**ERRATA SHEET FOR**
**ANSI/ASHRAE/IES STANDARD 90.1-2016 (SI 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 90.1-2016, SI Edition. The first printing is identified on the outside back cover of the standard as "Product code: 86276 10/16". Shaded items have been added since the previously published errata sheet dated March 17, 2025 was distributed.

**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 https://www.ashrae.org/technical-resources/standards-and-guidelines/project-committee-list-servers.

| Page(s) | Erratum |
|---|---|
| 10 | **Footnote 1 (bottom of page).** Change the URL for the schedules and internal loads as shown below.<br><br>1. Schedules and internal loads by *building* area type are at http://sspc901.ashraepcs.org/documents.php. |
| 37 | **3.3 Abbreviations and Acronyms.** Change IES from "Illumination Engineering Society of North America" to "Illuminating Engineering Society". |
| 53 | **Table 5.5-2 *Building Envelope* Requirements for Climate Zone 2 (A, B)*.** In Table 5.5-2, in the row for Floors, Mass, in the column Nonresidential, Insulation Min. R-Value, change "R-1.9" to "R-1.1". |
| 70 | **5.9.1 Inspections.** Insert the following informative note immediately after Section 5.9.1.<br>*(Note: Additions are shown in underline.)*<br><br>***Informative Note:*** See Appendix E for commissioning references. |
| 80 | **6.4.3.4.3 Damper Leakage.** Revise Section 6.4.3.4.3 as shown below.<br>*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*<br><br>**6.4.3.4.3 Damper Leakage**<br>Where *outdoor air* supply and exhaust/relief dampers are required by Section 6.4.3.4~~6.4.3.4.1~~, they shall have a maximum leakage rate as indicated in Table 6.4.3.4.3 when tested in accordance with AMCA 500D. |
| 85 | **6.4.4.2.2 Duct Leakage Tests.** Correct the equation in Section 6.4.4.2.2 as shown below.<br>*(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 m² of duct surface area

$C_L$ = ~~4~~0.00563, duct leakage class, L/s·per m² 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

**89** **Table 6.5.1.1.3 High-Limit Shutoff Control Settings for Air Economizers.** Revise Table 6.5.1.1.3 as shown in the attached.

**97** **6.5.3.6 Fractional Kilowatt Fan Motors.** Revise item 3 of the Exceptions to 6.5.3.6 as shown below.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

**Exceptions to 6.5.3.6**
…
3. Motors covered by Table 10.8-3 or Table 10.8-4 ~~Table 10.8-4 or Table 10.8-5~~.

**99** **6.5.4.4 Chilled- and Hot-Water Temperature Reset Controls.** In the Exceptions to 6.5.4.4, Exception 3, change the reference to "Section 6.5.4.1" to "Section 6.5.4.2".

**100** **TABLE 6.5.4.6 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).

**103** **Table 6.5.6.1-2 Exhaust Air Energy Recovery Requirements for Ventilation Systems Operating Greater than or Equal to 8000 Hours per Year.** Change "≥35" to "≥66" in Table 6.5.6.1-2 as shown below.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

**Table 6.5.6.1-2 Exhaust Air *Energy* Recovery Requirements for *Ventilation Systems* Operating Greater than or Equal to 8000 Hours per Year**

| | % *Outdoor Air* at Full Design Airflow Rate | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ≥10% and <20% | ≥20% and <30% | ≥30% and <40% | ≥40% and <50% | ≥50% and <60% | ≥60% and <70% | ≥70% and <80% | ≥80% |
| **Climate Zone** | **Design Supply Fan Airflow Rate, L/s** | | | | | | | |
| 3C | NR | NR | NR | NR | NR | NR | NR | NR |
| 0B, 1B, 2B, 3B, 4C, 5C | NR | ≥9203 | ≥4248 | ≥2360 | ≥1888 | ≥1416 | ≥708 | ≥60 |
| 0A, 1A, 2A, 3A, 4B, 5B | ≥1180 | ≥944 | ≥472 | ≥236 | ≥66~~35~~ | ≥60 | ≥50 | ≥40 |
| 4A, 5A, 6A, 6B, 7, 8 | ≥100 | ≥65 | ≥50 | ≥40 | ≥35 | ≥30 | ≥25 | ≥20 |

