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2017 Addenda

Standard for the Design of High-Performance Green Buildings

Except Low-Rise Residential Buildings

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NOTE

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FOREWORD

This addendum clarifies the location of a CO_2 sensor to determine the outdoor air concentration. This addendum responds to concerns received on a prior addendum that is now incorporated into the Standard.

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 a to Standard 189.1-2014

Modify Section 7.4.3.2 as follows.

7.4.3.2 Ventilation Controls for Densely Occupied Spaces. The requirements in this section supersede those in Section 6.4.3.8 of ANSI/ASHRAE/IES Standard 90.1.*Demand control ventilation* (*DCV)* shall be provided for *densely occupied spaces* served by systems with one or more of the following:

a. An air-side economizer.
b. *Automatic* modulating control of the outdoor air dampers.
c. A design outdoor airflow greater than 1000 cfm (500 L/s).

Exceptions to 7.4.3.2:

1. Systems with exhaust air energy recovery complying with Section 7.4.3.6.
2. Systems with a design outdoor airflow less than 750 cfm (375 L/s).
3. Spaces where more than 75% of the space design *outdoor air*flow is utilized as *makeup air* or *transfer air* to provide *makeup air* for other space(s).
4. Spaces with one of the following occupancy categories as defined in ASHRAE Standard 62.1: Cells in Correctional Facilities; Daycare sickrooms; Science laboratories; Barber; Beauty and nail salons; and Bowling alley (seating).

The *DCV* system shall be designed to be in compliance with Section 6.2.7 of ANSI/ASHRAE Standard 62.1. Occupancy assumptions shall be shown in the design documents for spaces provided with *DCV*. All CO_2 sensors used as part of a *DCV* system or any other system that dynamically controls outdoor air shall meet the following requirements:

a. *Spaces* with CO_2 sensors or air sampling probes leading to a central CO_2 monitoring station shall be provided with at least one sensor or probe for each 10,000 ft^2 (1000 m^2) of floor *space*. Sensors or probes shall be installed between 3 and 6 ft (1 and 2 m) above the floor.
b. CO_2 sensors shall ~~must be~~have a rated accuracy~~accurate of~~~~to~~ ±50 ppm at 1000 ppm.
c. *Outdoor air* CO_2 concentrations shall be determined by one of the following:
   1. *Outdoor air* CO_2 concentrations shall be dynamically measured using one or multiple ~~a~~ CO_2 sensors. The CO_2 sensor locations shall be identified on the construction documents.
   2. When documented statistical data are available on the local ambient CO_2 concentrations, a fixed value typical of the location where the building is located shall be allowed in lieu of an outdoor sensor.
d. Occupant CO_2 generation rate assumptions shall be shown in the design documents.

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FOREWORD

This addendum replaces the mandatory requirement for peak load reduction in Section 7.3.4 that was introduced in addendum ce to the standard.

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 b to Standard 189.1-2014

[Note: This addendum modifies the text of addendum ce to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014.]

Modify Section 7.3.4 as follows.

~~**7.3.4 Peak Load Reduction.** *Building projects* shall contain automatic systems, such as demand limiting or load shifting, that are capable of reducing electric peak demand of the building by not less than 10% of the projected peak demand. Standby power generation shall not be used to achieve the reduction in peak demand.~~

7.3.4 Peak Demand Reduction. *Building projects* shall contain automatic control systems that reduce building equipment loads to lower electric peak demand of the building.

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FOREWORD

This addendum is intended to incorporate ASHRAE/IES Standard 202, Commissioning Process for Buildings and Systems*, into Standard 189.1, thereby basing commissioning on an industry standard.*

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 c to Standard 189.1-2014

Modify Section 10.3.1.2 as follows.

10.3.1.2 Building Project Commissioning. For buildings that exceed 5000 ft^2 (500 m^2) of gross floor area, commissioning shall be performed in accordance with this section using ANSI/ASHRAE/IES Standard 202 or other *generally accepted engineering standards* and handbooks acceptable to the *AHJ*. Buildings undergoing the *commissioning process* will be deemed to comply with the requirements of Section 10.3.1.1, "Building Acceptance Testing."

Add new Normative Reference to Section 11 as follows.

Reference	Title	Section
ASHRAE **1791 Tullie Circle NE** **Atlanta, GA 30329, United States** **1-404-636-8400; www.ashrae.org**		
ANSI/ASHRAE/IES Standard 202-2013	Commissioning Process for Buildings and Systems	10.3.1.2

(This foreword 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.)

FOREWORD

This addendum corrects and clarifies a potentially confusing sentence in the standard that could cause some designers to believe that the bonus lighting power control factors from ASHRAE Standard 90.1, Table 9.6.3, cannot be used in Standard 189.1. This is not the case. The Standard 90.1, Table 9.6.3, control factors from can be used to help meet the lighting power density (LPD) requirements of Standard 189.1 as long as the applicable control method from Standard 90.1, Table 9.6.3, is not mandatory in Standard 189.1.

Misinterpretation of the original language is problematic because Standard 189.1 should encourage designers to use the control methods from Standard 90.1, Table 9.6.3, as those methods increase energy savings.

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 d to Standard 189.1-2014

Modify Section 7.4.6.1.1 as follows.

7.4.6.1.1 Interior Lighting Power Densities (LPDs)

[. . .]

c. Any of the ~~C~~control factors from Table 9.6.3 in ANSI/ASHRAE/IES Standard 90.1 shall be permitted to be applied ~~not be used for any~~ provided that the corresponding control method~~ologies~~ is not required~~in~~ by this standard (ASHRAE Standard 189.1).

(This foreword 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.)

FOREWORD

This new Section 7.4.6.1.1(d) to Standard 189.1 provides control credits (control factors times the wattage of the controlled lighting) for institutional tuning that are in addition to the control factors that already exist in Standard 90.1-2013, Section 9.6.3. This proposal does not specify the design light levels; it requires that the relative light output (or relative power consumption) of tuned lighting be 15% less than the maximum light output of the installed lighting receiving the credit.

The definitions of institutional tuning and task tuning are based on definitions in IES LEM 7-13, Lighting Controls for Energy Management[1]*, and definitions in the NEMA Lighting Systems Division Document,* Lighting Controls Terminology[2].

The functional performance test for institutional tuning is conducted when all other controls are set to their highest light output setting. As a result, for lighting systems that are controlled by automatic daylighting controls, the functional performance test for institutional tuning is required to be conducted at night when the daylighting controls will be calling for full normal light output from the controlled lighting system.

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 e to Standard 189.1-2014

Modify Section 3.2 as follows.

3.2 Definitions

institutional tuning: the process, by authorized personnel, of adjusting the maximum light output of individual luminaires, groups of luminaires or entire lighting systems to support visual needs or save energy. *Institutional tuning* is also known as high end trim control.

Modify Section 7.4.6.1.1 as follows.

7.4.6.1.1 Interior Lighting Power Densities (LPDs). The interior *lighting power allowance* shall be determined using either Section 9.5 or Section 9.6 of ANSI/ASHRAE/IES Standard 90.1 with the following modifications:

a. For those areas where the Building Area Method is used, the LPD from Table 9.5.1 of ANSI/ASHRAE/IES Standard 90.1 shall be multiplied by the corresponding LPD Factor from Table 7.4.6.1A.
b. For those areas where the Space-by-Space Method is used, the LPD from Table 9.6.1 of ANSI/ASHRAE/IES Standard 90.1 shall be multiplied by the corresponding LPD Factor from Table 7.4.6.1B.
c. Control factors from Table 9.6.3 in ANSI/ASHRAE/IES Standard 90.1 shall not be used for any control methodologies required in this standard.

d. An additional lighting power allowance shall be credited for *institutional tuning* of dimmable lighting systems that meet all of the following requirements:
   1. *Institutional tuning* controls shall be accessible only to authorized personnel.
   2. Construction documents shall state that maximum light output or power of controlled lighting shall be reduced by at least 15% from full output.
   3. The maximum light output or power of the controlled lighting shall be measured without *institutional tuning* and with *institutional tuning* to verify reduction of light output or power by at least 15% when tuned. In daylighted areas these measurements shall be conducted at night.

   For controlled lighting in daylighted areas, the additional lighting power allowance shall be 0.05 times the controlled lighting power. In non-daylighted areas, the additional lighting power allowance shall be 0.10 times the controlled lighting power.

Modify Section 10.3.1.1.3 as follows.

10.3.1.1.3 Systems. The following systems, if included in the *building project*, shall have acceptance testing:

a. Mechanical systems: heating, ventilating, air conditioning, IAQ, and refrigeration systems (mechanical and/or passive) and associated controls.
b. Lighting systems: automatic daylighting controls, manual daylighting controls, occupancy sensing devices, ~~and~~, automatic shut-off controls, and dimming systems claiming a lighting power allowance for *institutional tuning* according to Section 7.4.6.1.1(d).
c. Fenestration Control Systems: Automatic controls for shading devices and dynamic glazing.
d. Renewable energy systems.
e. Water measurement devices, as required in Section 6.3.3.
f. Energy measurement devices, as required in Section 7.3.3.

Modify Section 10.3.1.2.4 as follows.

10.3.1.2.4 Systems. The following systems and associated controls, if included in the *building project*, shall be commissioned:

a. Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and/or passive).
b. *Building envelope* systems, components, and assemblies to verify the airtightness and thermal and moisture integrity.

1. "Institutional tuning" definition, Section 2.6, p. 8, Personal Tuning Section 21.1
2. Lighting Controls Terminology, NEMA Lighting Systems Division Document LSD 64-2012, p. 7, definition 82, "Tuning." https://nlcaa.org/documents/aboutlightingcontrols.pdf

Building envelope airtightness commissioning shall also comply with Section 10.3.1.2.5.

c. Lighting systems including dimming systems claiming a lighting power allowance *for institutional tuning* according to Section 7.4.6.1.1(d).
d. *Fenestration* control systems: *Automatic* controls for shading devices and *dynamic glazing*.
e. Irrigation.
f. Plumbing.
g. Domestic and process water pumping and mixing systems.
h. *Service water heating* systems.
i. Renewable energy systems.
j. Water measurement devices, as required in Section 6.3.3.

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FOREWORD

This addendum modifies Table 6.3.2.1 to make it consistent with the text of Section 6.3.2.1(b). Addendum v, incorporated into Standard 189.1-2014, included changes to the provisions for dual-flush water closets (toilets) in the text of the standard but failed to change the corresponding line item in the table.

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 f to Standard 189.1-2014

Modify Table 6.3.2.1 as follows.

TABLE 6.3.2.1 Plumbing Fixtures and Fittings Requirements

Plumbing Fixture	Maximum
Water closets (toilets)—flushometer single-flush valve type	Single-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—flushometer dual-flush valve type	Full-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—single-flush tank type	Single-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—dual-flush tank type	~~Effective dual~~ Full-flush volume of 1.28 gal (4.8 L)
Urinals	Flush volume 0.5 gal (1.9 L)
Public lavatory faucets	Flow rate—0.5 gpm (1.9 L/min)
Public metering self-closing faucet	0.25 gal (1.0 L) per metering cycle
Residential bathroom lavatory sink faucets	Flow rate—1.5 gpm (5.7 L/min)
Residential kitchen faucets	Flow rate— 1.8 gpm (6.8 L/min)*
Residential showerheads	Flow rate—2.0 gpm (7.6 L/min)
Residential shower compartment (stall) in *dwelling units* and guest rooms	Flow rate from all shower outlets total of 2.0 gpm (7.6 L/min)

* With provision for a temporary override to 2.2 gpm (8.3 L/min) as specified in Section 6.3.2.1(g).

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FOREWORD

This addendum to Standard 189.1 provides a higher level of indoor moisture control (primarily to reduce the likelihood of microbial growth on indoor surfaces) than is currently required by reference to Standard 62.1. The requirements for humidity limits during mechanical cooling operation supersede the requirements for humidity analysis during mechanical cooling in Standard 62.1, Section 5.9.1, but do not supersede the requirements in Section 5.9 or 5.9.2. Standard 62.1 requires designers to analyze mechanical cooling system capability to limit indoor relative humidity at a single low-sensible and high-latent load condition, but this addendum requires designs that either directly or indirectly limit zone relative humidity during cooling operation.

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 g to Standard 189.1-2014

Add new Section 8.3.1.4 and renumber existing section as follows.

8.3.1.4 Humidity Control. The requirements in this section supersede the requirements in Section 5.9.1 of ANSI/ASHRAE Standard 62.1. Mechanical air-conditioning and evaporative cooling systems shall be designed in accordance with Sections 8.3.1.4.1 and 8.3.1.4.2, as applicable.

Exceptions:

1. Systems serving *HVAC zones* with construction, furnishings and fixtures that manage liquid water and high humidity using impervious or moisture-retardant surfaces and other means
2. Systems where performance simulation demonstrates that *HVAC zone* relative humidity levels during cooling do not exceed 65% rh for more than 48consecutive hours.

8.3.1.4.1 Cooling Coils. *HVAC systems* with dehumidification capability in Climate Zones 1a, 2a, 3a, 4a, and 4c shall be designed in accordance with one of the following:

a. Where recirculating systems do not include means for *HVAC zone* humidity sensing, such systems shall include controls capable of maintaining the average cooling-coil leaving air temperature at 53°F (12°C) or lower and shall include devices and controls capable of maintaining each *HVAC zone* sensible temperature setpoint using one of the following approaches:
   1. Variable *HVAC zone* supply airflow rate
   2. Variable return-air bypass flow around each cooling coil serving one or more *HVAC zones*
   3. Variable *HVAC zone* supply air reheat using site-recovered energy or site-solar energy
b. Where a 100% outdoor air system provides preconditioned outdoor air for ventilation, and where such systems do not include means for *HVAC zone* humidity sensing, the 100% outdoor air system shall include devices and controls capable of maintaining the average cooling-coil leaving air temperature at 53°F (12°C) or lower.
c. Where systems include means for *HVAC zone* relative humidity sensing, such systems shall include devices and controls capable of limiting *HVAC zone* relative humidity to not exceed 65% rh for more than 48 consecutive hours.

8.3.1.4.2 Direct Evaporative Cooling. Direct evaporative cooling systems shall include devices and controls capable of limiting *HVAC zone* relative humidity to not exceed 65% rh for more than 48 consecutive hours.

~~8.3.1.4~~ 8.3.1.5 Environmental Tobacco Smoke

Add new Section 10.3.2.1.4.7 and renumber existing section as follows.

10.3.2.1.4.7 Moisture Measurement. The plan for operation shall document procedures for implementing a regular humidity-sensor monitoring program after building occupancy. Such procedures shall include provisions for the following:

a. For systems complying with Section 8.3.1.4 using relative humidity sensors to determine *HVAC zone* relative humidity directly, or using dew-point and zone temperature sensors to determine *HVAC zone* relative humidity indirectly, the relative humidity determined shall be checked annually and compared to the relative humidity established using methods described in ASHRAE Standard 111.
b. Sensors shall be cleaned or repaired and recalibrated as necessary to ensure that sensor measurements are within 10% of actual relative humidity measurements.

10.3.2.1.4.~~7~~8 Document all …

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FOREWORD

Addendum i reorganizes the roof heat island mitigation section and adds new provisions for vegetated terrace and roofing systems relative to plant selection, growing medium, roof membrane protection, and clearances. In addition, provisions for the operation and maintenance of vegetated roofs have been added to Section 10.

There are also additional language changes to clarify how to enforce the standard and ensure there are no potential conflicts with the International Fire Code.

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 i to Standard 189.1-2014

Revise Section 5.3.5.3 as follows.

5.3.5.3 *Roofs*. This section applies to the building and covered parking *roof* surfaces for *building projects* in *Climate Zones* 1, 2, and 3. A minimum of 75% of the ~~entire~~ *roof* surface ~~not used for *roof* penetrations and associated equipment; *on-site renewable energy systems*, such as photovoltaics or solar thermal energy collectors, including necessary *space* between rows of panels or collectors; portions of the *roof* used to capture heat for building energy technologies; rooftop decks or walkways; or vegetated (green) roofing systems~~ shall be covered with products that

a. have a minimum three-year-aged *SRI* of 64 for a low-sloped *roof* in accordance with Section 5.3.5.4. A low-sloped *roof* has a slope of less than or equal to 2:12.
b. have a minimum three-year-aged *SRI* of 15 for a steep-sloped *roof* in accordance with Section 5.3.5.4. A steep-sloped *roof* has a slope of more than 2:12.

The area occupied by one or more of the following shall be excluded from the calculation to determine the roof surface area required to comply with this section:

a. *Roof* penetrations and associated equipment.
b. *On-site renewable energy systems*, including photovoltaics, solar thermal energy collectors, and required access around the panels or collectors.
c. Portions of the *roof* used to capture heat for building energy technologies.
d. *Roof* decks and rooftop walkways.
e. Vegetated terrace and roofing systems complying with Section 5.3.5.5.

Exceptions to 5.3.5.3:

1. *Building projects* where an annual energy analysis simulation demonstrates that the total annual building energy cost and total annual CO_2e, as calculated in accordance with Sections 7.5.2 and 7.5.3, are both a minimum of 2% less for the proposed *roof* than for a *roof* material complying with the *SRI* requirements of Section 5.3.5.3~~(a)~~.
2. *Roofs* used to shade or cover parking and *roofs* over *semiheated spaces*, provided that they have a minimum initial *SRI* of 29. A default *SRI* value of 35 for new concrete without added color pigment is allowed to be used instead of measurements.

Add new Section 5.3.5.5 as follows.

