanks	All		R-2.2	(none)

[a] *Energy factor* (EF) and thermal *efficiency* (*Et*) are minimum requirements, while standby loss (SL) is maximum W based on a 38.9°C temperature difference between stored water and ambient requirements. In the EF equation, *V* is the rated volume in ~~gallons~~ liters. In the SL equation, *V* is the rated volume in ~~gallons~~ liters and *Q* is the nameplate input rate in W.

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

[c] Section G1 is titled "Test Method for Measuring Thermal Efficiency" and Section G2 is titled "Test Method for Measuring Standby Loss."

[d] Instantaneous *water heaters* with input rates below 58.62 W must comply with these requirements if the *water heater* is designed to heat water to temperatures 82.2°C or higher.