The corrections listed in this errata sheet apply to ANSI/ASHRAE/IES Standard 90.1-2019, SI Edition. The first printing is identified on the outside back cover of the standard as “Product code: 86272 1/20”. Shaded items have been added since the previously published errata sheet dated October 5, 2020 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](https://www.ashrae.org/technical-resources/standards-and-guidelines/project-committee-list-servers).

### Page(s) Erratum

<table>
<thead>
<tr>
<th>Page</th>
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</table>
| 11   | 3.2 Definitions. In Section 3 add the following definition which was inadvertently removed when the 2019 edition was published.  
*(Note: Additions are shown in *underline*)

   **computer room energy**: annual energy use of the data center, including all IT equipment energy, plus energy that supports the IT equipment and computer room space, calculated in accordance with industry-accepted standards defined as Total Annual Energy (see Informative Appendix E). |
| 75   | 5.8.1.2 Manufacturer’s Installation Instructions. In Exception 2 to Section 5.8.1.2 change the reference to Table A9.4.5 to Table A9.4.6 as shown below.  
*(Note: Additions are shown in *underline* and deletions are shown in *strikethrough*)

   **Exceptions to 5.8.1.2**  
1. The R-value of compressed cavity insulation is determined in accordance with Table A9.4.3.  
2. Where metal building roof or wall insulation is compressed between the steel structure and the metal roof or wall panels, the overall assembly **U-factor** is determined in accordance with Section A2.3, Section A3.2, or Section A9.4.5A9.4.6. |
| 78   | 5.8.3.1 Maximum Air Leakage for Materials and Assemblies. Change the table heading in column two of Table 5.8.3.1 from “Maximum Air Leakage, L/s?m²” to “Maximum Air Leakage, L/s·m²”. |
| 86   | 6.4.1.3 Ceiling Fans. Add the following informative note immediately following Section 6.4.1.3.  
*(Note: Additions are shown in *underline*)

   **6.4.1.3 Ceiling Fans**  
   Large-diameter ceiling fans shall be rated in accordance with 10 CFR 430 Appendix U or |
AMCA 230. The following data shall be provided:

a. Blade span (blade tip diameter)
b. Rated airflow and power consumption at the maximum speed

*Informative Note: See Informative Appendix F for the U.S. Department of Energy requirements for US applications.*

6.5.4.8 Buildings with High-Capacity Space-Heating Gas Boiler Systems. Delete Section 6.5.4.8 in its entirety as shown below. Note that this material was inadvertently included in the published standard, the material is included in an addendum that is expected to be published to the 2019 edition at a later date. *(Note: Deletions are shown in strikethrough.)*

### 6.5.4.8 Buildings with High-Capacity Space-Heating Gas Boiler Systems

New buildings with gas hot-water boiler systems for space heating with a total system input of at least 290 kW but not more than 2900 kW shall comply with Sections 6.5.4.8.1 and 6.5.4.8.2.

#### Exceptions to 6.5.4.8

1. Where 25% of the annual space heating requirement is provided by on-site renewable energy, site-recovered energy, or heat recovery chillers.
2. Space heating boilers installed in individual dwelling units.
3. Where 50% or more of the design heating load is served using perimeter convective heating, radiant ceiling panels, or both.
4. Individual gas boilers with input capacity less than 87 kW shall not be included in the calculations of the total system input or total system efficiency.

#### 6.5.4.8.1 Boiler Efficiency

Gas hot-water boilers shall have a minimum thermal efficiency \( E_t \) of 90% when rated in accordance with the test procedures in Table 6.8.1-6. Systems with multiple boilers are allowed to meet this requirement if the space-heating input provided by equipment with thermal efficiency \( E_t \) above and below 90% provides an input capacity-weighted average thermal efficiency of at least 90%. For boilers rated only for combustion efficiency, the calculation for the input capacity-weighted average thermal efficiency shall use the combustion efficiency value.

#### 6.5.4.8.2 Hot-Water Distribution System Design

The hot-water distribution system shall be designed to meet all of the following:

a. Coils and other heat exchangers shall be selected so that at design conditions the hot-water return temperature entering the boilers is 49°C or less.

b. Under all operating conditions, the water temperature entering the boiler is 49°C or less, or the flow rate of supply hot water that recirculates directly into the return system, such as by three-way valves or minimum flow bypass controls, shall be no greater than 20% of the design flow of the operating boilers.

### Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements

In Table 6.8.1-7 for Equipment Type “Propeller or axial fan dry coolers (air-cooled fluid coolers)” change “35.0°C entering wb” to “35.0°F entering db”.

### Table 6.8.9-17 Ceiling-Mounted Computer-Room Air Conditioners—Minimum Efficiency
Requirements. Change Table 6.8.9-17 to Table 6.8.1-17.

7.4.3 Service Hot-Water Piping Insulation. In the first sentence of Section 7.4.3 change “Table 6.8.1-3” to “Table 6.8.3-1” as shown below.
(Note: Additions are shown in underline and deletions are shown in strikethrough.)

7.4.3 Service Hot-Water Piping Insulation
The following piping shall be insulated to levels shown in Section 6, Table 6.8.1-3 Table 6.8.3-1:

9.3.2 Simplified Building Method of Calculating Exterior Lighting Power Allowance. In Section 9.3.2 change “Tables 9.3.1-1, 9.3.1.2, and 9.3.1.3” to “Table 9.3.2” as shown below.
(Note: Additions are shown in underline and deletions are shown in strikethrough.)

9.3.2 Simplified Building Method of Calculating Exterior Lighting Power Allowance
For all building types listed in Section 9.3, exterior areas (new and alterations) shall comply with the lighting power allowance and control requirements of Table 9.3.2 Tables 9.3.1-1, 9.3.1-2, and 9.3.1-3.

11.2 Compliance. In Section 11.2(e) change the reference to “Section 11.7(b)” to “Section 11.7.2(d)”.

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget (Continued). Revise Section 13 of Table 11.5.1 as shown in the attached.
(Note: Additions are shown in underline and deletions are shown in strikethrough.)

12 Normative References. Addendum bv to Standard 90.1-2016 added a reference to ASHRAE Standard 90.4-2016 (with Addenda a and b) but that reference was inadvertently left out of Section 12. Add the following reference to Section 12 as shown below.
(Note: Additions are shown in underline.)

12 Normative References

ASHRAE
1791 Tullie Circle, NE, Atlanta, GA 30329

ANSI/ASHRAE Standard 90.4-2016 (with Addenda a and b) Energy Standard for Data Centers

A2.3.3 U-Factors for Metal Building Roofs. Revise Section A2.3.3 to change Table A2.2.3 to Table A2.3.3 in two places as shown below.
(Note: Additions are shown in underline and deletions are shown in strikethrough.)

A2.3.3 U-Factors for Metal Building Roofs
U-factors for metal building roofs shall be taken from Table A2.3.3 A2.2.3 or determined in accordance with Section A9.2, provided the average purlin spacing for systems with compressed insulation is at least 52 in. U-factors for metal building roof assemblies with average purlin spacing less than 52 in. shall be determined in accordance with Section A9.2. U-factors in Table A2.3.3 A2.2.3 shall not be used where the insulation is substantially compressed by the bracing between the purlins.
Informative Appendix E Informative References. Update the references as shown below. See also the revised table from Informative Appendix E attached with changes shown in red text. (Note: Additions are shown in underline and deletions are shown in strikethrough.)

**LBNL Characterization and Survey of Automated Fault Detection and Diagnostics Tools**
Lawrence Berkeley National Laboratory Building Technology and Urban Systems Division Energy Technologies Area
MS-90R3111
1 Cyclotron Road
Berkeley, CA 94720 USA

**Office of Energy Efficiency and Renewable Energy (EERE)**
US Department of Energy
Better buildings
Forrestal Building
1000 Independence Avenue, SW
Washington, DC 20585
betterbuildingssolutioncenter.energy.gov/alliance

**MICA**
Midwest Insulation Contractors Association
16712 Elm Circle
Omaha, NE 68130
www.micainsulation.org

**IWEC2 Data**
ASHRAE
1791 Tullie Circle, NE
Atlanta, GA 30329-2305
(T) 404-636-8400
(F) 404-321-5478
http://www.techstreet.com/ashrae
(Direct link: http://www.techstreet.com/ashrae/products/1876209)