5.3.5.5 Vegetated Terrace and Roofing Systems. Vegetated terrace and roofing systems, where provided in accordance with Section 5.3.5.3, shall comply with the following:

a. All plantings shall be capable of withstanding the microclimate conditions of the vegetated area, including but not limited to wind, precipitation, and temperature. Plants shall be selected and placed to provide foliage coverage of not less than 50% of designed area of vegetation, based on the anticipated plant growth within two years of the issuance of the final certificate of occupancy. Construction documents shall be submitted that show the planting location and anticipated two-year foliage coverage of the plantings. Duplicate coverage shall not be credited where multiple plants cover the same area. *Invasive plants* shall not be planted.
b. The growing medium shall be designed for the physical conditions and local climate to support the plants selected. The planting design shall include measures to protect the growing medium until the plants are established. The maximum wet weight and water holding capacity of a growing medium shall be determined in accordance with ASTM E 2399.
c. Nonvegetated clearances and borders shall be provided in accordance with the International Fire Code, Section 317.
d. Plantings shall be capable of maintaining the function of the vegetated roof or terrace as required by Section 10.3.2.1.1.
e. Irrigation of the vegetated roofs and terraces shall comply with Section 6.3.2.4.
f. Installation of plantings shall be in accordance with the roof covering manufacturer's installation instructions.

Revise Section 10.3.2.1.1 as follows.

10.3.2.1.1 *Site* Sustainability. A *site* sustainability portion of the plan for operation shall be developed and shall contain the following provisions:

a. ~~When~~ Where trees and vegetation are used to comply with the shade requirements of Section ~~5.3.4~~ 5.3.5, the plan for operation shall include the maintenance procedures needed to maintain healthy vegetation growth. The plan shall also outline the procedures for replacing any vegetation used to comply with the provisions in Section 5.

b. For *roof* surface materials selected to comply with the requirements of Section ~~5.3.4.3~~ 5.3.5.3, the plan for operation shall include the maintenance procedures for keeping the *roof* surfaces cleaned in accordance with manufacturer's recommendations.

c. For vegetated terrace and roofing systems selected to comply with Section 5.3.5.5, the plan for operation shall include the maintenance procedures needed to maintain healthy vegetation growth and roof membrane system. The plan shall also outline the procedures for replacing any vegetation used to comply with the provisions in Section 5.

Add the following reference Section 11.

Reference	Title	Section
ASTM E 2399-11	Standard Test Method for Maximum Media Density for Dead Load Analysis of Vegetative (Green) Roof Systems	5.3.5.5

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FOREWORD

Addendum j clarifies the exceptions contained under Section 5.3.1.2, "Prohibited Development Activity," which includes provisions for fish/wildlife habitat conservation areas and wetlands. The current language allows for any type of planting to be used, which was not the intent. Rather, the intent was to provide an exception for plantings that provide for habitat enhancement or the restoration of ecological functions of the area.

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 j to Standard 189.1-2014

Revise Section 5.3.1.2 as follows.

5.3.1.2 Prohibited Development Activity. There shall be no *site* disturbance or development of the following:

a. Previously undeveloped land having an elevation lower than 5 ft (1.5 m) above the elevation of the 100-year flood, as defined by USFEMA.

Exceptions to Section 5.3.1.2(a):

1. Development of *low-impact trails* shall be allowed anywhere within a flood zone.
2. Development of building structures shall be allowed in alluvial "AO" designated flood zones, provided that such structures include engineered floodproofing up to an elevation that is at least as high as the minimum lowest floor elevation determined by the *authority having jurisdiction* (*AHJ*), and provided that the *site* includes drainage paths constructed to guide floodwaters around and away from the structures.

b. Land within 150 ft (50 m) of any *fish and wildlife habitat conservation area.*

Exceptions to Section 5.3.1.2(b):

1. Development of *low-impact trails* shall be allowed, provided that such trails are located at least 15 ft (4.5 m) from the area.
2. *Site* disturbance or development shall be allowed~~, provided that it involves plantings or~~ for habitat enhancement measures ~~of the functions and values of the area~~.

c. Land within 100 ft (35 m) of any *wetland.*

Exceptions to Section 5.3.1.2(c):

1. Development of *low-impact trails* shall be allowed, provided that such trails are located at least 15 ft (4.5 m) from the *wetland*.
2. *Site* disturbance or development shall be allowed~~, provided that it involves plantings or~~ for habitat enhancement measures or for restoration of the functions ~~and values~~ of the *wetland*.

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FOREWORD

Addendum k is based in part on a comparison of 189.1 with the 2015 International Green Construction Code (IgCC). The change from 10% to 5% in the U-, C- and F- factors and in the SHGC is based on it being more practical to design and build, while having only a limited impact on energy use. The proposed change also adds skylights to the requirements for fenestration SHGC and U-factors to implement a more consistent technical approach to the issue. In addition, the SHGC for fenestration is proposed to be reduced in Climate Zones 1 through 3 in addition to Climate Zones 4 through 8, which were already included. This change reflects the fact that a 5% reduction is not very difficult to achieve and need not be restricted by climate zone.

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 k to Standard 189.1-2014

Revise Section 7.4.2.1 as follows.

7.4.2.1 *Building Envelope* Requirements. The *building envelope* shall comply with the requirements in Tables 5.5-1 through 5.5-8 of ANSI/ASHRAE/IES Standard 90.1, with the following modifications to values in each table. For the opaque elements, each U-factor, C-factor, and F-factor in Tables 5.5-4 through 5.5-8 shall be reduced by ~~ten percent~~5%. The "Insulation Min. R-Value" column in Tables 5.5-4 through 5.5-8 of ANSI/ ASHRAE/IES Standard 90.1 shall not apply. For *vertical fenestration* and *skylights*, each U-factor shall be reduced by ~~ten percent~~5%. For *skylights* and east-oriented and west-oriented *vertical fenestration*, each *solar heat gain coefficient* (*SHGC*) in Tables 5.5-1 ~~4~~ through 5.5-8 shall be reduced by ~~ten~~ 5% ~~percent~~.

Informative Notes:

1. U-factors, C-factors, and F-factors for many common assemblies are provided in ANSI/ASHRAE/IES Standard 90.1, Normative Appendix A.
2. Section 5.3.5.3 of this standard includes additional provisions related to *roofs*.

Exceptions to 7.4.2.1:

1. The U-factor, C-factor, or F-factor shall not be modified where the corresponding R-value requirement is designated as "NR" (no requirement) in ANSI/ASHRAE/IES Standard 90.1 Tables 5.5-4 through 5.5-8.
2. The *SHGC* shall not be modified where the *SHGC* requirement is designated as "NR" (no requirement) in ANSI/ASHRAE/IES Standard 90.1 5.5-1 4 through 5.5-8.
3. *Spaces* that meet the requirements of Section 8.4.1, regardless of *space* area, are exempt from the *SHGC* criteria for *skylights*.

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FOREWORD

Addendum l revises the title and scope of Section 9 in order to improve clarity and more accurately describe the content of the section.

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 l to Standard 189.1-2014

Revise the Section 9 title as follows.

9. ~~THE BUILDING'S IMPACT ON THE ATMOSPHERE,~~ MATERIALS~~,~~ AND RESOURCES

Revise Section 9.1 as follows.

9.1 Scope. This section specifies requirements ~~for the building's impact on the atmosphere, materials, and resources, including construction waste management, refrigerants, storage and collection of recyclables, and reduced impact materials.~~related to the environmental and human health impacts of materials, including resource conservation, reduced life-cycle impacts of building materials, impacts on the atmosphere, product transparency, and waste management.

(This foreword 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.)

FOREWORD

Addendum m augments provisions for connection of on-site walkways and bicycle paths to street sidewalks and bicycle paths. Facilitating pedestrian and bicycle connectivity reduces the need to drive short distances, thereby reducing transportation impacts such as air pollution and greenhouse gas emissions. In addition, such connectivity can improve building occupant productivity by providing alternative means of transportation, while improving health through physical activity.

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 m to Standard 189.1-2014

Modify Section 5.3.7.1.1 as follows.

5.3.7.1 Pedestrian and ~~Transit~~ Bicycle Connectivity

5.3.7.1.1 Pedestrian Walkways. Each primary *building entrance* shall be provided with a pedestrian walkway that extends to either a *public way* or a transit stop. Walkways ~~across parking lots~~ shall be not less than 5 ft (1.5 m) in width and shall be clearly delineated.

A public-use walkway shall be provided along the length of the adjoining public way frontage of the building project site and such walkways shall connect to adjacent public-use walkways.

5.3.7.1.2 Bicycle Paths. On-site bicycle paths shall be designed to connect bicycle parking areas to existing and planned off-site bicycle path(s) adjacent to the building project.

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FOREWORD

Addendum n clarifies footnote b to Table 7.5.2A of Standard 189.1-2014. This footnote provides a method to adjust the percent reduction for buildings with unregulated energy cost exceeding 35% of the total energy cost. This change clarifies that the adjustment is to be made on the basis of energy cost, not energy use.

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 n to Standard 189.1-2014

Modify Section 3 as follows.

regulated energy use: see ANSI/ASHRAE/IES Standard 90.1.

unregulated energy use: see ANSI/ASHRAE/IES Standard 90.1.

Modify footnote (b) to Table 7.5.2A as follows.

TABLE 7.5.2A Performance Option A: Energy Cost and CO_2e Reductions

Building Type	Percent Reduction
Apartments	10%
Restaurants	5%
Lodging	12%
Semiheated Warehouses[a]	45%
Other[b]	24%

a. Conditioned warehouses shall use the "Other" category.

b. When the cost of modeled ~~energy use~~ *unregulated energy use* ~~that is not regulated energy use~~ exceeds 35% of the total proposed building energy ~~use~~ cost, the percent reduction shall be calculated using the following equation: Percent reduction = 0.55 – 0.99 × percent ~~nonregulated energy~~ *unregulated energy use* cost. The percent reduction shall be no lower than 5%.

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FOREWORD

This addendum proposes revisions to the existing purpose and scope of the standard to clarify the intended purposes of the standard and its application and to better reflect revisions to the standard that are being considered by the committee.

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 o to Standard 189.1-2014

Modify Sections 1 and 2 as follows.

1. PURPOSE

1.1 The purpose of this standard is to provide minimum requirements for the siting, design, construction, and plans for operation of *high-performance green buildings* to

a. ~~balance environmental responsibility, resource efficiency, occupant comfort and well being, and community sensitivity;~~ reduce emissions from buildings and building systems, enhance building occupant health and comfort, conserve water resources, protect local biodiversity and ecosystem services, promote sustainable and regenerative materials cycles, enhance building quality, and enhance resilience to natural, technological, and human-caused hazards; and
b. support the goal of development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

1.2 This standard is intended to provide the technical basis of mandatory building codes and regulations for *high-performance green buildings* that are broadly adoptable by national and local jurisdictions.

2. SCOPE

2.1 This standard ~~provides minimum criteria~~ contains requirements that

a. apply to the following ~~elements of~~ *building projects*:
   1. New buildings and their systems.
   2. New portions of buildings and their systems.
   3. New systems and equipment in existing buildings.
   4. Relocated existing buildings and temporary structures where specified in this standard.
b. address *site* sustainability, water use efficiency, energy efficiency, indoor environmental quality (IEQ), ~~and the building's impact on the atmosphere,~~ materials~~,~~ and resources, and construction and plans for operation.

2.2 The provisions of this standard do not apply to

a. single-family houses, multifamily structures of three stories or fewer above grade, manufactured houses (mobile homes) and manufactured houses (modular), and
b. ~~buildings~~ *building projects* that use none of the following: electricity, fossil fuel, or water.

2.3 The requirements in t~~T~~his standard shall not be used to circumvent any applicable safety, health, or environmental requirements.

(This foreword 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.)

FOREWORD

Addendum p adds requirements for water-bottle filling stations, which are intended to improve water efficiency and sanitation of public drinking water and reduce the environmental effects of plastic bottles.

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 p to Standard 189.1-2014

Add the following to Section 3.

water-bottle filling station: a plumbing fixture or fixture fitting that is controlled by the user for the sole intended purpose of dispensing potable water into a personal drinking water bottle. Such fixtures and fittings are connected to the potable water distribution system of the premises and can be stand-alone fixtures or integrated with another fixture.

Add the following to Section 6.3.2.1, "Plumbing Fixtures and Fittings."

j. Water-bottle filling stations shall be an integral part of, or shall be installed adjacent to, not less than 50% of all drinking fountains installed indoors on the premises.

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FOREWORD

Addendum q to Standard 189.1 was developed in response to the update of ASHRAE Standard 169-2013, Climatic Data for Building Design Standards*. Standard 169-2013 includes more-recent weather data (resulting in changes in climate zone assignments for some locations, including approximately 10% of the 3000 counties in the United States) and the creation of a new Climate Zone 0. Per this addendum, Standard 189.1 now references ASHRAE/IES Standard 90.1 and Standard 169 for climatic data and includes criteria for Climate Zone 0.*

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 q to Standard 189.1-2014

Add new section 4.1.4 as shown (I-P and SI).

4.1.4 Reference Standard Reproduction Annexes. The reference standard reproduction annexes contain material that is cited in this standard but that is contained in another standard. The reference standard reproduction annexes are not part of this standard but are included in its publication to facilitate its use.

Revise Section 5.3.5.3 as shown (I-P and SI).

5.3.5.3 ***Roofs*****.** This section applies to the building and covered parking *roof* surfaces for *building projects* in *Climate Zones* 0, 1, 2, and 3. A minimum of 75% of the entire *roof* surface not used for *roof* penetrations and associated equipment; *on-site renewable energy systems*, such as photovoltaics or solar thermal energy collectors, including necessary *space* between rows of panels or collectors; portions of the *roof* used to capture heat for building energy technologies; rooftop decks or walkways; or vegetated (green) roofing sys-

Revise Section 7.4.2.1 as shown (I-P and SI).

7.4.2.1 ***Building Envelope*** **Requirements.** The *building envelope* shall comply with the requirements in Tables 5.5-0~~1~~ through 5.5-8 of ANSI/ASHRAE/IES Standard 90.1, with the following modifications to values in each table. For the opaque elements, each U-factor, C-factor, and F-factor in Tables 5.5-4 through 5.5-8 shall be reduced by ten percent. The "Insulation Min. R-Value" column in Tables 5.5-4 through 5.5-8 of ANSI/ ASHRAE/IES Standard 90.1 shall not apply. For *vertical fenestration*, each U-factor shall be reduced by ten percent. For east-oriented and west-oriented *vertical fenestration*, each *solar heat gain coefficient* (*SHGC*) in Tables 5.5-4 through 5.5-8 shall be reduced by ten percent.

Revise Section Revise 7.4.2.5 as shown (I-P and SI).

7.4.2.5 Permanent Projections. For *Climate Zones* ~~1~~0 through 5, the *vertical fenestration* on the west, south, and east shall be shaded by permanent projections that have an area-weighted average *projection factor* (*PF*) of not less than 0.50. The building is allowed to be rotated up to 45 degrees to the nearest cardinal orientation for purposes of calculations and showing compliance.

Revise Table 7.4.3.3 as shown (I-P and SI).

Revise Section 7.4.3.7.2 as shown (I-P and SI).

7.4.3.7.2 Kitchen/dining facilities with total kitchen hood exhaust airflow rate greater than 2000 cfm shall comply with at least one of the following:

[. . .]

d. In *Climate Zones* 0B, 1B, 2B, 3B, 4B, 5B, 6B, 7B, and 8B, when *makeup air* is uncooled or cooled without the use of *mechanical cooling*, the capacity of any nonmechanical *cooling* system(s) (for example, natural cooling or evaporative cooling) shall be demonstrated to be no less than the system capacity of a *mechanical cooling* system(s) necessary to meet the same loads under design conditions.

[. . .]

Revise Table 8.4.1.2 as shown (I-P and SI).

Revise Section 11 as shown (I-P and SI).

TABLE 7.4.3.3 Minimum System Size for which an Economizer is Required

Climate Zones	Cooling Capacity for which an Economizer is Required[a]
0A, 0B, 1A, 1B	No economizer requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	≥33,000 Btu/h (9.7 kW)[a]

a. Where economizers are required, the total capacity of all systems without economizers shall not exceed 480,000 Btu/h (140 kW) per building or 20% of the building's air economizer capacity, whichever is greater.

TABLE 8.4.1.2 Minimum *Sidelighting* Effective Aperture

Climate Zone	Minimum *Sidelighting* Effective Aperture
0, 1, 2, 3A, 3B	0.10
3C, 4, 5, 6, 7, 8	0.15

7. NORMATIVE REFERENCES

Section numbers indicate where the reference occurs in this document.

Reference	Title	Section
ASHRAE **1791 Tullie Circle NE** **Atlanta, GA 30329, United States** **1-404-636-8400; www.ashrae.org**		
[. . .]		
ANSI/ASHRAE Standard 169-~~2006~~2013	Climatic~~Weather~~ Data for Building Design Standards	
[. . .]		

Revise Appendix A as shown (I-P and SI).

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

NORMATIVE APPENDIX A
CLIMATE ZONES AND PRESCRIPTIVE *BUILDING ENVELOPE* AND DUCT INSULATION TABLES

Tables A-1 through A-3 appear twice in this appendix. The three tables are shown first with I-P units, followed by three tables with SI units.

For *climate zones*, see Section 5.1.4 of ANSI/ASHRAE/IES Standard 90.1 and ~~Normative Appendix A of~~ ANSI/ASHRAE Standard 169.