NR—Not required

**115** **TABLE 6.8.1-4 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.** Remove "/1000" from the efficiency equations in Table 6.8.1-4 as shown below.
*(Note: 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* | 4.04 – (0.300 × Cap~~/1000~~)[c] $COP_C$ (before 1/1/2015)<br>4.10 – (0.300 × Cap~~/1000~~)[c] $COP_C$ (as of 1/1/2015) | AHRI 310/380 |
| *PTAC* (cooling mode) nonstandard size[b] | All capacities | 35.0°Cdb *outdoor air* | 3.19 – (0.213 × Cap~~/1000~~)[c] COPc | AHRI 310/380 |
| *PTHP* (cooling mode) standard size | All capacities | 35.0°Cdb *outdoor air* | 4.10 – (0.300 × Cap~~/1000~~)[c] $COP_c$ | AHRI 310/380 |
| *PTHP* (cooling mode) nonstandard size[b] | All capacities | 35.0°Cdb *outdoor air* | 3.16 – (0.213 × Cap~~/1000~~)[c] COPc | AHRI 310/380 |
| *PTHP* (heating mode) standard size | All capacities | | 3.7 – (0.052 × Cap~~/1000~~)[c] $COP_H$ | AHRI 310/380 |
| *PTHP* (heating mode) nonstandard size[b] | All capacities | | 2.9 – (0.026 × Cap~~/1000~~)[c] $COP_H$ | AHRI 310/380 |

**120** **Table 6.8.1-10 Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps – Minimum *Efficiency* Requirements (*Continued*).** Revise the equipment type subcategory for "*VRF* groundwater source (cooling mode)" as shown in the attached Table 6.8.1-10.
*(Note: Deletions are shown in ~~strikethrough~~.)*

**127** **Table 6.8.3-1 Minimum *Piping* Insulation Thickness Heating and Hot Water Systems[a,b,c,d,e] (Steam, Steam Condensate, Hot-Water Heating and Domestic Water *Systems*).** Revise Note e of Table 6.8.3-1 as shown below.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

e. The table is based on steel pipe. Nonmetallic pipes schedule 80 thickness or less shall use the table values. For other nonmetallic pipes having *thermal resistance* greater than that of steel pipe, reduced insulation thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per metre ~~foot~~ than a steel pipe of the same size with the insulation thickness shown in the table.

**128** **Table 6.8.3-2 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.

**143** **Exception to 9.4.1.1(g).** Revise the Exception to 9.4.1.1(g) as shown below.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

**Exception to 9.4.1.1(g)**
This requirement does not have to be complied with in *spaces* that meet all four ~~three~~ of the following requirements:

1. The *space* has an installed *LPD* of no more than 0.80 $W/ft^2$.
2. The *space* is lighted by *HID lamp*.
3. The *general lighting* power in the *space* is automatically reduced by at least 30% within 20 minutes of all occupants leaving the *space*.

4. Lighting load does not exceed 0.02 W/ft$^2$ multiplied by the *gross lighted area* of the *building*.

144 **94.1.1 Interior Lighting Controls.** Add the following exception to the Exceptions to 9.4.1.1(h) as shown below.

4. Lighting load not exceeding 0.22 W/m$^2$ multiplied by the *gross lighted area* of the *building.*

147 **Table 9.4.2-2 Individual Lighting Power Allowance for *Building* Exteriors.** For Nontradable Surfaces, *Building* facades, change "66 W/lin m of facade length" to "8.2 W/lin m of facade length".