**NEBB**
National Environmental Balancing Bureau
8575 Grovemont Circle
Gaithersburg, MD 20877
www.nebb.org

**SMACNA**
Sheet Metal & Air Conditioning Contractors’ National Association
4201 Lafayette Center Drive
Chantilly, VA 20151
info@smacna.org
www.smacna.org

**TMY3 Data**

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

Informative Appendix F
U.S. Department of Energy Minimum Energy Efficiency Requirements, Test Procedures, and Definitions

In the United States, the U.S. Department of Energy establishes efficiency standards for products that it defines as “residential covered products.” Since these products are used in buildings covered by this standard, the DOE efficiency requirements are shown here for convenience. All DOE efficiency requirements for residential products are found in the U.S. Code of Federal Regulations, 10 CFR Part 430 Subpart C, Section 430.32.

DOE also establishes definitions and test procedures for covered products. These are found in 10 CFR 430.2 and 10 CFR 430.23, respectively.

 […]

F3 DOE Test Procedure and Definitions for Ceiling Fans
DOE definitions for ceiling fans are found in 10 CFR 430.2 and 10 CFR part 430, subpart B, appendix U. On or after January 23, 2017, manufacturers of ceiling fans must make any representations with respect to energy use or efficiency in accordance with the test procedure in 10 CFR part 430, subpart B, appendix U. DOE also specifies, in 10 CFR 430.32, design requirements for ceiling fans, and for ceiling fans manufactured on or after January 21, 2020, minimum efficiency requirements.

Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance. Revise Table G3.1, No. 6 Lighting, item g, as shown in the attached.

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

G3.1.1.4 Modeling Building Envelope Infiltration. Revise Section G3.1.1.4 as follows.

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

S = total area of the building envelope (m²), including the lowest floor, any below-grade walls or above-grade walls, and roof (including vertical fenestration and skylights)

G3.1.2.1 Equipment Efficiencies. In Section G3.1.2.1 add the last sentence as shown below. The text was added by Addendum z to 90.1-2016 but was inadvertently omitted from 90.1-2019.

(Note: Additions are shown in underline.)

G3.1.2.1 Equipment Efficiencies

All HVAC equipment in the baseline building design shall be modeled at the minimum efficiency
levels, both part load and full load, in accordance with Tables G3.5.1 through G3.5.6. Where multiple HVAC zones or residential spaces are combined into a single thermal block in accordance with Table G3.1, the efficiencies (for baseline HVAC System Types 1, 2, 3, 4, 9, and 10) taken from Tables G3.5.1, G3.5.2, G3.5.4, and G3.5.5 shall be based on the equipment capacity of the thermal block divided by the number of HVAC zones or residential spaces. HVAC System Types 5 or 6 efficiencies taken from Table G3.5.1 shall be based on the cooling equipment capacity of a single floor when grouping identical floors in accordance with Section G3.1.1(a)(4). Fan energy shall be modeled separately according to Section G3.1.2.9.

Table G3.5.4 Performance Rating Method Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps (efficiency ratings excluding supply fan power). Deleting the superscript “a” in Minimum Efficiency in Table G3.5.4.
<table>
<thead>
<tr>
<th>13. Refrigeration</th>
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<td>Where refrigeration equipment in the proposed design is rated in accordance with AHRI 1200, the rated energy use shall be modeled. Otherwise, the proposed design shall be modeled using the actual equipment capacities and efficiencies.</td>
</tr>
</tbody>
</table>

Where refrigeration equipment is specified in the proposed design and listed in Table 6.8.1-13 the budget building design shall be modeled as specified in 6.8.1-13 using the actual equipment capacities.

If the refrigeration equipment is not listed in Table 6.8.1-13 the budget building design shall be modeled the same as the proposed design.
### Informative Appendix E Informative References