~~a. For the United States, the ANSI/ASHRAE Standard 169 *climate zone* map is reproduced below. A list of counties and their respective *climate zones* can be found in Table B1 in ANSI/ASHRAE Standard 169.~~

~~b. For Canada, see Table B2 in ANSI/ASHRAE Standard169.~~

~~c. For available international locations (outside the U.S. and Canada), see Table B3 in ANSI/ASHRAE Standard 169.~~

~~d. For locations not provided in Tables B2 or B3, see Table B4 (reproduced below) in ANSI/ASHRAE Standard 169 for the international climate zone definitions.~~

a. For locations in the United States and its territories, use ASHRAE Standard 169, Table B-1, "U.S. States by State and County," to determine the assigned climate zone and, where required, the assigned climate zone letter.

Informative Note: Reference Standard Reproduction Annex ASHRAE Standard 169 (included at the end of this document) contains an extraction of ASHRAE Standard 169, Figure B-1, "Climate Zone for United States Counties," (which is informative for Standards 90.1 and 189.1). ANSI/ASHRAE/ IES Standard 90.1 Reference Standard Reproduction Annex ASHRAE Standard 169 (included at the end of ANSI/ASHRAE/ IES Standard 90.1) contains an extraction of ASHRAE Standard 169, Table B-1, "U.S. States by State and County."

b. For locations in Canada that are listed in ASHRAE Standard 169, Table A-5, "Canada Stations and Climate Zones," use this table to determine the assigned climate zone number and, where required, the assigned climate zone letter. For locations in other international countries that are listed in ASHRAE Standard 169, Table A-6, "International Stations and Climate Zones," use this table to determine the required climate zone number and, where required, the assigned climate zone letter. For all international locations that are not listed either in ASHRAE Standard 169, Table A-5, "Canada Stations and Climate Zones," or Table A-6, "International Stations and Climate Zones," use ASHRAE Standard 169, Section A3, "Climate Zone Definitions," and Table A-3, "Thermal Climate Zone Definitions," to determine both the climate zone number and letter.

Informative Note: Reference Standard Reproduction Annex ASHRAE Standard 169 (included at the end of this document) contains an extraction of ASHRAE Standard 169, Section A3, "Climate Zone Definitions," and Table A-3, "Thermal Climate Zone Definitions.") ANSI/ASHRAE/IES Standard 90.1 Reference Standard Reproduction Annex ASHRAE Standard 169 (included at the end of ANSI/ASHRAE/IES Standard 90.1) contains an extraction of ASHRAE Standard 169, Table A-5, "Canada Stations and Climate Zones," and Table A-6, "International Stations and Climate Zones."

Delete U.S. climate zone map and accompanying table from Appendix A.

Revise Tables A-1, A-2, and A-3 as shown. Note: For simplicity, only the I-P versions of the tables are shown. The changes apply identically to the SI version.

TABLE A-1 (Supersedes Table A2.4.2 in ANSI/ASHRAE/IES Standard 90.1) *Single-Rafter Roof* Requirements (I-P)

	Minimum Insulation R-Value or Maximum Assembly U-Factor		
Climate Zone	***Nonresidential***	***Residential***	**Semiheated**
0, 1	R-38 U-0.029	R-38 + R10 ci U-0.022	R-19 U-0.055
2	R-38 + R10 ci U-0.022	R-38 + R10 ci U-0.022	R-19 U-0.055
3, 4, 5	R-38 + R10 ci U-0.022	R-38 + R10 ci U-0.022	R-30 U-0.036
6	R-38 + R10 ci U-0.022	R-38 + R10 ci U-0.022	R-38 U-0.029
7, 8	R-38 + R15 ci U-0.020	R-38 + R15 ci U-0.020	R-38 U-0.029

TABLE A-2 (Supersedes Table 6.8.2-1 in ANSI/ASHRAE/IES Standard 90.1)
Minimum Duct Insulation R-Value[a] Heating- and Cooling-Only Supply Ducts and Return Ducts (I-P)

	Duct Location						
Climate Zone	**Exterior**	**Ventilated Attic**	**Unvented Attic above Insulated Ceiling**	**Unvented Attic with *Roof* Insulation[a]**	**Unconditioned *Space*[b]**	**Indirectly Conditioned *Space*[c]**	**Buried**
Heating-Only Ducts							
0, 1, 2	None	None	None	None	None	None	None
3	R-6	None	None	None	R-6	None	None
4	R.6	None	None	None	R-6	None	None
5	R-8	R-6	None	None	R-6	None	R-6
6	R-8	R-8	R-6	None	R-6	None	R-6
7	R-10	R-8	R-8	None	R-6	None	R-6
8	R-10	R-10	R-8	None	R-8	None	R-8
Cooling-Only Ducts							
0, 1	R-6	R-8	R-10	R-6	R-6	None	R-6
2	R-6	R-8	R-10	R-6	R-6	None	R-6
3	R-6	R-8	R-8	R-6	R-3.5	None	None
4	R-3.5	R-6	R-8	R-3.5	R-3.5	None	None
5, 6	R-3.5	R-3.5	R-6	R-3.5	R-3.5	None	None
7, 8	R-1.9	R-3.5	R-3.5	R-3.5	R-3.5	None	None
Return Ducts							
~~1~~0 to 8	R-6	R-6	R-6	None	None	None	None

a. Insulation R-values, measured in (h·ft2·°F)/Btu, are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and possible surface condensation. Where exterior *walls* are used as plenum *walls*, *wall* insulation shall be as required by the most restrictive condition of this table or Section 7.4.2. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F at the installed thickness.

b. Includes crawl *spaces*, both ventilated and nonventilated.

c. Includes return air plenums with or without exposed *roofs* above.

TABLE A-3 (Supersedes Table 6.8.2-2 in ANSI/ASHRAE/IES Standard 90.1)
Minimum Duct Insulation R-Value[a] Combined Heating and Cooling Supply Ducts and Return Ducts (I-P)

	Duct Location						
Climate Zone	**Exterior**	**Ventilated Attic**	**Unvented Attic above Insulated Ceiling**	**Unvented Attic with *Roof* Insulation[a]**	**Unconditioned *Space*[b]**	**Indirectly *Conditioned Space*[c]**	**Buried**
Supply Ducts							
0, 1	R-8	R-8	R-10	R-6	R-6	None	R-6
2	R-8	R-8	R-8	R-6	R-8	None	R-6
3	R-8	R-8	R-8	R-6	R-8	None	R-6
4	R-8	R-8	R-8	R-6	R-8	None	R-6
5	R-8	R-8	R-8	R-3.5	R-8	None	R-6
6	R-10	R-8	R-8	R-3.5	R-8	None	R-6
7	R-10	R-8	R-8	R-3.5	R-8	None	R-6
8	R-10	R11	R11	R-3.5	R-8	None	R-8
Return Ducts							
~~1~~0 to 8	R-6	R-6	R-6	None	None	None	None

a. Insulation R-values, measured in $(h \cdot ft^2 \cdot °F)/Btu$, are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and possible surface condensation. Where exterior *walls* are used as plenum *walls*, *wall* insulation shall be as required by the most restrictive condition of this table or Section 7.4.2. Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F at the installed thickness.

b. Includes crawl *spaces*, both ventilated and non-ventilated.

c. Includes return air plenums with or without exposed *roofs* above.

Add new Table E-0 for Climate Zone 0 of Informative Appendix E as shown (I-P and SI).

TABLE E-0 (Supersedes Table 5.5-0 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope Requirements* for *Climate Zone 0* (A,B)* (I-P)**

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Roofs						
Insulation entirely above deck	U-0.048	R-20 c.i.	U-0.039	R-25 c.i.	U-0.218	R-3.8 c.i.
Metal building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
Attic and other	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
Walls, above grade						
Mass	U-0.580	NR	U-0.151[b]	R-5.7 c.i.[b]	U-0.580	NR
Metal building	U-0.094	R-0 + R-9.8 c.i.	U-0.094	R-0 + R-9.8 c.i.	U-0.352	NR
Steel framed	U-0.124	R-13	U-0.124	R-13	U-0.352	NR
Wood framed and other	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
Wall, below grade						
Below-grade *wall*	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.322	NR	U-0.322	NR	U-0.322	NR
Steel joist	U-0.350	NR	U-0.350	NR	U-0.350	NR
Wood framed and other	U-0.282	NR	U-0.282	NR	U-0.282	NR
Slab-on-grade floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-1.450		U-0.500		U-1.450	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min VT/ *SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min VT/ *SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min VT/ *SHGC***
Vertical fenestration 0% to 40% of *wall*	(for all frame types)			(for all frame types)			(for all frame types)		
Nonmetal framing, all	U-0.29	E,W, & S-0.25 N-0.35	1.10	U-0.29	E,W, & S-0.25 N-0.35	1.10	U-0.84	NR	NR
Metal framing, fixed	U-0.45			U-0.45			U-1.08		
Metal framing, operable	U-0.59			U-0.59			U-1.08		
Metal framing, entrance door	U-0.75			U-0.75			U-0.99		
Skylight, 0% to 3% of *roof*									
All types	U-0.75	0.35	NR	U-0.75	0.35	NR	U-1.80	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1-2013, Section 3.2), FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2.5), *Ls = liner system* (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2).

b. Exception to ANSI/ASHRAE/IES Standard 90.1-2013, Section 5.5.3.2, applies for mass *walls* above grade.

TABLE E-0 (Supersedes Table 5.5-0 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for Climate Zone 0 (A,B)* (SI)**

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Roofs						
Insulation entirely above deck	U-0.273	R-3.5 c.i.	U-0.220	R-4.4 c.i.	U-1.240	R-0.7 c.i.
Metal building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.653	R-1.8
Attic and other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
Walls, above grade						
Mass	U-3.293	NR	U-0.857[b]	R-1.0 c.i.[b]	U-3.293	NR
Metal building	U-0.533	R-0 + R-1.7 c.i.	U-0.533	R-0 + R-1.7 c.i.	U-1.998	NR
Steel framed	U-0.705	R-2.3	U-0.705	R-2.3	U-1.998	NR
Wood framed and other	U-0.504	R-2.3	U-0.504	R-2.3	U-1.660	NR
Wall, below grade						
Below-grade *wall*	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors						
Mass	U-1.825	NR	U-1.825	NR	U-1.825	NR
Steel joist	U-1.986	NR	U-1.986	NR	U-1.986	NR
Wood framed and other	U-1.599	NR	U-1.599	NR	U-1.599	NR
Slab-on-grade floors						
Unheated	F-1.264	NR	F-1.264	NR	F-1.264	NR
Heated	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm
Opaque doors						
Swinging	U-3.975		U-2.839		U-3.975	
Nonswinging	U-8.233		U-2.839		U-8.233	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min VT/ *SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min VT/ *SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min VT/ *SHGC***
Vertical fenestration 0% to 40% of *wall*	(for all frame types)			(for all frame types)			(for all frame types)		
Nonmetal framing, all	U-1.64	E,W, & S-0.25 N-0.35	1.10	U-1.64	E,W, & S-0.25 N-0.35	1.10	U-4.75	NR	NR
Metal framing, fixed	U-2.56			U-2.56			U-6.13		
Metal framing, operable	U-3.32			U-3.32			U-6.13		
Metal framing, entrance door	U-4.24			U-4.24			U-5.62		
Skylight, 0% to 3% of *roof*									
All types	U-4.26	0.35	NR	U-4.26	0.35	NR	U-10.22	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1-2013, Section 3.2), FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2.5), *Ls = liner system* (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2).

b. Exception to ANSI/ASHRAE/IES Standard 90.1-2013, Section 5.5.3.2, applies for mass *walls* above grade.

c. For locations in *Climate Zone* 1 with a cooling design temperature of 35°C and greater, the maximum U-factors for *vertical fenestration* shall be 10% lower than those in ANSI/ASHRAE/IES Standard 90.1-2013, Section 5.5.4.3.

Revise Table E-1 as shown (I-P and SI). Note: For simplicity, only the I-P version of the table is shown. The changes apply identically to the SI version.

TABLE E-1 (Supersedes Table 5.5-1 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 1 (A,B)* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Roofs						
Insulation entirely above deck	U-0.048	R-20 c.i.	U-0.039	R-25 c.i.	U-0.218	R-3.8 c.i.
Metal building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
Attic and other	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
Walls, above grade						
Mass	U-0.580	NR	U-0.151[b]	R-5.7 c.i.[b]	U-0.580	NR
Metal building	U-0.094	R-0 + R-9.8 c.i.	U-0.094	R-0 + R-9.8 c.i.	U-0.352	NR
Steel framed	U-0.124	R-13	U-0.124	R-13	U-0.352	NR
Wood framed and other	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
Wall, below grade						
Below-grade *wall*	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.322	NR	U-0.322	NR	U-0.322	NR
Steel joist	U-0.350	NR	U-0.350	NR	U-0.350	NR
Wood framed and other	U-0.282	NR	U-0.282	NR	U-0.282	NR
Slab-on-grade floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-1.450		U-0.500		U-1.450	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical fenestration, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.45[c]	E,W, &S-0.25 N-0.35	1.10	U-0.45[c]	E,W, &S-0.25 N-0.35	1.10	U-0.84	NR	NR
Metal framing, fixed	U-0.51[c]			U-0.51[c]			U-1.08		
Metal framing, operable	U-0.59[c]			U-0.59[c]			U-1.08		
Metal framing, entrance door	U-0.99[c]			U-0.99[c]			U-0.99[c]		
Skylight, 0% to 3% of *roof*		0.35			0.35				
All types	U-0.75		NR	U-0.75		NR	U-1.80	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1-2013, Section 3.2), FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2.5), *Ls = liner system* (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1-2013, Section A2.3.2).

b. Exception to ANSI/ASHRAE/IES Standard 90.1-2013, Section 5.5.3.2, applies for mass *walls* above grade.

~~c. For locations in *Climate Zone* 1 with a cooling design temperature of 95°F and greater, the maximum U-factors for *vertical fenestration* shall be 10% lower than those in ANSI/ASHRAE/IES Standard 90.1-2013, Section 5.5.4.3.~~

Add new Appendix XX as shown. Final order of appendices will be determined upon publication of the next edition of the standard. "XX" is used here as a placeholder.

(This appendix contains normative material from an existing ASHRAE standard that is cited in this standard. The reference standard reproduction appendix is not part of this standard; its inclusion is merely informative. It is included here to facilitate use of this standard.)

INFORMATIVE APPENDIX XX
REFERENCE STANDARD REPRODUCTION ANNEX
ASHRAE STANDARD 169

This reference standard reproduction annex contains an extraction from ASHRAE Standard 169. Table XX-1 lists where the reference to the source material appears in addendum q, and whether or not the information published in Standard 169 is normatively or informatively referenced in addendum q.

TABLE XX-1 ASHRAE Standard 169 Material

Standard 189.1 Subsection No.	ASHRAE Standard 169 Material	Status in Standard 189.1
Appendix A	Figure B-1, Climate Zones for United States Counties	Informative
Appendix A	Section A3 Climate Zone Definitions	Normative
Appendix A	Table A-3 Thermal Climate Zone Definitions	Normative

(This foreword 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.)

FOREWORD

Since 1989, ASHRAE Standard 90.1 has required testing of 25% of ductwork that is designed for above 3 in. pressure class. In the intervening years, limits on fan power in Standard 90.1 have led to much lower-pressure duct system designs, which has resulted in testing a much lower percentage of new duct systems. Addendum r lowers the threshold to include 3 in. pressure class ducts, which are common upstream of VAV boxes.

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 r to Standard 189.1-2014

Add new Section 7.4.3.3 as follows, and renumber existing Section 7.4.3.3 and the remainder of Section 7.4.3.

7.4.3.3 Duct Leakage Tests. Leakage tests shall comply with the requirements in Section 6.4.4.2.2 of ANSI/ASHRAE/IES 90.1, with the following modification. Ductwork that is designed to operate at static pressures in excess of 2 in. of water (500 Pa), and all ductwork located outdoors, shall be leak-tested according to industry-accepted test procedures.

(This foreword 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.)

FOREWORD

This addendum removes the performance option for water use and moves the prescriptive option into the mandatory section.

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 s to Standard 189.1-2014

Modify Section 6 as follows (I-P and SI units).

6. WATER USE EFFICIENCY

6.1 Scope. This section specifies requirements for *potable water* and *nonpotable water* use efficiency, both for the *site* and for the building, and water monitoring.

6.2 Compliance. ~~The water systems shall comply with Section 6.3, "Mandatory Provisions," and either~~ All provisions of Section 6 are mandatory provisions.

~~a. Section 6.4, "Prescriptive Option," or~~
~~b. Section 6.5, "Performance Option."~~

~~*Site* water use and building water use are not required to use the same option, i.e., prescriptive or performance, for demonstrating compliance.~~

6.3 Mandatory Provisions

6.3.1 Site Water Use Reduction

6.3.1.1 Landscape Design. A minimum of 60% of the area of the *improved landscape* shall be in *biodiverse planting* of *native plants* and *adapted plants* other than *turfgrass*.

Exception: The area of dedicated athletic fields, golf courses, and driving ranges shall be excluded from the calculation of the *improved landscape* for schools, *residential* common areas, or public recreational facilities.

6.3.1.2 Irrigation. For golf courses and driving ranges, only municipally reclaimed water or *alternate on-site sources of water* shall be used to irrigate the landscape. For other landscaped areas, not greater than one-third of *improved landscape* area is allowed to be irrigated with *potable water*. The area of dedicated athletic fields shall be excluded from the calculation of the *improved landscape* for schools, *residential* common areas, and public recreational facilities. All other irrigation shall be provided from *alternate on-site sources of water* or municipally reclaimed water.