151 **Table 9.5.1 *Lighting Power Density* Allowances Using the *Building* Area Method.** Add the *LPD* value for Workshop as "9.7" W/m$^2$.

171 **11.5.2 HVAC Systems.** Revise Section 11.5.2 as shown below.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

**11.5.2 HVAC Systems**

**…**

**i.…**Unmet load hours for the proposed design or ~~*baseline building designs*~~ *budget building design* shall not exceed 300 hours. 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 2400 L/s, 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 6.5.7.2.2 for the numbers and types of hoods and appliances provided in the proposed design.

174 **Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget.** Revise Table 11.5.1 as shown below.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

**Table 11.5.1 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 design* and ~~*baseline building design*~~ *budget building design*.
…

**Table 11.5.1 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
… 3. 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.

183 **12. Normative References.** In Section 12 make the following correction.
*(Note: Deletions are shown in ~~strikethrough~~.)*

AHRI 340/360-2015 ~~(I-P) and AHRI 341/361-2015 (SI)~~ Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

205 **Table A3.1-3 Assembly *U-Factors, C-Factors, Ru, Rc*, and *HC* for Concrete Block *Walls* (*Continued)*.** In Table A3.1-3 for 200 mm block, Density 1,680 kg/m³, Partly Grouted, Cells Empty, change *HC* from "0.8" to "208".

249 **Footnote 2 (bottom of page).** Change the URL for the schedules and internal loads as shown below.

2. Schedules and internal loads by *building* area type are found at http://sspc901.ashraepcs.org/documents.php.

257 **Informative Appendix E Informative References.** In the table in Informative Appendix E make the following corrections. See attached.
*(Note: Additions are shown in underline and deletions are shown in ~~strikethrough~~.)*

282 **G3.1.3.11 Heat Rejection (Systems 7, 8, 9, 12, and 13).** In Section G3.1.3.11 replace "water-side economizer" with "fluid economizer" in two places.

285 **Table G3.1.1.-3 Baseline *HVACV System* Types.** In the first column of Table G3.1.1-3 change "residential" to "nonresidential" in three places.

311 **Table H-1 Addenda to ANSI/ASHRAE/IES Standard 90.1-2013 *(Continued).*** For Addendum ad in Table H-1 change "unlabled" to "unlabeled".

376 **Section Annex1-1: ASHRAE Standard 169-2013, Section A3: Climate Zone Definitions.** In Section A3, sentence immediately following item b.3 delete the extra "the" from the first word

"Userthe" so the sentence reads "Use the third criteria below for determining the Dry/Humid threshold if not Marine (C)".

**Table 6.5.1.1.3 High-Limit Shutoff *Control* Settings for *Air Economizers*[b]**

| *Control* Type | Allowed Only in Climate Zone at Listed *Set Point* | Required High-Limit *Set Points* (Economizer Off when): | |
|---|---|---|---|
| | | Equation | Description |
| *Fixed* dry-bulb temperature | 0B, 1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8 | $T_{OA}$ > 24°C | *Outdoor air* temperature exceeds 24°C |
| | 5A, 6A | $T_{OA}$ > 21°C | *Outdoor air* temperature exceeds 21°C |
| | 0A, 1A, 2A, 3A, 4A, | $T_{OA}$ > 18°C | *Outdoor air* temperature exceeds 18°C |
| Differential dry-bulb temperature | 0B, 1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8 | $T_{OA} > T_{RA}$ | *Outdoor air* temperature exceeds return air temperature |
| *Fixed* enthalpy with *fixed* dry-bulb temperature | All | $h_{OA}$ > 65.1 ~~47~~ kJ/kg[a] or $T_{OA}$ > 24°C | *Outdoor air* enthalpy exceeds 65.1 ~~47~~ kJ/kg[a] of dry air[a] or *outdoor air* temperature exceeds 24°C |
| Differential enthalpy with *fixed* dry-bulb temperature | All | $h_{OA} > h_{RA}$ or $T_{OA}$ > 24°C | *Outdoor air* enthalpy exceeds return air enthalpy or *outdoor air* temperature exceeds 24°C |

a. At altitudes substantially different than sea level, the *fixed* enthalpy limit shall be set to the enthalpy value at 24°C and 50% rh. As an example, at approximately 1830 m elevation, the *fixed* enthalpy limit is approximately 71.4 ~~53.5~~ kJ/kg.