<table>
<thead>
<tr>
<th>Subsection No.</th>
<th>Reference</th>
<th>Title/Source</th>
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<tbody>
<tr>
<td>5.7.3.2</td>
<td>NIBS Guideline 3-2012</td>
<td>Building Enclosure Commissioning Process BECx, Annex O</td>
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<tr>
<td>5.7.3.2</td>
<td>ASTM E2947-16a</td>
<td>Standard Guide for Building Enclosure Commissioning, Section 9.4</td>
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<tr>
<td>5.9.1, H1</td>
<td>ASTM E2947-16a</td>
<td>Standard Guide for Building Enclosure Commissioning</td>
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<tr>
<td>5.9.1, H1</td>
<td>ASTM E2813-18</td>
<td>Standard Practice for Building Enclosure Commissioning</td>
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<tr>
<td>6.4.2</td>
<td>2017 ASHRAE Handbook—Fundamentals</td>
<td>ASHRAE</td>
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<tr>
<td>6.4.3.1</td>
<td>ASHRAE Guideline 22-2012</td>
<td>Instrumentation for Monitoring Central Chilled-Water Plant Efficiency</td>
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<tr>
<td>6.4.4.1.1</td>
<td>MICA Insulation Standards—7th Edition</td>
<td>National Commercial and Industrial Insulation Standards</td>
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<tr>
<td>6.4.4.2.1</td>
<td>SMACNA Duct Construction Standards—2005</td>
<td>HVAC Duct Construction Standards, Metal and Flexible</td>
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<tr>
<td>6.4.4.2.2</td>
<td>SMACNA Duct Leakage Test Procedures—2012</td>
<td>HVAC Air Duct Leakage Test Manual Sections 3.5, and 6</td>
</tr>
<tr>
<td>6.7.3.3.1</td>
<td>ASHRAE Guideline 4-2019</td>
<td>Preparation of Operating and Maintenance Documentation for HVAC&amp;R Systems</td>
</tr>
<tr>
<td>6.7.3.3.1</td>
<td>AABC 2002</td>
<td>Associated Air Balance Council, National Standards for Total System Balance</td>
</tr>
<tr>
<td>6.7.3.3.1</td>
<td>ASHRAE Standard 111-2008</td>
<td>Measurement, Testing, Adjusting and Balancing of Building HVAC Systems</td>
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<tr>
<td>6.9.2, H1</td>
<td>ASHRAE Guideline 0-2013</td>
<td>The Commissioning Process</td>
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<td>6.9.2, H1</td>
<td>ASHRAE Guideline 1.1-2007</td>
<td>HVAC&amp;R Technical Requirements for the Commissioning Process</td>
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<td>8.4.2</td>
<td>US Department of Energy EEERE, Better Buildings</td>
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<tr>
<td>9.6.1</td>
<td>IES RP-6-15</td>
<td>Recommended Practice for Sports and Recreational Area Lighting</td>
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<td>10.4.3.4</td>
<td>ISO 25745-2:2015</td>
<td>Energy performance of lifts, escalators and moving walks – Paret2: Energy calculation and classification for lifts (elevators)</td>
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<td>10.4.5</td>
<td>ISO 27327-1:209 (R2014)</td>
<td>Air curtain units — Part 1: Laboratory Methods of Testing for Aerodynamic Performance Rating</td>
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<td>10.4.5</td>
<td>ANSI/AMCA Standard 220-05 (R2012)</td>
<td>Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating</td>
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<td>10.4.7</td>
<td>ANSI/HI 1.1-1.2-2014</td>
<td>Rotodynamic Centrifugal Pumps for Nomenclature and Definitions</td>
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<td>10.4.7</td>
<td>ANSI/HI 2.1-2.2-2014</td>
<td>Rotodynamic Vertical Pumps or Radial, Mixed, and Axial Flow Types for Nomenclature and Definitions</td>
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<tr>
<td>11.4.2</td>
<td>CWEEC</td>
<td>Canadian Weather for Energy Calculations</td>
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<td>11.4.2</td>
<td>IWEC2</td>
<td>International Weather for Energy Calculations, Generation 2</td>
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<td>TMY3</td>
<td>Typical Meteorological Year, Generation 3</td>
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<tr>
<td>A9.4.6</td>
<td>ASHRAE Transactions 122(1):16–014</td>
<td>Choudhary, M.K. 2016. A general approach for predicting the thermal performance of metal building fiberglass insulation assemblies</td>
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<td>H1</td>
<td>ISO/IEC 17024:2012</td>
<td>Community Assessment – General requirements for bodies operating certification of persons</td>
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Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance (Continued)

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<td></td>
<td>g. For lighting controls, at a minimum, the proposed design shall contain the mandatory automatic lighting controls specified in Section 9.4.1 (e.g., automatic daylight responsive controls, occupancy sensors, programmable controls, etc.). These controls shall be modeled in accordance with (g-h) and (h-i).</td>
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