Exception: *Potable water* is allowed to be temporarily used on such newly installed landscape for the *landscape establishment period*. The amount of *potable water* allowed to be applied to the newly planted areas during the temporary *landscape establishment period* shall not exceed 70% of ET_o for *turfgrass* and 55% of ET_o for other plantings. Where municipally-reclaimed water is available at a water main within 200 ft (60 m) of the project *site*, such water shall be used instead of *potable water* during the *landscape establishment period*. After the *landscape establishment period* has expired, all irrigation water use shall comply with the requirements established elsewhere in this standard.

6.3.1.2.1 Irrigation System Design. *Hydrozoning* of automatic irrigation systems to water different plant materials such as *turfgrass* versus shrubs is required. Landscaping sprinklers shall not be permitted to spray water directly on a building and within 3 ft (1 m) of a building.

6.3.1.~~3~~2.2 Controls. Any irrigation system for the project *site* shall be controlled by a qualifying *smart controller* that uses *ET* and weather data to adjust irrigation schedules and that complies with the minimum requirements or an on-site rain or moisture sensor that automatically shuts the system off after a predetermined amount of rainfall or sensed moisture in the soil. Qualifying *smart controllers* shall meet the minimum requirements as listed below when tested in accordance with IA *SWAT* Climatological Based Controllers 8th Draft Testing Protocol. *Smart controllers* that use *ET* shall use the following inputs for calculating appropriate irrigation amounts:

a. *Irrigation adequacy*—80% minimum ET_c.
b. *Irrigation excess*—not to exceed 10%.

Exception to 6.3.1.~~3~~2.2: A temporary irrigation system used exclusively for the establishment of new landscape shall be exempt from this requirement. Temporary irrigation systems shall be removed or permanently disabled at such time as the *landscape establishment period* has expired.

6.3.2 Building Water Use Reduction

6.3.2.1 Plumbing Fixtures and Fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements, as shown in Table 6.3.2.1:

a. **Water closets (toilets)—flushometer valve type.** For single flush, maximum flush volume shall be determined in accordance with ASME A112.19.2/CSA B45.1 and shall not exceed 1.28 gal (4.8 L). For dual-flush, the full flush volume shall not exceed 1.28 gal (4.8 L) per flush. Dual-flush fixtures shall also comply with the provisions of ASME A112.19.14.
b. **Water closets (toilets)—tank-type.** Tank-type water closets shall be certified to the performance criteria of the USEPA WaterSense Tank-Type High-Efficiency Toilet Specification and shall have a maximum flush volume of 1.28 gal (4.8 L). Dual-flush fixtures shall also comply with the provisions of ASME A112.19.14.
c. **Urinals.** Maximum flush volume when determined in accordance with ASME A112.19.2/CSA B45.1-0.5 gal

TABLE 6.3.2.1 Plumbing Fixtures and Fittings Requirements

Plumbing Fixture	Maximum
Water closets (toilets)—flushometer valve type	Single flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—flushometer valve type	Effective dual flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—tank-type	Single flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—tank-type	Effective dual flush volume of 1.28 gal (4.8 L)
Urinals	Flush volume 0.5 gal (1.9 L)
Public lavatory faucets	Flow rate—0.5 gpm (1.9 L/min)
Public metering self-closing faucet	0.25 gal (1.0 L) per metering cycle
Residential bathroom lavatory sink faucets	Flow rate—1.5 gpm (5.7 L/min)
Residential kitchen faucets	Flow rate—1.8 gpm (6.8 L/min)*
Residential showerheads	Flow rate—2.0 gpm (7.6 L/min)
Residential shower compartment (stall) in *dwelling units* and guest rooms	Flow rate from all shower outlets total of 2.0 gpm (7.6 L/min)

(1.9 L). Flushing urinals shall comply with the performance criteria of the USEPA WaterSense Specification for Flushing Urinals. Non-water urinals shall comply with ASME A112.19.19 (vitreous china) or IAPMO Z124.9 (plastic) as appropriate.

d. **Public lavatory faucets.** Maximum flow rate—0.5 gpm (1.9 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1.

e. **Public metering self-closing faucet.** Maximum water use—0.25 gal (1.0 L) per metering cycle when tested in accordance with ASME A112.18.1/CSA B125.1.

f. ***Residential* bathroom lavatory sink faucets.** Maximum flow rate—1.5 gpm (5.7 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1. *Residential* bathroom lavatory sink faucets shall comply with the performance criteria of the USEPA WaterSense High-Efficiency Lavatory Faucet Specification.

g. ***Residential* kitchen faucets.** Maximum flow rate-1.8gpm (6.8L/min) when tested in accordance with ASME A112.18.1/CSA B125.1. Kitchen faucets shall be permitted to temporarily increase the flow greater than 1.8 gpm (6.8 L/min) but shall not exceed 2.2 gpm (8.3 L/min) and must automatically revert to the established maximum flow rate of 1.8 gpm (6.8 L/min) upon physical release of the activation mechanism or closure of the faucet valve.

h. ***Residential* showerheads.** Maximum flow rate—2.0 gpm (7.6 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1. Residential showerheads shall comply with the performance requirements of the USEPA WaterSense Specification for Showerheads.

i. ***Residential* shower compartment (stall) in *dwelling units* and guest rooms.** The allowable flow rate from all shower outlets (including rain systems, waterfalls, bodysprays, and jets) that can operate simultaneously shall be limited to a total of 2.0 gpm (7.6 L/min).

Exception to 6.3.2.1(i): Where the area of a shower compartment exceeds 2600 in.^{2} (1.7 m^2), an additional flow of 2.0 gpm (7.6 L/min) shall be permitted for each multiple of 2600 in.^{2} (1.7 m^2) of floor area or fraction thereof.

6.3.2.2 Appliances

a. Clothes washers and dishwashers installed within *dwelling units* shall comply with the ENERGY STAR Program Requirements for Clothes Washers and ENERGY STAR Program Requirements for Dishwashers. Maximum water use shall be as follows:

   1. Clothes washers—Maximum *water factor* of 5.4 gal/ft^3 of drum capacity (0.72 L/L of drum capacity).
   2. Dishwashers—Standard-size dishwashers shall have a maximum *water factor* of 3.8 gal/full operating cycle (14.3 L/full operating cycle). Compact sizes shall have a maximum water factor of 3.5 gal/full operating cycle (13.2 L/full operating cycle). Standard and compact size shall be defined by ENERGY STAR criteria.

   (See also the energy efficiency requirements in Section 7.4.7.3.)

b. Clothes washers installed in publicly accessible *spaces* (e.g., multifamily and hotel common areas) and coin-and card-operated clothes washers of any size used in laundromats shall have a maximum *water factor* of 4.0 gal/ft^3 of drum capacity normal cycle (0.53 L/L of drum capacity normal cycle). (See also the energy efficiency requirements in Section 7.4.7.3.)

c. Commercial dishwashers in commercial food-service facilities shall meet all ENERGY STAR requirements as listed in the Version 2.0 ENERGY STAR Program Requirements for Commercial Dishwashers.

6.3.2.3 HVAC Systems and Equipment

a. Once-through cooling with potable water is prohibited.

b. <u>The water being discharged from cooling towers for air-conditioning systems such as chilled-water systems shall be limited in accordance with method (1) or (2):</u>

1. For makeup waters having less than 200 ppm (200 mg/L) of total hardness expressed as calcium carbonate, by achieving a minimum of five *cycles of concentration*.
2. For makeup waters with more than 200 ppm (200 mg/L) of total hardness expressed as calcium carbonate, by achieving a minimum of 3.5 *cycles of concentration*.

Exception to 6.3.2.3(b): Where the total dissolved solids concentration of the discharge water exceeds 1500 mg (1500 ppm/L) or the silica exceeds 150 ppm (150 mg/L) measured as silicon dioxide before the above cycles of concentration are reached.

~~b~~c. Cooling towers and evaporative coolers shall be equipped with makeup and blowdown meters, conductivity controllers, and overflow alarms in accordance with the thresholds listed in Table 6.3.~~3A~~4B. Cooling towers shall be equipped with efficient drift eliminators that achieve drift reduction to a maximum of 0.002% of the recirculated water volume for counterflow towers and 0.005% of the recirculated water flow for cross-flow towers.

~~c~~d. Building projects located in regions where the ambient mean coincident wet-bulb temperature at 1% design cooling conditions is greater than or equal to 72°F (22°C) shall have a system for collecting condensate from air-conditioning units with a capacity greater than 65,000 Btu/h (19 kW), and the condensate shall be recovered for re-use.

6.3.2.4 Roofs

a. The use of *potable water* for *roof* spray systems to thermally condition the *roof* is prohibited.
b. The use of *potable water* for irrigation of vegetated (green) *roofs* is prohibited once plant material has been established. After the *landscape establishment period* is completed, the *potable water* irrigation system shall be removed or permanently disconnected.

6.3.2.5 Commercial Food Service Operations. Commercial food service operations (e.g., restaurants, cafeterias, food preparation kitchens, caterers, etc.)

a. shall use high-efficiency prerinse spray valves (i.e., valves that function at 1.3 gpm (4.9 L/min) or less and comply with a 26 second performance requirement when tested in accordance with ASTM F2324),
b. shall use dishwashers that comply with the requirements of the ENERGY STAR Program for Commercial Dishwashers,
c. shall use boilerless/connectionless food steamers that consume no more than 2.0 gal/h (7.5 L/h) in the full operational mode,
d. shall use combination ovens that consume not more than 10 gal/h (38 L/h) in the full operational mode,
e. shall use air-cooled ice machines that comply with the requirements of the ENERGY STAR Program for Commercial Ice Machines, and
f. shall be equipped with hands-free faucet controllers (foot controllers, sensor activated, or other) for all faucet fittings within the food preparation area of the kitchen and the dish room, including pot sinks and washing sinks.

6.3.2.6 Medical and Laboratory Facilities. Medical and laboratory facilities, including clinics, hospitals, medical centers, physician and dental offices, and medical and nonmedical laboratories of all types shall

a. use only water-efficient steam sterilizers equipped with (1) water-tempering devices that allow water to flow only when the discharge of condensate or hot water from the sterilizer exceeds 140°F (60°C) and (2) mechanical vacuum equipment in place of venturi-type vacuum systems for vacuum sterilizers.
b. use film processor water recycling units where large frame x-ray films of more than 6 in. (150 mm) in either length or width are processed. Small dental x-ray equipment is exempt from this requirement.
c. use digital imaging and radiography systems where the digital networks are installed.
d. use a dry-hood scrubber system or, if the applicant determines that a wet-hood scrubber system is required, the scrubber shall be equipped with a water recirculation system. For perchlorate hoods and other applications where a hood wash-down system is required, the hood shall be equipped with self-closing valves on those wash-down systems.
e. use only dry vacuum pumps unless fire and safety codes for explosive, corrosive, or oxidative gases require a liquid ring pump.
f. use only efficient water treatment systems that comply with the following criteria:
   1. For all filtration processes, pressure gages shall determine and display when to backwash or change cartridges.
   2. For all ion exchange and softening processes, recharge cycles shall be set by volume of water treated or based upon conductivity or hardness.
   3. For reverse osmosis and nanofiltration equipment with capacity greater than 27 gal/h (100 L/h), reject water shall not exceed 60% of the feed water and shall be used as scrubber feed water or for other beneficial uses on the project *site*.
   4. Simple distillation is not acceptable as a means of water purification.
g. Food service operations within medical facilities shall comply with Section 6.4.2.2.

6.3.3 Special Water Features. Water use shall comply with the following:

a. Ornamental fountains and other ornamental water features shall be supplied either by *alternate on-site sources of water* or by municipally reclaimed water delivered by the local water utility acceptable to the *AHJ*. Fountains and other features shall be equipped with (1) makeup water meters (2) leak detection devices that shut off water flow if a leak of more than 1.0 gal/h (3.8 L/h) is detected, and (3) equipment to recirculate, filter, and treat all water for reuse within the system.

TABLE 6.3.3~~A~~4B Subsystem Water Measurement Thresholds

Subsystem	Submetering Threshold
Cooling towers (meter on makeup water and blowdown)	Cooling tower flow through tower >500 gpm (30 L/s)
Evaporative coolers	Makeup water >0.6 gpm (0.04 L/s)
Steam and hot-water boilers	>500,000 Btu/h (50 kW) input
Total irrigated landscape area with controllers	>25,000 ft^2 (2500 m^2)
Separate campus or project buildings	Consumption >1000 gal/day (3800 L/day)
Separately leased or rental *space*	Consumption >1000 gal/day (3800 L/day)
Any large water-using process	Consumption >1000 gal/day (3800 L/day)

TABLE 6.3.3~~B~~4A Water Supply Source Measurement Thresholds

Water Source	Main Measurement Threshold
Potable water	1000 gal/day (3800 L/day)
Municipally *reclaimed water*	1000 gal/day (3800 L/day)
Alternate sources of water	500 gal/day (1900 L/day)

Exception to 6.3.3(a): Where *alternate on-site sources of water* or municipally reclaimed water are not available within 500 ft (150 m) of the *building project site*, *potable water* is allowed to be used for water features with less than 10,000 gal (38,000 L) capacity.

b. Pools and spas:
   1. Recover filter backwash water for reuse on landscaping or other applications, or treat and reuse backwash water within the system.
   2. For filters with removable cartridges, only reusable cartridges and systems shall be used. For filters with backwash capability, use only pool filter equipment that includes a pressure drop gage to determine when the filter needs to be backwashed and a sight glass enabling the operator to determine when to stop the backwash cycle.
   3. Pool splash troughs, if provided, shall drain back into the pool system.

6.3.3~~4~~ Water Consumption Measurement

6.3.3~~4~~.1 Consumption Management. Measurement devices with remote communication capability shall be provided to collect water consumption data for the domestic water supply to the building. Both potable and reclaimed water entering the *building project* shall be monitored or sub-metered. In addition, for individual leased, rented, or other tenant or sub-tenant space within any building totaling in excess of 50,000 ft^2 (5000 m^2), separate submeters shall be provided. For subsystems with multiple similar units, such as multi-cell cooling towers, only one measurement device is required for the subsystem. Any project or building, or tenant or sub-tenant space within a project or building, such as a commercial car wash or aquarium, shall be submetered where consumption is projected to exceed 1000 gal/day (3800 L/ day).

Measurement devices with remote capability shall be provided to collect water use data for each water supply source (e.g., *potable water,* reclaimed water, rainwater) to the *building project* that exceeds the thresholds listed in Table 6.3.3~~4~~A. Utility company service entrance/interval meters are allowed to be used.

Provide sub-metering with remote communication measurement to collect water use data for each of the building subsystems, if such subsystems are sized above the threshold levels listed in Table 6.3.3~~4~~B.

6.3.3~~4~~.2 Consumption Data Collection. All building measurement devices, monitoring systems, and sub-meters installed to comply with the thresholds limits in Section 6.3.3~~4~~.1 shall be configured to communicate water consumption data to a meter data management system. At a minimum, meters shall provide daily data and shall record hourly consumption of water.

6.3.3~~4~~.3 Data Storage and Retrieval. The meter data management system shall be capable of electronically storing water meter, monitoring systems, and submeter data and creating user reports showing calculated hourly, daily, monthly, and annual water consumption for each measurement device and submeter and provide alarming notification capabilities as needed to support the requirements of the Water User Efficiency Plan for Operation in Section 10.3.2.1.2.

~~**6.4 Prescriptive Option**~~

~~**6.4.1 Site Water Use Reduction.** For golf courses and driving ranges, only municipally reclaimed water and/or *alternate on-site sources of water* shall be used to irrigate the landscape. For other landscaped areas, a maximum of one-third of *improved landscape* area is allowed to be irrigated with *potable water*. The area of dedicated athletic fields shall be excluded from the calculation of the *improved landscape* for schools, *residential* common areas, or public recreational facilities. All other irrigation shall be provided from *alternate on-site sources of water* or municipally reclaimed water.~~

Exception: *Potable water* is allowed to be temporarily used on such newly installed landscape for the *landscape establishment period*. The amount of *potable water* that may be applied to the newly planted areas during the temporary *landscape establishment period* shall not exceed 70% of ET_o for *turfgrass* and 55% of ET_o for other plantings. If municipally-reclaimed water is available at a water main within 200 ft (60 m) of the project *site*, it shall be used in lieu of *potable water* during the *landscape establishment period*. After the *landscape establishment period* has expired, all irrigation water use shall comply with the requirements established elsewhere in this standard.

6.4.2 Building Water Use Reduction

6.4.2.1 Cooling Towers. The water being discharged from cooling towers for air conditioning systems such as chilled water systems shall be limited in accordance with method (a) or (b):

a. For makeup waters having less than 200 ppm (200 mg/L) of total hardness expressed as calcium carbonate, by achieving a minimum of five *cycles of concentration*.
b. For makeup waters with more than 200 ppm (200 mg/L) of total hardness expressed as calcium carbonate, by achieving a minimum of 3.5 *cycles of concentration*.

Exception to 6.4.2.1: Where the total dissolved solids concentration of the discharge water exceeds 1500 mg (1500 ppm/L), or the silica exceeds 150 ppm (150 mg/L) measured as silicon dioxide before the above cycles of concentration are reached.

6.4.2.2 Commercial Food Service Operations. Commercial food service operations (e.g., restaurants, cafeterias, food preparation kitchens, caterers, etc.):

a. shall use high-efficiency pre-rinse spray valves (i.e., valves which function at 1.3 gpm (4.9 L/min) or less and comply with a 26-second performance requirement when tested in accordance with ASTM F2324),
b. shall use dishwashers that comply with the requirements of the ENERGY STAR Program for Commercial Dishwashers,
c. shall use boilerless/connectionless food steamers that consume no more than 2.0 gal/hour (7.5 L/hour) in the full operational mode,
d. shall use combination ovens that consume not more than 10 gal/hour (38 L/hour) in the full operational mode,
e. shall use air-cooled ice machines that comply with the requirements of the ENERGY STAR Program for Commercial Ice Machines, and
f. shall be equipped with hands-free faucet controllers (foot controllers, sensor-activated, or other) for all faucet fittings within the food preparation area of the kitchen and the dish room, including pot sinks and washing sinks.