b. Devices with selectable rather than adjustable *set points* shall be capable of being set to within 1.1°C and 3.4kJ/kg of the *set point* listed.

**Table 6.8.1-10 Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps— Minimum *Efficiency* Requirements *(Continued)***

| *Equipment* Type | Size Category | Heating Section Type | Subcategory or Rating Condition | Minimum *Efficiency* | Test Procedure |
|---|---|---|---|---|---|
| *VRF* groundwater source (cooling mode) | <40 *kW* | All | *VRF* multisplit *system* ~~with heat recovery~~ 15°C entering water | 4.75 $COP_C$ | AHRI 1230 |
| | | | *VRF* multisplit *system* with heat recovery 15°C entering water | 4.69 $COP_C$ | |
| | ≥40 *kW* | | *VRF* multisplit *system* ~~with heat recovery~~ 15°C entering water | 4.04 $COP_C$ | |
| | | | *VRF* multisplit *system* with heat recovery 15°C entering water | 3.99 $COP_C$ | |

## Informative Appendix E
## Informative References

| Subsection No. | Reference | Title/Source |
|---|---|---|
| 5.9.1 | ASTM E2947-14 | Standard Guide for Building Enclosure Commissioning |
| 5.9.1 | ASTM E2813-12 | Standard Practice for Building Enclosure Commissioning |
| ~~6.7.2.3~~ 6.7.2.4 | NEBB Procedural Standards—2013 | Procedural Standards for Building Systems Commissioning |
| 6.7.2.3.1 | AABC 2002 | Associated Air Balance Council, National Standards for Total System Balance |
| 6.7.2.3.1 | ASHRAE Standard 111-2008 | Measurement, Testing, Adjusting and Balancing of Building HVAC Systems |
| 6.7.2.4 | ASHRAE Standard 202-2013 | Commissioning Process for Buildings and Systems |
| 6.7.2.4 | ASHRAE Guideline 0-2013 | The Commissioning Process |

**Table G3.1.1-3 Baseline *HVAC System* Types**

| ***Building* Type, Number of *Floors*, and Gross Conditioned Floor Area** | **Climate Zones 3B, 3C, and 4 to 8** | **Climate Zones 0 to 3A** |
|---|---|---|
| Residential | *System* 1—*PTAC* | *System* 2—*PTHP* |
| Public assembly <11,000 $m^2$ | *System* 3—PSZ-AC | *System* 4—PSZ-HP |
| Public assembly ≥11,000 $m^2$ | *System* 12—SZ-CV-HW | *System* 13—SZ-CV-ER |
| Heated-only storage | *System* 9—Heating and *ventilation* | *System* 10—Heating and *ventilation* |
| Retail and 2 *floors* or fewer | *System* 3—PSZ-AC | *System* 4—PSZ-HP |
| Other *nonresidential* and 3 *floors* or fewer and <2300 $m^2$ | *System* 3—PSZ-AC | *System* 4—PSZ-HP |
| Other *nonresidential* and 4 or 5 *floors* and <2300 $m^2$ or 5 *floors* or fewer and 2300 $m^2$ to 14,000 $m^2$ | *System* 5—Packaged *VAV* with *reheat* | *System* 6—Packaged *VAV* with PFP boxes |
| Other *nonresidential* and more than 5 *floors* or >14,000 $m^2$ | *System* 7—*VAV* with *reheat* | *System* 8—*VAV* with PFP boxes |