6.4.2.3 Medical and Laboratory Facilities. Medical and laboratory facilities, including clinics, hospitals, medical centers, physician and dental offices, and medical and nonmedical laboratories of all types shall use all of the following:

a. Only water-efficient steam sterilizers equipped with (1) water-tempering devices that allow water to flow only when the discharge of condensate or hot water from the sterilizer exceeds 140°F (60°C) and (2) mechanical vacuum equipment in place of venturi-type vacuum systems for vacuum sterilizers.
b. Film processor water recycling units where large frame x-ray films of more than 6 in. (150 mm) in either length or width are processed. Small dental x-ray equipment is exempt from this requirement.
c. Digital imaging and radiography systems where the digital networks are installed.
d. A dry-hood scrubber system or, if the applicant determines that a wet-hood scrubber system is required, the scrubber shall be equipped with a water recirculation system. For perchlorate hoods and other applications where a hood wash-down system is required, the hood shall be equipped with self-closing valves on those wash-down systems.
e. Only dry vacuum pumps, unless fire and safety codes for explosive, corrosive or oxidative gases require a liquid ring pump.
f. Only efficient water treatment systems that comply with the following criteria:
    1. For all filtration processes, pressure gauges shall determine and display when to backwash or change cartridges.
    2. For all ion exchange and softening processes, recharge cycles shall be set by volume of water treated or based upon conductivity or hardness.
    3. For reverse osmosis and nanofiltration equipment, with capacity greater than 27 gal/h (100 L/h), reject water shall not exceed 60% of the feed water and shall be used as scrubber feed water or for other beneficial uses on the project *site*.
    4. Simple distillation is not acceptable as a means of water purification.
g. Food service operations within medical facilities shall comply with Section 6.4.2.2.

6.4.3 Special Water Features. Water use shall comply with the following:

a. Ornamental fountains and other ornamental water features shall be supplied either by *alternate on-site sources of water* or by municipally reclaimed water delivered by the local water utility acceptable to the *AHJ*. Fountains and other features shall be equipped with: (1) makeup water meters (2) leak detection devices that shut off water flow if a leak of more than 1.0 gal/h (3.8 L/h) is detected, and (3) equipment to recirculate, filter, and treat all water for reuse within the system.

Exception to 6.4.3(a): Where *alternate on-site sources of water* or municipally reclaimed water are not available within 500 ft (150 m) of the *building project site*, *potable water* is allowed to be used for water features with less than 10,000 gallon (38,000 L) capacity.

b. Pools and spas:

1. Backwash water: Recover filter backwash water for reuse on landscaping or other applications, or treat and reuse backwash water within the system.

2. Filtration: For filters with removable cartridges, only reusable cartridges and systems shall be used. For filters with backwash capability, use only pool filter equipment that includes a pressure drop gauge to determine when the filter needs to be backwashed and a sight glass enabling the operator to determine when to stop the backwash cycle.

3. Pool splash troughs, if provided, shall drain back into the pool system.

6.5 Performance Option. Calculations shall be made in accordance with *generally accepted engineering standards* and handbooks acceptable to the *AHJ*.

6.5.1 *Site* Water Use Reduction. *Potable water* (and municipally *reclaimed water*, where used) intended to irrigate *improved landscape* shall be limited to 35% of the water demand for that landscape. The water demand shall be based upon *ET* for that climatic area and shall not exceed 70% of ET_o for *turfgrass* areas and 55% of ET_o for all other plant material after adjustment for rainfall.

6.5.2 Building Water Use Reduction. The *building project* shall be designed to have a total annual interior water use less than or equal to that achieved by compliance with Sections 6.3.2, 6.4.2, and 6.4.3.

(This foreword 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.)

FOREWORD

Addendum t adds new requirements for reverse osmosis and on-site reclaim water systems in order reduce the likelihood of excessive water use due to poor design of water treatment and filter systems. In addition, requirements are proposed to prevent the production of reject water, as it is often of suitable quality for many other on-site uses.

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 t to Standard 189.1-2014

Add the following new sections.

6.3.4 Reverse Osmosis Water Treatment Systems. Reverse osmosis systems shall be equipped with an automatic shutoff valve that prevents the production of reject water when there is no demand for treated water. Point-of-use reverse osmosis treatment systems for drinking water shall be listed and labeled in accordance with NSF 58.

6.3.5 On-Site Reclaimed Water Treatment Systems. On-site reclaimed water treatment systems, including gray water reuse treatment systems and waste water treatment systems, used to produce nonpotable water for use in water closet and urinal flushing, surface irrigation, and similar applications shall be listed and labeled in accordance with NSF 350.

(This foreword 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.)

FOREWORD

Addendum u adds new requirements for water softeners to reduce water consumption, given the impact of their design and efficiency on water discharge water rates.

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 u to Standard 189.1-2014

Add the following new section.

6.3.4 Water Softeners. Water softeners shall comply with Sections 6.3.4.1 through 6.3.4.4

6.3.4.1 Demand-Initiated Regeneration. Water softeners shall be equipped with demand-initiated regeneration control systems. Timer-based control systems shall be prohibited.

6.3.4.2 Water Consumption. Water softeners shall have a maximum water consumption during regeneration of 4 gal (15.1 L) per 1000 grains (17.1 g/L) of hardness removed as measured in accordance with NSF 44.

6.3.4.3 Waste Connections. Waste water from water softener regeneration shall not discharge to reclaimed water collection systems and shall discharge in accordance with the *International Plumbing Code*.

6.3.4.4 Efficiency and Listing. Water softeners that regenerate in place, that are connected to the water system they serve by piping not exceeding 1 1/4 in. (31.8 mm) in diameter, or that have a volume of 3 ft^3 (0.085 m^3) or more of cation exchange media shall have a rated salt efficiency of not less than 4000 grains of total hardness exchange per pound of salt (571 g of total hardness exchange per kg of salt), based on sodium chloride equivalency, and shall be listed and labeled in accordance with NSF 44. All other water softeners shall have a rated salt efficiency of not less than 3500 grains of total hardness exchange per pound of salt (500 g of total hardness exchange per kg of salt), based on sodium chloride equivalency.

(This foreword 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.)

FOREWORD

This addendum revises two paragraphs in Section 5.3.1.1, "Allowable Sites." The revisions reference ASTM standards that provide more precision than the requirements that currently exist in Standard 189.1. The ASTM standards better focus these provisions on the criteria that are important to encouraging people to walk or use public transit, including distance over walkable pathways, safety, and quality of the transit.

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 v to Standard 189.1-2014

Modify Section 3.2 as follows.

~~***adequate transit service:*** at least two buses (including bus rapid transit), streetcars, or *light rail* trains per hour on weekdays, operating between 6:00 a.m. and 9:00 a.m., and between 3:00 p.m. and 6:00 p.m., or at least five heavy passenger rail or ferries operating between 6:00 a.m. and 9:00 a.m., and between 3:00 p.m. and 6:00 p.m.~~

***brownfield ~~site~~*:** [. . .]

***greenfield ~~site~~*:** [. . .]

***greyfield ~~site~~*:** [. . .]

~~***light rail:*** a streetcar-type vehicle that has step entry or level boarding entry and is operated on city streets, semiexclusive rights-of-way, or exclusive rights-of-way.~~

Modify Section 5.3.1.1 as follows.

5.3.1.1 Allowable *Sites.* The *building project* shall take place in or on one of the following:

a. An existing *building envelope*.
b. A *brownfield ~~site~~*.
c. A *greyfield ~~site~~*.
d. A *greenfield ~~site~~* that is within 1/2 mi (800 m) of *residential* land that is developed, or that has one or more buildings under construction, with an average density of ten *dwelling units* per acre (4 units per ha) unless that *site* is *agricultural land* or *forest land*. Proximity is determined by drawing a circle with a 1/2 mi (800 m) radius around the center of the proposed *site*.
e. A *greenfield ~~site~~* where the proposed building complies with ASTM E2843~~is within 1/2 mi (800 m) of not less than ten basic services and that has pedestrian access between the building and the services~~, unless that *site* is *agricultural land* or *forest land*. ~~Basic services include but are not limited to (1) financial institutions, (2) places of worship, (3) convenience or grocery stores, (4) day care facilities, (5) dry cleaners, (6) fire stations, (7) beauty shops, (8) hardware stores, (9) laundry facilities, (10) libraries, (11) medical/dental offices, (12) senior care facilities, (13) parks, (14) pharmacies, (15) post offices, (16) restaurants, (17) schools, (18) supermarkets, (19) theaters, (20) community centers, (21) fitness centers, (22) museums, and (23) local government facilities. Proximity is determined by drawing a circle with a 1/2 mi (800 m) radius around the center of the proposed *site*.~~
f. A *greenfield ~~site~~* ~~that~~ where the proposed building complies with ASTM E2844~~is either within 1/2 mi (800 m) of an existing or planned and funded commuter rail, *light rail*, or subway station, or within 1/4 mi (400 m) of *adequate transit service* usable by building occupants~~, unless that *site* is *agricultural land* or *forest land*. ~~Proximity is determined by drawing a circle with a 1/2 mi (800 m) radius around the center of the proposed *site*.~~
g. A *greenfield ~~site~~* that is *agricultural land*, and the ~~building's~~ purpose of the proposed building is related to the agricultural use of the land.
h. A *greenfield ~~site~~* that is *forest land*, and the ~~building's~~ purpose of the proposed building is related to the forestry use of the land.
i. A *greenfield ~~site~~* that is *designated park land*, and the ~~building's~~ purpose of the proposed building is related to the use of the land as a park.

Modify Section 11 as follows.

Reference	Title	Section
ASTM E2843-16a	Standard Specification for Demonstrating That a Building is in Walkable Proximity to Neighborhood Assets	5.3.1.1
ASTM E2844-15e1	Standard Specification for Demonstrating That a Building's Location Provides Access to Public Transit	5.3.1.1

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FOREWORD

The purpose of this addendum is to update Performance Option A of Section 7.5.2 to be consistent with recent changes to the Performance Rating Method as published in Standard 90.1-2016.

The definitions of regulated energy use and unregulated energy use are included in Standard 90.1-2016. They are included here for information purposes only:

regulated energy use: *energy used by building systems and components with requirements prescribed in Sections 5 through 10. This includes energy used for HVAC, lighting, service water heating, motors, transformers, vertical transportation, refrigeration equipment, computer-room cooling equipment, and other building systems, components, and processes with requirements prescribed in Sections 5 through 10.*

unregulated energy use: *energy used by building systems and components that is not regulated energy use.*

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 w to Standard 189.1-2014

Modify Section 7.5.2 as follows.

7.5.2 Performance Option A

a. **Annual Energy Cost.** The proposed building Performance Cost Index (PCI) with consideration of renewables shall be calculated in accordance with Appendix G of Standard 90.1 and be equal to or less than the Performance Cost Target, as determined from the following equation:

$$PCI_{target} = \frac{BBUEC + (BBREC \times BPF) - REC}{BBUEC + BBREC}$$

where

PCI_{target} = target Performance Cost Index required for ~~achieving compliance with the standard,~~ unitless

BBUEC = the component of *baseline building performance* that is due to *unregulated energy use*, $

BBREC = the component of *baseline building performance* that is due to *regulated energy use*, or *baseline building performance* minus BBUEC, $

BPF = building performance factor taken from Table 7.5.2A, unitless

REC = renewable energy production determined from Section 7.4.1.1.1 and converted to cost, $

The proposed building PCI without consideration of renewables shall comply with the requirements of Standard 90.1, Section 4.2.1.1.

~~The proposed building performance shall be equal to or less than the baseline building performance multiplied by one minus the percentage reduction in Table 7.5.2A using the Performance Rating Method in Normative Appendix G of ANSI/ASHRAE/IES Standard 90.1.~~ *On-site renewable energy systems* in the *proposed design* shall be calculated using the procedures in ~~Table C.1.1(15) of~~ Normative Appendix C. For mixed-use buildings, the percent reduction shall be determined by weighting each building type by floor area.

b. **Annual Carbon Dioxide Equivalent (CO_2e).** The *proposed design* shall have an annual CO_2e equal to or less than the annual CO_2e of the *baseline building design* multiplied by the building performance factor (BPF) target determined from Table 7.5.2A ~~one minus the percentage reduction in Table 7.5.2A~~ using the Performance Rating Method in Normative Appendix G of ANSI/ASHRAE/IES Standard 90.1. To determine the annual CO_2e for each energy source in the *baseline building design* and *proposed design*, the energy consumption shall be multiplied by the CO_2e emission factors from Table 7.5.2B.

TABLE 7.5.2A Performance Option A: Energy Cost and CO_2e Building Performance Factors

Building Type	Building Performance Factor (BPF) ~~Percent Reduction~~
Multifamily	0.72
Healthcare/hospital	0.56
Hotel/motel	0.61
Office	0.56
Restaurant	0.59
Retail	0.55
School	0.45
Semiheated warehouse[a]	0.58
All others	0.58
~~Apartments~~	~~10%~~
~~Restaurants~~	~~5%~~
~~Lodging~~	~~12%~~
~~Semiheated warehouses[a]~~	~~45%~~
~~Other[b]~~	~~24%~~

a. Conditioned warehouses shall use the "Other" category.

b. ~~When the modeled energy use that is not regulated energy use exceeds 35% of the total proposed building energy use, the reduction shall be calculated using the following equation: Percent reduction = 0.55 + 0.99 x Percent Non-Regulated Energy. The reduction shall be no lower than 5%.~~

(This foreword 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.)

FOREWORD

Addendum x proposes to delete Performance Path B and sections of Appendix C, motivated in part by changes to the Performance Rating Method published in Standard 90.1-2016, which made significant structural changes to the performance compliance path on which the requirements in Standard 189.1 are heavily based. Standard 90.1-2016 created a fixed baseline in the performance path, which renders Performance Path B in Standard 189.1 obsolete as well as most of the modifications to Standard 90.1 contained in Appendix C on which that path is based.

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 x to Standard 189.1-2014

Modify Section 7.5 as follows.

7.5 Performance Option

~~**7.5.1 General Comprehensive Performance Requirements.** Projects shall comply with either Section 7.5.2 or 7.5.3.~~

Renumber subsequent sections as follows.

~~**7.5.2 Performance Option A**~~

~~a.~~ **7.5.1 Annual Energy Cost.** [. . .]

~~b.~~ **7.5.2 Annual Carbon Dioxide Equivalent (CO_2e).** [. . .]

~~**7.5.3 Performance Option B**~~

~~a. **Annual Energy Cost.** The *building project* shall have an annual energy cost less than or equal to that achieved by compliance with Sections 7.3 and 7.4, and Sections 5.3.4.2, 5.3.4.3, 6.3.2, 6.4.2, 8.3.1, and 8.4.1. Comparisons shall be made using Normative Appendix C.~~

~~b. **Annual *Carbon Dioxide Equivalent* (CO_2e).** The *building project* shall have an annual CO_2e less than or equal to that achieved by compliance with Sections 7.3 and 7.4, and Sections 5.3.4.2, 5.3.4.3, 6.3.2, 6.4.2, 8.3.1, and 8.4.1. Comparisons shall be made using Normative Appendix C. To determine the CO_2e value for each energy source in the *baseline building design* and *proposed design*, the energy consumption shall be multiplied by the emissions factor. CO_2e emission factors shall be taken from Table 7.5.2B.~~

Modify Appendix C as follows.

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

NORMATIVE APPENDIX C PERFORMANCE OPTION FOR ENERGY EFFICIENCY

C1. GENERAL

~~**C1.1 Performance Option Scope.** *Building projects* complying with Section 7.5, the "Performance Option," shall comply with the requirements in Normative Appendix G of ANSI/ASHRAE/IES Standard 90.1 with the following modifications and additions. When a requirement is provided in this appendix, it supersedes the requirement in ANSI/ASHRAE/IES Standard 90.1. This appendix shall be used both for *building projects* demonstrating compliance with the requirements of this standard and for *building projects* demonstrating performance that substantially exceeds the requirements of this standard. Where stated in Normative Appendix G of ANSI/ASHRAE/IES Standard 90.1, the rating authority or program evaluator shall be the *authority having jurisdiction* (*AHJ*).~~

~~***Note to Adopting Authority:*** ASHRAE Standing Standard Project Committee 189.1 recommends that a compliance shell implementing the rules of a compliance supplement that controls inputs to and reports outputs from the required computer analysis program be adopted for the purposes of easier use and simpler compliance.~~

~~**C1.1.1 Performance Rating Mandatory Requirements (Section G1.2 of ANSI/ASHRAE/IES Standard 90.1).** In addition to the requirements in Section G1.2 of ANSI/ASHRAE/IES Standard 90.1, all requirements in Sections 5.3, 6.3, 7.3, 8.3, and 9.3 shall be met.~~

~~**C1.1.2 Trade-Off Limits (Section G1.3 of ANSI/ASHRAE/IES Standard 90.1).** In addition to the requirements in Section G1.3 of ANSI/ASHRAE/IES Standard 90.1, future building components shall meet all requirements in Section 7.4.~~

~~**C1.1.3 Documentation Requirements (Section G1.4 of ANSI/ASHRAE/IES Standard 90.1)**~~

~~a. In addition to the requirements in Section G1.4(d) of ANSI/ASHRAE/IES Standard 90.1, the documentation list shall include compliance with the requirements in Section 7.3.~~

~~b. In addition to the requirements in Section G1.4(e) of ANSI/ASHRAE/IES Standard 90.1, the documentation list shall identify aspects that are less stringent than the requirements in Section 7.4.~~

~~c. In addition to the requirements in Section G1.4(f) of ANSI/ASHRAE/IES Standard 90.1, the documentation list shall include a table with a summary of CO_2e by end use in the *proposed building performance*.~~

C1.1.4 Renewable, Recovered, and Purchased Energy. *On-site renewable energy systems* and *site* recovered energy (Section G2.4.1 of ANSI/ASHRAE/IES Standard 90.1): The modeling requirements for *on-site renewable energy systems* in the *proposed building performance* in Section G2.4.1 of ANSI/ASHRAE/IES Standard 90.1 shall not apply and are superseded by Section 15, "Renewable Energy Systems," in Table C1.1.

Annual energy costs (Section G2.4.2 of ANSI/ASHRAE/IES Standard 90.1): Where *on-site renewable energy systems* or *site*-recovered energy are used, the *baseline building design* shall be modeled in accordance with the requirements in Section 15, "Renewable Energy Systems," in Table C1.1. The requirements for *baseline building design* energy source in Section G2.4.2 of ANSI/ASHRAE/IES Standard 90.1 shall not apply.

C1.1.5 Baseline HVAC System Type and Description (Section G3.1.1 of ANSI/ASHRAE/IES Standard 90.1). Exception (4) to Section G3.1.1 of ANSI/ASHRAE/IES Standad 90.1 shall be replaced as follows:

> Kitchens with a total exhaust hood airflow rate greater than 2000 cfm shall use system type 5 or 7 with a demand ventilation system on 75% of the exhaust air. The system shall reduce exhaust and replacement airflow rates by 50% for one-half of the kitchen occupied hours in the baseline 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 7.4.3.7.1 for the numbers and types of hoods and appliances provided for in the *proposed design*. For all- electric buildings, the heating shall be electric resistance.

C1.1.6 Equipment Efficiencies (Section G3.1.2.1 of ANSI/ASHRAE/IES Standard 90.1). Section G3.1.2.1 of ANSI/ASHRAE/IES Standard 90.1 is superseded by the requirements of Section 10, "HVAC Systems," in Table C1.1.

C1.1.7 Ventilation (Section G3.1.2.6 of ANSI/ASHRAE/IES Standard 90.1)

a. Exception (1) to Section G3.1.2.6 of ANSI/ASHRAE/IES Standard 90.1 shall be used only where *DCV* is not required by Section 7.4.3.2.
b. Exception (3) to Section G3.1.2.6 of ANSI/ASHRAE/IES Standard 90.1 shall not apply.

C1.1.8 Economizers (Section G3.1.2.7 of ANSI/ASHRAE/IES Standard 90.1)

a. *Outdoor air* economizers shall be included in the baseline systems identified in Section G3.1.2.7 of ANSI/ASHRAE/IES Standard 90.1 for the *climate zones* and capacities specified in Table 7.4.3.3A.
b. Exception (1) to Section G3.1.2.7 of ANSI/ASHRAE/IES Standard 90.1 shall not apply.

C1.1.9 System Fan Power (Section G3.1.2.10 of ANSI/ASHRAE/IES Standard 90.1)

a. System fan brake horsepower shall be 10% less than the values calculated using Section G3.1.2.10 of ANSI/ASHRAE/IES Standard 90.1.
b. Fan motor efficiency shall meet the requirements of Section 7.4.7.1.

C1.1.10 Exhaust Air Energy Recovery (Section G3.1.2.11 of ANSI/ASHRAE/IES Standard 90.1). Exhaust air energy recovery shall be modeled in the *baseline building design* as specified in Section 7.4.3.6.

C1.1.11 System-Specific Baseline HVAC System Requirements (Section G3.1.3 of ANSI/ASHRAE/IES Standard 90.1). Heat Rejection (Section G3.1.3.11 of ANSI/ASHRAE/ IES Standard 90.1): In addition to the requirements in Section G3.1.3.11 of ANSI/ASHRAE/IES Standard 90.1, the heat rejection device shall meet the performance requirements in Table B-8.

C1.1.12 Variable-Air-Volume (VAV) Minimum Flow Setpoints (Section G3.1.3.13 of ANSI/ASHRAE/IES Standard 90.1). Zone minimum airflow setpoints shall be modeled as specified in Section 7.4.3.4.

C1.2~~1.13~~ Building Performance Calculations (Table G3.1 of ANSI/ASHRAE/IES Standard 90.1). In addition to Table G3.1 of ANSI/ASHRAE/IES Standard 90.1, the ~~*baseline building design* and~~ *proposed design* shall comply with all modifications and additions in Table C1.1. All references to "Table G3.1" in Table C1.1 refer to Table G3.1 of Appendix G of ANSI/ASHRAE/IES Standard 90.1.

TABLE C1.1 Modifications and Additions to Table G3.1 of Appendix Gin ANSI/ASHRAE/IES Standard 90.1

Proposed Building Performance	*Baseline Building Performance*
1. Design Model	
No modifications	No modifications
2. Additions and Alterations	
~~In addition to the requirements in Table G3.1(2)(a), work to be performed in the excluded parts of the building shall comply with Sections 7.3 and 7.4.~~ No modifications	No modifications
3. *Space* Use Classification	
No modifications	No modifications
4. Schedules	
No modifications	No modifications
5. *Building Envelope*	
~~Exception (3) of Table G3.1(5) shall be replaced with the following: The exterior *roof* surface shall be modeled using the solar reflectance and thermal emittance determined in accordance with Sections 5.3.5.3 and 5.3.5.4. Where test data are unavailable, the *roof* surface shall be modeled with a solar reflectance of 0.30 and a thermal emittance of 0.90.~~ No modifications	~~a. In addition to the requirements in Table G3.1(5), the *baseline building design* shall comply with Section 7.4.2, not including Section 7.4.2.8.~~ ~~b. The *baseline building performance* shall be equal to the lowest annual energy cost of the following four simulations: the building in its actual orientation and the building rotated 90, 180, and 270 degrees.~~ ~~**Exception to (b):** *Building projects that qualify for* Exceptions (1) or (2) to Table G3.1(5)(a) are not required to have the building model rotated.~~ ~~c. In addition to the requirements in Table G3.1(5)(f) and G3.1(5)(g), *roof* surfaces shall comply with Sections 5.3.4.3.~~ No modifications
6. Lighting	
~~a. In addition to the requirements in Table G3.1(6)(c), when lighting neither exists nor is specified, lighting power shall comply with Section 7.4.6.~~ ~~b. When taking credit for daylight controls under Table G3.1(6)(f), credit may be taken only for lighting controls that are not required by Section 7.4.6. Credit for daylighting controls is allowed to be taken up to a distance of 2.5 times window head height where all lighting more than one window head height from the perimeter (head height is the distance from the floor to the top of the glazing) is automatically controlled separately from lighting within one window head height of the perimeter.~~No modifications	~~In addition to the requirements in Table G3.1(6), lighting power shall comply with Section 7.4.6. *Automatic* and manual controls shall be modeled as required in Section 7.4.6~~ .No modifications
7. Thermal Blocks—HVAC Zones Designed	
No modifications	No modifications
8. Thermal Blocks—HVAC Zones Not Designed	
No modifications	No modifications
9. Thermal Blocks—Multifamily *Residential* Buildings	
No modifications	No modifications
10. HVAC Systems	
~~The HVAC system type and all related performance parameters in the *proposed design*, such as equipment capacities and efficiencies, shall be determined as follows:~~ ~~Where a complete HVAC system exists, the model shall reflect the actual system type using actual component capacities and efficiencies.~~ ~~a. Where an HVAC system has been designed, the HVAC model shall be consistent with design documents. Mechanical equipment efficiencies shall be adjusted from actual design conditions to the standard rating conditions specified in Section 7.4.3 and Normative Appendix C if required by the simulation model.~~ ~~b. Where no heating system exists or no heating system has been specified, the heating system classification shall be assumed to be electric, and the system characteristics shall be identical to the system modeled in the *baseline building design*.~~ ~~Where no cooling system exists or no cooling system has been specified, the cooling system shall be identical to the system modeled in the *baseline building design*.~~ No modifications	~~The HVAC system(s) in the *baseline building design* shall be of the type and description specified in Section G3.1.1, shall comply with the general HVAC system requirements specified in Section G3.1.2, shall comply with any system-specific requirements in Section G3.1.3 that are applicable to the baseline HVAC system type(s), and shall comply with Sections 7.3 and 7.4.3 under the standard renewables approach as described in Section 7.4.1.1.1. The equipment efficiency requirements in Section 7.4.3.1 do not apply to the *baseline building design*.~~ No modifications

TABLE C1.1 Modifications and Additions to Table G3.1 of Appendix Gin ANSI/ASHRAE/IES Standard 90.1 (Continued)

Proposed Building Performance	*Baseline Building Performance*
11. Service Hot-Water Systems	
~~In addition to the requirements in Table G3.1(11), service hot-water usage is allowed to be lower in the *proposed design* than in the *baseline building design* if service hot-water use can be demonstrated to be less than that resulting from compliance with Sections 6.3.2, 6.4.2, and 6.4.3.~~ No modifications	~~The service hot-water system in the baseline building design shall use the same energy source as the corresponding system in the proposed design and shall conform with the following conditions:~~ ~~a. Where a complete service hot water system exists, the baseline building design shall reflect the actual system type using actual component capacities and efficiencies.~~ ~~b. Where a new service hot water system has been specified, the system shall be sized according to the provisions of Section 7.4.1 of ANSI/ASHRAE/IES Standard 90.1 and the equipment shall match the minimum efficiency requirements in Section 7.4.4 under the standard renewables approach as described in Section 7.4.1.1.1 and the supermarket heat recovery requirements in Section 7.4.7.2 The equipment efficiency requirements in Section 7.4.4.1 do not apply to the baseline building design. Where the energy source is electricity, the heating method shall be electrical resistance.~~ No modifications
12. Receptacle and Other Loads	
No modifications	~~In addition to the requirements in Table G3.1(12), the *baseline building design* must meet the requirements in Section 7.4.7; except for the equipment efficiency requirements in Section 7.4.7.1, the ENERGY STAR® requirements in Section 7.4.7.3.2, and equipment efficiency requirements in Normative Appendix B.~~ No modifications
13. Modeling Limitations to the Simulation Program	
No modifications	No modifications
14. Exterior Conditions	
No modifications	No modifications
15. *On-Site Renewable Energy Systems*	
The reduction in the *proposed building performance* and annual CO_2e of the *proposed design* due to energy generated by *on-site renewable energy systems* shall be calculated as follows: a. **Annual Energy Cost.** The annual energy cost of the *proposed design* with an *on-site renewable energy system* shall be calculated on an hourly basis and adjusted as follows. 1. **Thermal Energy Performance Calculation.** The hourly thermal loads of the *proposed design* shall be reduced by the hourly thermal energy production of the *on-site renewable energy system* (but thermal loads shall not be reduced to less than zero). When the on-site renewable thermal energy production exceeds the applicable thermal demands of the building for any hour, the excess generated energy may be used to displace thermal loads at other times, provided the system has the storage capability and storage losses are included in the calculation. The approved energy rate structure shall be applied to the reduced energy consumption. 2. **Electric Energy Performance Calculation.** The total electrical energy production of the *on-site renewable energy system* shall be calculated on an hourly basis and the energy cost of the *proposed building performance* shall be calculated by applying the approved electrical rate structure to each hour's electrical usage, including any reduction from hourly electrical energy production of the *on-site renewable energy system.* **Exception to (a):** For *building projects* with no net metering agreement, feed-in tariff, or other electrical rate structure for net generated electricity, the cost of imported electricity from the grid is calculated by applying the approved electrical rate structure to each hour's electrical loads minus the hourly electrical energy production of the *on-site renewable energy system*, but the cost of imported electricity shall not be less than zero on a monthly basis.	~~The *baseline building design* shall include an *on-site renewable energy system* that generates an annual amount of energy equal to that required under the standard renewables approach as described in Section 7.4.1.1.1. The *on-site renewable energy system* shall reduce the annual energy cost and the annual CO_2e.~~ ~~a. **Annual Energy Cost.** The reduction in annual energy cost of the *baseline building performance* due to on-site renewable production shall be equal to the amount of on-site renewable energy production required in under the standard renewables approach as described in Section 7.4.1.1.1 multiplied by the average energy rate for the *baseline building design*. The average energy rate shall be equal to the calculated total annual cost of energy to serve the baseline building divided by the total annual *site* energy consumption of the building not including reductions in consumption from on-site renewable energy production.~~ ~~b. **Annual CO_2e.** The reduction in annual CO_2e of the baseline building due to on-site renewable production shall be equal to the amount of on-site renewable energy production required under the standard renewables approach as described in Section 7.4.1.1.1 multiplied by the average CO_2e rate for the *baseline building design*. The average CO_2e rate shall be equal to the calculated total annual CO_2e for all types of imported energy used by the baseline building divided by the total annual *site* energy consumption of the building not including reductions in consumption from on-site renewable energy production.~~ ~~**Exception to (b):** When the *proposed design* qualifies for the exception to Section 7.4.1.1.1, an *on-site renewable energy system* shall not be included in the *baseline building design*.~~

TABLE C1.1 Modifications and Additions to Table G3.1 of Appendix Gin ANSI/ASHRAE/IES Standard 90.1 (Continued)

Proposed Building Performance	*Baseline Building Performance*
15. *On-Site Renewable Energy Systems* (contd.)	
Exception to (a) (contd.): Electricity production of the *on-site renewable energy system* which has a retail value in excess of the retail cost of electricity consumption on a monthly basis shall be credited as a reduction in energy costs to the *building performance* at the wholesale rate as follows. $\text{Credit} = \frac{(\text{ExRR} - \text{ImRR})}{\text{ExRR}} \times \text{ExkWh} \times \text{WR}$ where Credit = cost reduction credit for month where retail value of exported electricity is greater than retail value of imported electricity ExRR = month's value of exported electricity at retail rate ImRR = month's value of imported electricity at retail rate ExkWh = total kilowatt-hours exported in month WR = average monthly wholesale rate for the region where the building located	
b. **Annual CO_2e.** The annual CO_2e of the proposed building that includes an *on-site renewable energy system* shall be equal to the annual CO_2e of the imported energy to serve the proposed building (with reduced loads due to the *on-site renewable energy system*) minus the annual exported electricity produced by the *on-site renewable energy system* multiplied by the electrical CO_2e emission factor.	
Documentation: The documentation required in Section G2.5(a), (b), and (e) in ASHRAE/IES Standard 90.1 shall be made available to the *AHJ* upon request for all *on-site renewable energy systems* in the *proposed design*.	

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FOREWORD

Addendum y adds a requirement for an Indoor Environmental Quality (IEQ) occupant satisfaction survey to be included in the postoccupancy plan for operation. Survey questions include satisfaction question for each IEQ category and diagnostic questions to help identify potential sources of dissatisfaction. Satisfaction questions and reporting reference ASHRAE Standard 55, and results are required to be benchmarked against IEQ survey databases. Section 10.3.2.1.5 is renamed to more accurately reflect that the section relates to air quality and not all IEQ factors, which are generally considered to also include thermal, acoustic, and lighting.

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 y to Standard 189.1-2014

Make the following changes to Section 10.3.2.1.

10.3.2.1 High-Performance Building Operation Plan. A master building plan for operation shall be developed that meets the requirements specified in Sections 10.3.2.1.1 through 10.3.2.1.45.

Rename Section 10.3.2.1.4 as follows. The remainder of the section is unchanged.

10.3.2.1.4 Indoor ~~Environmental~~ Air Quality. [. . .]

Add a new Section 10.3.2.1.5 at the end of Section 10.3.2.1.

10.3.2.1.5 Indoor Environmental Quality Survey. The plan for operation shall include an indoor environmental quality occupant survey complying with all of the following:

a. The survey shall be implemented within a period of 6 to 18 months after issuance of the certificate of occupancy. The survey shall be repeated not less often than once every three years.

b. The survey questions shall include satisfaction questions and diagnostic questions for indoor air quality, lighting, acoustics, and thermal comfort. The survey questions shall use a seven-point satisfaction scale and comply with ASHRAE Standard 55, Section 7.3.1.1.

c. A plan for reporting the survey results shall be produced that includes the following:

   1. The survey report shall state where the response rate was less than the response rates specified in ASHRAE Standard 55, Section 7.3.1.

   2. The survey report shall indicate the percentage of satisfaction for each question in accordance with ASHRAE 55, Section 7.4.1(a).

   3. The percentage satisfaction results shall be compared to a nationally recognized survey benchmarking database where the building occupancy category is represented in the databases of nationally recognized organizations.

Add the following new reference to Appendix G.

Center for the Built Environment
Indoor Environmental Quality (IEQ) Survey™
http://www.cbe.berkeley.edu/research/survey.htm
Center for the Built Environment
University of California, 390 Wurster Hall #1839
Berkeley, CA 94720-1839
(510) 642-4950

Usable Buildings Trust Occupant Satisfaction Evaluation Survey
http://www.busmethodology.org.uk/info@busmethodology.org.uk

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FOREWORD

Addendum z revises the lighting power density (LPD) requirements in Standard 189.1 to include parking structures. The ratio of the target LPD to that in Standard 90.1-2013, Addendum ch, is proposed for LPD factors in ASHRAE Standard 189.1 Tables 7.4.6.1A and 7.4.6.1B. Foreword Table 1 shows the target premium efficiency LPD achievable with current lighting technologies with an emphasis on the use of LED luminaires. The proposed LPD values are developed based on the same analysis methodology used by the Standard 90.1 Lighting subcommittee. It is possible to achieve this LPD using either greater-efficacy luminaires or a slightly lower amount of light than the inputs in the analysis used to develop Standard 90.1, Addendum ch.

Foreword Table 1 LPD Requirements for Parking Structure in 90.1 Addendum ch and the 189.1 Proposal

Application	90.1-2013 Addendum LPD (W/sf)	Target Premium Efficiency for 189.1 LPD (W/sf)	189.1 Proposed Ratio
Parking Garage—Whole-Building Area Method	0.15	0.12	0.80
Parking Area, Interior—Space-by-Space Method	0.14	0.11	0.80

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Addendum z to Standard 189.1-2014

Modify Tables 7.4.6.1A and 7.4.6.1B as follows.

TABLE 7.4.6.1A LPD Factors when Using the Building Area Method

Building Area Type	LPD Factor
Courthouse	0.95
Dining—Cafeteria/Fast Food	0.95
Dining—Family	0.95
Dormitory	0.95
Exercise Center	0.95
Healthcare Clinic	0.95
Hospital	0.95
Library	0.95
Multifamily	0.95
Office	0.95
Parking Garage	0.80
Penitentiary	0.95
Police Station	0.95
Religious Building	0.95
School/University	0.95
Town Hall	0.95
Transportation	0.95
All Other Building Area Types	1.00

TABLE 7.4.6.1B Lighting Power Density (LPD) Factors When Using the Space-by-Space Method

Common *Space* Types		**Common *Space* Types**	
***Space* Type**	**LPD Factor**	***Space* Type**	**LPD Factor**
Audience *seating* area		Office	
… in an auditorium	1.00	… enclosed	0.95
… in a convention center	1.00	… open plan	0.85
… in a gymnasium	0.85	Sales area	0.95
… in a motion picture theater	1.00	Parking area, interior	0.80
… in a penitentiary	1.00	All other common *space* types	1.00
… in a performing arts theater	1.00	**Building-Type Specific *Space* Types**	
… in a religious building	1.00	***Space* Type**	**LPD Factor**
… in a sports arena	1.00	Convention center—Exhibit *space*	0.85
… in all other audience *seating* areas	1.00	Gymnasium/fitness center	
Classroom/lecture hall/training room		… in an exercise area	0.85
… in a penitentiary	1.00	… in a playing area	1.00
… in all other *classrooms*/lecture halls/training rooms	0.85	Healthcare facility	
Conference/meeting/multipurpose room	0.90	… in an exam/treatment room	0.85
Corridor		… in an imaging room	1.00
… in a facility for the visually impaired (and used primarily by residents)	1.00	… in a medical supply room	0.90
… in a hospital	1.00	… in a nursery	0.85
… in a manufacturing facility	1.00	… in a nurse's station	0.90
… in all other corridors	0.85	… in an operating room	1.00
Courtroom	0.85	… in a patient room	0.90
Dining area		… in a physical therapy room	0.85
… in a penitentiary	1.00	… in a recovery room	1.00
… in a facility for the visually impaired (and used primarily by residents)	1.00	Library	
… in bar/lounge or leisure dining	1.00	… in a reading area	1.00
… in cafeteria or fast food dining	1.00	… in the stacks	0.95
… in family dining	0.85	Manufacturing facility	
… in all other dining areas	0.90	… in a detailed manufacturing area	1.00
Laboratory		… in an equipment room	1.00
… in or as a *classroom*	1.00	… in an extra high bay area	1.00
… in all other laboratories	0.95	… in a high bay area	0.85
Laundry/washing area	0.95	… in a low bay area	0.85
Lobby		Transportation facility	
… in a facility for the visually impaired (and used primarily by residents)	1.00	… in a baggage/carousel area	0.90
… for an elevator	0.85	… in an airport concourse	0.90
… in a hotel	1.00	… at a terminal ticket counter	0.85
… in a motion picture theater	0.95	Warehouse—Storage area	
… in a performing arts theater	1.00	… for medium to bulky, palletized items	0.85
… all other lobbies	0.95	… for smaller, hand-carried items	1.00
Lounge/breakroom		All other building-type specific *space* types	1.00
… in a healthcare facility	0.85		
… in all other lounge/breakrooms	0.85		

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FOREWORD

Addendum aa revises current requirements for renewable energy systems and related exceptions. It requires that renewable energy certificates (RECs) be retained and retired by the building owner for all compliance options. Currently, building owners are not required to retain RECs. Unless the RECs are retained and retired, the building owner cannot claim the environmental benefits, and if someone else buys the RECs, the buyer can take credit for the environmental impacts. In addition, the addendum proposes to base the requirement on the building footprint instead of roof area. For saw tooth and other roof configurations, the roof area can be significantly larger than the building footprint, requiring a larger PV system.

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 aa to Standard 189.1-2014

Modify Section 3.2 as shown.

renewable energy certificate (REC): a tradable instrument that represents the environmental attributes of one megawatt-hour of renewable electricity generation and is transacted separately from the electricity generated by the renewable energy source.

REC: see *renewable energy certificate (REC)*.

Modify Section 7.4.1.1 as shown.

7.4.1.1 On-Site Renewable Energy Systems. *Building projects* shall comply with either the Standard Renewables Approach in Section 7.4.1.1.1 or the Alternate Renewables Approach in Section 7.4.1.1.2.

7.4.1.1.1 Standard Renewables Approach. Baseline On-Site Renewable Energy Systems. *Building projects* shall contain *on-site renewable energy systems* that provide the annual energy production equivalent of not less than 6.0 kBtu/ft^2 (20 kWh/m^2) multiplied by the horizontal projection of the *gross roof area* in ft^2 (m^2) for single-story buildings, and not less than 10.0 kBtu/ft^2 (32 kWh/m^2) multiplied by the horizontal projection of the *gross roof area* in ft^2 (m^2 for all other buildings. The annual energy production shall be the combined sum of all *on-site renewable energy systems*. Documentation shall be provided to the AHJ that indicates that the *RECs* associated with the *on-site renewable energy system* will be retained and retired by the *owner*. Where the building owner does not have ownership of the RECs associated with the on-site renewable energy system, the owner shall obtain and retire an equal or greater quantity of RECs.

Exceptions to 7.4.1.1.1: Buildings that demonstrate compliance with both of the following are not required to contain *on-site renewable energy systems*:

1. An annual daily average incident solar radiation available to a flat plate collector oriented due south at an angle from horizontal equal to the latitude of the collector location less than 4.0 kWh/ m^2·day (1.2 kBtu/ft²/day), accounting for existing buildings, permanent infrastructure that is not part of the *building project*, topography, and trees.
2. A commitment to purchase electricity products complying with the Green-e Energy National Standard for Renewable Electricity Products of at least 7 kWh/ft² (75 kWh/m²) of *conditioned space* each year until the cumulative purchase totals 70 kWh/ft^2 (750 kWh/m²) of *conditioned space*.

7.4.1.1.2 Alternate Renewables Approach. Reduced On-Site Renewable Energy Systems and Higher-Efficiency Equipment. *Building projects* complying with this approach shall comply with the applicable equipment efficiency requirements in Normative Appendix B, the water-heating efficiency requirements in Section 7.4.4.1, equipment efficiency requirements in Section 7.4.7.1, and the applicable ENERGY STAR® requirements in Section 7.4.7.3.2, and shall contain *on-site renewable energy systems* that provide the annual energy production equivalent of not less than 4.0 kBtu/ft² (13 kWh/m²) multiplied by the horizontal projection of the *gross roof area* in ft² (m²) for single-story buildings, and not less than 7.0 kBtu/ft² (22 kWh/m²) multiplied by the horizontal projection of the *gross roof area* in ft² (m²) for all other buildings. The annual energy production shall be the combined sum of all *on-site renewable energy systems*. For equipment listed in Section 7.4.7.3.2 that are also contained in Normative Appendix B, the installed equipment shall comply by meeting or exceeding both requirements.

Documentation shall be provided to the AHJ that indicates that the *RECs* associated with the *on-site renewable energy system* will be retained and retired by the *owner*. Where the building owner does not have ownership of the RECs associated with the on-site renewable energy system, the owner shall obtain and retire an equal or greater quantity of RECs.

Modify Section 11 as shown.

Reference	Title	Section
Green-e **c/o Center for Resource Solutions** **1012 Torney Ave., Second Floor** **San Francisco, California 94129, United States** **1-415-561-2100, www.green-e.org**		
Version 2.7, July 14, 2015~~1.6, Dec 5, 2008~~	Green-e Energy National Standard for Renewable Electricity Products	7.4.1.1(2)

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FOREWORD

Addendum ab adds SI values to the requirements for kitchen hood exhausts. The SI values were extracted from Standard 90.1-2016, Table 6.5.7.2.2, which has the same table content as Table 7.4.3.7.

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 ab to Standard 189.1-2014

Modify as shown.

7.4.3.7.1 For kitchen/dining facilities with total kitchen hood exhaust airflow rate greater than 2000 cfm (950 L/s), the maximum exhaust flow rate for each hood shall be determined in accordance with Table 7.4.3.7. For single hoods, or hood sections installed over appliances with different duty ratings, the maximum allowable exhaust flow rate for the hood or hood section shall be determined in accordance with Table 7.4.3.7 for the highest appliance duty rating under the hood or hood section. Refer to ASHRAE Standard 154 for definitions of hood type, appliance duty, and net exhaust flow rate.

Exception: When at least 75% of all the replacement air is *transfer air* that would otherwise be exhausted.

7.4.3.7.2 Kitchen/dining facilities with total kitchen hood exhaust airflow rate greater than 2000 cfm (950 L/s) shall comply with at least one of the following:

a. At least 50% of all replacement air must be transfer air that would otherwise be exhausted.

b. At least 75% of kitchen hood exhaust air shall be controlled by a demand ventilation system(s), which shall

   1. be capable of reducing exhaust and replacement air system airflow rates by no more than the larger of

      i. 50% of total design exhaust and replacement air system airflow rate or

      ii. the outdoor airflow and exhaust rates required to meet the ventilation and exhaust requirements of Sections 6.2 and 6.5 of ANSI/ASHRAE Standard 62.1 for the zone;

   2. include controls to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent, and combustion products during cooking and idle;

   3. include controls that result in full flow when the demand ventilation system(s) fail to modulate airflow in response to appliance operation; and

   4. allow occupants to temporarily override the system(s) to full flow.

c. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40% shall be applied on at least 50% of the total exhaust airflow.

d. In Climate Zones 1B, 2B, 3B, 4B, 5B, 6B, 7B, and 8B, when makeup air is uncooled or cooled without the use of mechanical cooling, the capacity of any nonmechanical cooling system(s) (for example, natural cooling or evaporative cooling) shall be demonstrated to be no less than the system capacity of a mechanical cooling system(s) necessary to meet the same loads under design conditions.

TABLE 7.4.3.7 Maximum Net Exhaust Flow Rate ~~in cfm per Linear Foot of~~ per Length of Hood ~~Length~~

Type of Hood	Light-Duty Equipment		Medium-Duty Equipment		Heavy-Duty Equipment		Extra-Heavy-Duty Equipment	
	cfm per linear foot	L/s per linear metre	cfm per linear foot	L/s per linear metre	cfm per linear foot	L/s per linear metre	cfm per linear foot	L/s per linear metre
Wall-mounted canopy	140	217	210	325	280	433	385	596
Single island[a]	280	433	350	541	420	650	490	758
Double island (per side)	175	271	210	325	280	433	385	596
Eyebrow	175	271	175	271	Not allowed	Not allowed	Not allowed	Not allowed
Backshelf/Passover	210	325	210	325	280	433	Not allowed	Not allowed

a. The total exhaust flow rate for all single-island hoods in a kitchen/dining facility shall be no more than 5000 cfm (2360 L/s).

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FOREWORD

Addendum ac augments requirements for demand-response, including modifications to changes made by Addenda b and ce to Standard 189.1-2014 (both approved for publication). This addendum deletes the existing Section 7.3.4 and replaces with new text that is based in part on concepts that are included in the 2015 International Green Construction Code.

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 ac to Standard 189.1-2014

Modify the text as follows.

7.3.4 ~~Peak~~Automated Demand Response ~~Reduction~~. *Building projects* shall contain automatic control systems that have the capability to reduce building equipment loads to lower electric peak demand of the building.

The building controls shall be designed with automated demand-response (DR) infrastructure capable of receiving DR requests from the utility, electrical system operator, or third-party DR program provider, and automatically implementing load adjustments to the HVAC and lighting systems.

7.3.4.1 HVAC Systems Zone Set Points. *The building project's* HVAC systems shall be programmed to allow centralized demand reduction in response to a signal from a centralized contact or software point in accordance with the following:

a. The controls shall be programmed to automatically adjust upward the zone operating cooling set points by a minimum of 3°F (1.7°C).

b. The controls shall programmed to automatically adjust downward the zone operating heating set points by a minimum of 3°F (1.7°C).

c. The controls shall be programmed to automatically adjust downward the zone operating cooling set points by a minimum of 2°F (1.1°C).

d. The automated DR strategy shall include both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.

Exception to 7.3.4.1: Systems serving areas deemed by the owner to be critical in nature.

7.3.4.2 Variable-Speed Equipment. For HVAC equipment with variable-speed control, the controls shall be programmed to allow automatic adjustment of the maximum speed of the equipment to 90% of design speed during automated DR events. Airflow adjustments shall not decrease the supply airflow rate below the level that would result in outdoor airflow being below the *minimum outdoor airflow rates* specified in Section 8.3.1.1, or that would cause adverse building pressurization problems.

7.3.4.3 Lighting. For *building projects* with interior lighting control systems controlled at a central point, such systems shall be programmed to allow automated DR. The programming shall reduce the total connected lighting power demand during a DR event by not less than 15% but no more than 50% of the baseline power level. The baseline lighting power shall be determined in accordance with Section 7.4.6.1.1. For *building projects* without central lighting controls, DR capabilities for lighting systems shall not be required.

For spaces not in the *daylight area* and connected to automated daylighting control, the lighting levels shall be uniformly reduced throughout the space.

Exceptions:

1. Luminaires or signage on emergency circuits.
2. Luminaires located within a *daylight area* that are dimmable and connected to automated daylighting control systems.
3. Lighting systems, including dimming systems, claiming a lighting power allowance *for institutional tuning* according to Section 7.4.6.1.1(d).

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FOREWORD

Addendum ad changes the requirements for permanent projections (such as balconies, overhangs, or shading devices). It deletes the prescriptive requirements for permanent projections in Climate Zones 4A and 5, retaining the requirements in Climate Zones 0 through 3, 4B, and 4C. It also modifies some requirements and exceptions based on consideration of similar requirements in the 2015 IgCC.

Permanent projections are not required for Climate Zones 4A and 5 for several reasons. Permanent projections result in the most energy savings during warmer seasons, and these occur most frequently in warm, cooling dominated climates. An analysis of energy savings in representative building types (PNNL medium office and high-rise apartment prototypes) showed the energy savings were more highly dependent on the level and magnitude of thermal bridging through the building envelope insulation in these colder Climate Zones 4A and 5. In contrast, the analysis showed similar positive energy saving for permanent projections in Climate Zones 4B and 4C as well as in Climate Zone 3.

Addendum ad also adds an exception for vertical fenestration within 18 in. of a lot line. Finally, it clarifies the wording of the exception for fenestration that receives low amounts of solar radiation.

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Addendum ad to Standard 189.1-2014

Modify Section 7.4.2.5 as follows.

7.4.2.5 Permanent Projections. For *Climate Zones* 0~~1~~ through 3~~5~~ and *Climate Zones* 4B and 4C, the *vertical fenestration* on the west, south, and east shall be shaded by permanent projections that have an area-weighted average *projection factor* (*PF*) of not less than 0.50 for the first story above grade and 0.25 for other above-grade stories. The building is allowed to be rotated up to 45 degrees to the nearest cardinal orientation for purposes of calculations and showing compliance. Where different windows or glass doors have different projection factor values, each shall be evaluated separately, or an area-weighted projection factor value shall be calculated and used for all windows and glass doors. Horizontal projections shall extend over the full width of the glazing.

Exceptions: Permanent projections are not required for the following buildings and fenestrations:

1. Where *vertical fenestration* is located within 18 in. (450 mm) of the lot line.
2. Where equivalent shading of the *vertical fenestration* is provided by buildings, structures, geological formations, or permanent exterior projections that are not horizontal, as determined by sun-angle studies at the peak solar altitude on the summer solstice and three hours before and after the peak solar altitude on the summer solstice.

~~1. *Vertical fenestration* that receives direct solar radiation for fewer than 250 hours per year because of shading by permanent external buildings, existing permanent infrastructure, or topography.~~

3~~2~~. *Vertical fenestration* with automatically controlled shading devices capable of modulating in multiple steps the amount of solar gain and light transmitted into the *space* in response to daylight levels or solar intensity that comply with all of the following:

a. Exterior shading devices shall be capable of providing at least 90% coverage of the *fenestration* in the closed position.
b. Interior shading devices shall be capable of providing at least 90% coverage of the fenestration in the closed position and have a minimum solar reflectance of 0.50 for the surface facing the fenestration.
c. A manual override located in the same enclosed space as the vertical fenestration shall override operation of automatic controls no longer than four hours.
d. Acceptance testing and commissioning shall be conducted as required by Section 10 to verify that automatic controls for shading devices respond to changes in illumination or radiation intensity.

4~~3~~. *Vertical fenestration* with automatically controlled *dynamic glazing* capable of modulating in multiple steps the amount of solar gain and light transmitted into the *space* in response to daylight levels or solar intensity that comply with all of the following:

a. *Dynamic glazing* shall have a lower labeled *SHGC* equal to or less than 0.12, lowest labeled visible transmittance (VT) no greater than 0.05, and highest labeled VT no less than 0.40.
b. A manual override located in the same *enclosed space* as the *vertical fenestration* shall override operation of *automatic* controls no longer than 4 hours.
c. Acceptance testing and commissioning shall be conducted as required by Section 10 to verify that *automatic* controls for *dynamic glazing* respond to changes in illumination or radiation intensity.

5. Existing buildings undergoing alteration, repair, relocation, or a change of occupancy.

Modify Section 8.4.1.3 as follows.

8.4.1.3 Office *Space* Shading. Each west-, south-, and east-facing façade, shall be designed with a shading projection factor (PF). The PF shall be not less than 0.5 for the first

story above grade and 0.25 for other above-grade stories. Shading is allowed to be external or internal using the interior PF. The building is allowed to be rotated up to 45 degrees for purposes of calculations and showing compliance. Where different windows or glass doors have different projection factor values, each shall be evaluated separately, or an area-weighted projection factor value shall be calculated and used for all windows and glass doors. Horizontal projections shall extend over the full width of the glazing. The following shading devices are allowed to be used:

a. Louvers, sun shades, light shelves, and any other permanent device. Any vertical fenestration that employs a combination of interior and external shading is allowed to be separated into multiple segments for compliance purposes. Each segment shall comply with the requirements for either external or interior projection factor.
b. Building self-shading through roof overhangs or recessed windows.

Exceptions to 8.4.1.3: Permanent projections are not required for the following buildings and fenestrations:

1. Translucent panels and glazing systems with a measured haze value greater than 90%, tested according to ASTM D1003 (notwithstanding its scope) or other test method approved by the AHJ, and that are entirely 8 ft (2.5 m) above the floor, do not require external shading devices.
2. Where equivalent shading of the *vertical fenestration* is provided by buildings, structures, geological formations, or permanent exterior projections that are not horizontal, as determined by sun-angle studies at the peak solar altitude on the summer solstice and three hours before and after the peak solar altitude on the summer solstice.
2. ~~*Vertical fenestration* that receives direct solar radiation for less than 250 hours per year because of shading by permanent external buildings, existing permanent infrastructure, or topography.~~
3. Vertical fenestration with automatically controlled shading devices in compliance with Exception (2) of Section 7.4.2.5.
4. Vertical fenestration with automatically controlled dynamic glazing in compliance with Exception (3) of Section 7.4.2.5.
5. Existing buildings undergoing alteration, repair, relocation, or a change of occupancy.

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FOREWORD

Addendum ae adds new Section 5.3.8, which addresses plans for the treatment of waste materials originating from the development of a building project site.

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 ae to Standard 189.1-2014

Add Section 5.3.8 as follows.

5.3.8 Building Site Waste Management

5.3.8.1 Building Site Waste Management Plan. A building site waste management plan shall be developed and implemented for excavated soil, rock, and land-clearing debris. Land-clearing debris is limited to stumps and vegetation. Diverted land-clearing debris and removed rock and soil shall not be sent to sites where development activity is prohibited by Section 5.3.1.2 or to *greenfield* sites other than those being used for agricultural purposes or being developed as part of a building project.

Not less than 90% of the land-clearing debris, excluding invasive plant materials, shall be diverted from disposal in landfills and incinerators, other than waste-to-energy systems with an energy-recovery efficiency rate higher than 60%. Land-clearing debris calculations shall be based on either weight or volume but not both. Receipts or other documentation related to diversion shall be maintained through the course of construction.

The plan shall address all of the following:

a. Land-clearing debris, rock, and soil to be diverted from disposal by composting, recycling, or reuse.
b. Waste materials that will be diverted on-site.
c. The locations to which waste materials will be diverted off-site.
d. Soils to be stockpiled for future use at any location.
e. Woody waste to be used as fuel.
f. The destruction and disposal of *invasive plant* materials.
g. The methods of removal of any contaminated soils.
h. The treatment of vegetation to comply with the rules of government-designated quarantine zones for invasive insect species.

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FOREWORD

Addendum ag creates a new definition for plants that are suitable for inclusion in this standard. It replaces "adapted plants" in Section 6 to better define the desired vegetation and to avoid conflicting with the term's use in Section 5.

The definition for "rainfall-ET_c compatible plants" includes measurable means to determine whether the nonnative plant meets the requirements of the standard. Rainfall-ET_c compatible plants' water needs are based on the assigned ET_c less 20%, because the ET_c is based on maximum biomass production (not required for plant maintenance). Essentially, the plant is approved as long as its water needs (expressed in ET_c) do not exceed 20% of the average precipitation in the local climate. As frequent irrigation of rainfall-ET_c compatible plants past the establishment period is unnecessary, there is no need for a permanent irrigation system to be installed.

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Addendum ag to Standard 189.1-2014

Add new definition to Section 3 as shown.

plants:

a. ***adapted plants:*** *plants* that reliably grow well in a given habitat with minimal attention from humans in the form of winter protection, pest protection, water irrigation, or fertilization once root systems are established in the soil. *Adapted plants* are considered to be low maintenance but not invasive.

b. ***rainfall-ET_c compatible plants:*** plants with documented ET_c rates and having all of the following characteristics: (1) not native or invasive to the local geographic area of the site; (2) after the *landscape establishment period*, does not require supplemental annual irrigation based on the ten-year average annual rainfall of the local climate and based on 80% of the plant's ET_c.

~~b.~~c. ***invasive plants:*** species of *plants* that are not native to the *building project site* and that cause or are likely to cause environmental harm. At a minimum, the list of invasive species for a *building project site* includes *plants* included in city, county, and regional lists and state and federal noxious weeds laws.

~~c.~~d. ***native plants:*** *plants* that adapted to a given area during a defined time period and are not invasive. In America, the term often refers to *plants* growing in a region prior to the time of settlement by people of European descent.

Revise Section 6 as shown.

6.3.1 Site Water Use Reduction

6.3.1.1 Landscape Design. A minimum of 60% of the area of the *improved landscape* shall be in *biodiverse planting* of *native plants* and ~~*adapted plants*~~ *rainfall-ET_c compatible plants* ~~other than *turfgrass*~~.

Exceptions to 6.3.1.1:

1. The area of dedicated athletic fields, golf courses, driving ranges, and areas dedicated for production of food for human consumption shall be excluded from the calculation of the *improved landscape* for schools, *residential* common areas, or public recreational facilities.
2. Landscape areas irrigated solely with *alternate on-site sources of water* shall be exempt from these requirements.
3. Where average annual rainfall is less than 12 in. (30 cm), plants other than turfgrass with an annual ET_c of 15 in. (38 cm) or less shall be deemed equivalent to *rainfall-ET_c compatible plants*.

6.3.1.3 Controls. Where any ~~Any~~ irrigation system for the project *site* uses an automatic controller, the system shall be controlled by a qualifying *smart controller* that uses *evapotranspiration* (*ET*) and weather data to adjust irrigation schedules and that complies with the minimum requirements or an on-site rain or moisture sensor that automatically shuts the system off after a predetermined amount of rainfall or sensed moisture in the soil. Qualifying *smart controllers* shall meet the minimum requirements, as listed below, when tested in accordance with IA *SWAT* Climatological-Based Controllers 8th Draft Testing Protocol. *Smart controllers* that use *ET* shall use the following inputs for calculating appropriate irrigation amounts:

a. *Irrigation adequacy*—80% minimum ET_c.

b. *Irrigation excess*—not to exceed 10%.

Exception to 6.3.1.3: A temporary irrigation system used exclusively for the establishment of new landscape shall be exempt from this requirement. Temporary irrigation systems shall be removed or permanently disabled at such time as the *landscape establishment period* has expired.

6.3.1.4 Irrigation of *Rainfall-ET_c Compatible Plants*. The use of *potable water* or *reclaimed water* for irrigation of *adapted plants* is prohibited after the *landscape establishment period*. In-ground irrigation systems for *rainfall-ET_c compatible plants* using potable or off-site treated *reclaimed water* are prohibited. After the *landscape establishment period* of *adapted plants*, the irrigation system using *potable water* or *reclaimed water* shall be permanently disabled or removed from *site*.

Exception to 6.3.1.4: Plants deemed equivalent to *rainfall-ET_c compatible plants* by Section 6.3.1.1, Exception 3, shall be exempt from the requirements of Section 6.3.1.4.

(This foreword 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.)

FOREWORD

Addendum ah revises the lighting power density (LPD) requirements in Standard 189.1 for exterior parking areas using the same methodology employed in Standard 90.1 but targeting a high level of performance.

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

Addendum ah to Standard 189.1-2014

Modify Table 7.4.6.1C as follows.

TABLE 7.4.6.1C *Lighting Power Allowance* Factors

	Lighting Zone				
	LZ0	**LZ1**	**LZ2**	**LZ3**	**LZ4**
For tradable areas, others	1.00	0.90	0.90	0.95	0.95
For nontradable areas	1.00	0.95	0.95	0.95	0.95
For tradable areas, uncovered parking areas: parking areas and drives with measured SRI < 29 or without SRI measurement	Not allowed	1	0.75	0.83	0.63
For tradable areas, uncovered parking areas: parking areas and drives with new concrete without added color pigment or with measured SRI ≥ 29	Not allowed	1	1	1	1

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FOREWORD

Addendum ai adds requirements for testing, installing, and commissioning air curtains in building entrances. These requirements are intended to ensure that air curtains function and operate as intended.

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 ai to Standard 189.1-2014

Add new Section 7.4.2.4 as follows.

7.4.2.4 Air Curtains. Where air curtains are provided at building entrances or building entrance vestibules, for the distance from the air-curtain discharge nozzle to the floor, the air-curtain unit shall produce a minimum velocity of 6.6 ft/s (2.0 m/s), in accordance with ANSI/AMCA 220, and be installed in accordance with manufacturer's instructions. Automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section 10.3.1.2.4.

7.4.2.~~4~~ 5

Renumber existing section numbers as follows.

7.4.2.~~5~~6
7.4.2.~~6~~7
7.4.2.~~7~~8
7.4.2.~~8~~9

Modify Section 10.3.1.2.4 as follows.

10.3.1.2.4 Systems. The following systems and associated controls, if included in the building project, shall be commissioned:

a. Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and/or passive).
b. *Building envelope* systems, components, and assemblies to verify the airtightness and thermal and moisture integrity. *Building envelope* airtightness commissioning shall also comply with Section 10.3.1.2.5.
c. Air-curtain systems.
d. ~~c.~~ Lighting systems.
e. ~~d.~~ Fenestration control systems: Automatic controls for shading devices and dynamic glazing.
f. ~~e.~~ Irrigation.
g. ~~f.~~ Plumbing.
h. ~~g.~~ Domestic and process water pumping and mixing systems
i. ~~h.~~ Service water heating systems.
j. ~~i.~~ Renewable energy systems.
k. ~~j.~~ Water measurement devices, as required in Section 6.3.3.
l. ~~k.~~ Energy measurement devices, as required in Section 7.3.3.

Add the following entry to Section 11.

Reference	Title	Section
Air Movement and Control Association International, Inc. 30 West University Drive Arlington Heights, IL 60004-1893, United States 1-847-394-0150; www.amca.org		
ANSI/AMCA 220-05 (R2012)	Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating	7.4.2.4

(This foreword 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.)

FOREWORD

Addendum aj revises the bilevel motion control requirements to better align with the requirements of Standard 90.1-2016, which increased the lighting power reduction from 30% to 50% for signs and most exterior lighting (except façade and landscape lighting) after business hours.

Standard 90.1-2016 also requires that parking-lot lighting with mounting heights less than 24 ft "automatically reduce the power of each luminaire by a minimum of 50% when no activity has been detected in the area illuminated by the controlled luminaires for a time of no longer than 15 minutes." This relatively high level of power reduction for lighting parking lots represents the transition to LED technology, which can be dimmed more easily than legacy lighting systems.

This proposal also recommends that the bilevel motion-controlled lighting requirement be expanded to open areas in outdoor sales lots (but not street frontage for vehicle sales lots).

The defined expanded area of scope "open areas in outdoor retail sales" and the exemption for "street frontage for vehicle sales lots" make use of terms that exist in Standard 90.1-2016, Table 9.4.2-2, "Individual Lighting Power Allowances for Building Exteriors."

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 aj to Standard 189.1-2014

Modify Section 7.4.6.4 as follows.

7.4.6.4 Controls for Exterior Sign Lighting. This section supersedes Section 9.4.1.4 of ANSI/ASHRAE/IES Standard 90.1 for all exterior sign lighting. All exterior sign lighting, including internally illuminated signs and lighting on externally illuminated signs, shall comply with the requirements of Sections 7.4.6.~~6~~4.1 or 7.4.6.~~6~~4.2.

Exceptions:

1. Sign lighting that is specifically required by a health or life safety statute, ordinance, or regulation.
2. Signs in tunnels.

7.4.6.4.1 All sign lighting that operates more than one hour per day during *daylight hours* shall include controls to automatically reduce the input power to a maximum of 35% of full power for a period from one hour after sunset to one hour before sunrise.

Exception: Sign lighting using ~~metal halide, high-pressure sodium, induction, cold cathode, or~~ neon lamps ~~that includes~~ with controls to automatically reduce the input power to a maximum of 70% of full power for a period from one hour after sunset to one hour before sunrise.

7.4.6.4.2 All other sign lighting shall include the following:

a. Controls to automatically reduce the input power to a maximum of ~~70%~~ 50% of full power for a period from midnight or within one hour of the end of business operations, whichever is later, until 6:00 am or business opening, whichever is earlier.
b. Controls to automatically turn off during *daylight hours.*

Modify Section 7.4.6.5 as follows.

7.4.6.5 Parking and Outdoor Sales Lighting. This section supersedes Section 9.4.1.4 of ANSI/ASHRAE/IES Standard 90.1 for lighting serving uncovered parking areas and open areas in outdoor sales lots. Outdoor luminaires serving uncovered parking areas and open areas in outdoor sales lots shall be controlled by all of the following:

a. Luminaires shall be controlled by a device that automatically turns off the luminaire during *daylight hours*.
b. Luminaires shall be controlled by a timeclock or other control that automatically turns off the luminaire according to a timed schedule.
c. For luminaires having a rated input wattage of more than 50 W and where the bottom of the luminaire is mounted 24 ft (7.3 m) or less above the ground, the luminaires shall be controlled by one or more devices that automatically reduce lighting power of each luminaire by a minimum of ~~40%~~ 50% when there is no activity detected in the controlled zone for a period no longer than 15 minutes. No more than 1500 input watts of lighting power shall be controlled together.

Exceptions to 7.4.6.5(c):

1. Lighting serving ~~uncovered parking areas does not include lighting for outdoor sales, including vehicle sales lots.~~ street frontage for vehicle sales lots.
2. Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

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FOREWORD

Addendum ak revises Section 9.5 to reflect advancements in the implementation of life-cycle assessment and to reference ASTM E2921, Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes and Rating Systems. ASTM E2921 provides a consistent framework and criteria for performing a whole-building life-cycle assessment while allowing the identification of specific inputs to meet the objectives of the performance path for Standard 189.1.

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 ak to Standard 189.1-2014

Revise Section 9.5 as follows.

9.5 Performance Option

9.5.1 ***Life-Cycle Assessment*** **(*LCA*).** An *LCA* shall be performed in accordance with ASTM E2921 and ISO Standard 14044, as modified by this section, for a minimum of two building alternatives, ~~considering at least those material components included for consideration in Section 9.4.1,~~ both of which shall conform to the *owner's project requirements (OPR)*. ~~Each building alternative shall consist of a common design, construction, and materials for the locale, including building size and use, as commonly approved by the *AHJ*. Each building alternative shall comply with Sections 6, 7, and 8. The service life of the buildings shall be not less than that determined using Table 10.3.2.3, except that the design life of long-life buildings shall be no less than 75 years.~~

9.5.1.1 ***LCA*** **Performance Metric.** The *LCA* shall demonstrate that the final building design achieves the following minimum improvement over the reference building design assessed in the *LCA*: ~~The building alternative chosen for the project shall have~~

a. a 10% improvement in a minimum of each of two impact categories, one of which must be global warming, or

b. a 5% improvement ~~over the other building alternative assessed in the *LC4*~~ in a minimum of each of ~~two~~ three ~~of the~~ impact categories, one of which must be global warming.

The following impact categories ~~are~~ shall be used to determine compliance with this section and shall be included in the report described in Section 9.5.1.3: land use ~~(or habitat alteration)~~, resource use, ~~climate change~~ global warming, ozone layer depletion, human health effects, ecotoxicity, smog, acidification, and eutrophication.

9.5.1.2 Procedure. The *LCA* shall be performed in accordance with the service lives, life-cycle stages, study boundaries, and comparison methodologies of ASTM E2921 with ~~include~~ the following ~~three steps~~ modifications:

~~**Step 1:** Perform a life-cycle inventory (LCI). The LCI accounts for all the individual environmental flows to and from the material components in a building throughout its life cycle.~~

~~a. The LCI shall include the materials and energy consumed and the emissions to air, land, and water for each of the following stages:~~
~~1. Extracting and harvesting materials and fuel sources from nature.~~
~~2. Processing building materials and manufacturing building components.~~
~~3. Transporting materials and components.~~
~~4. Assembly and construction.~~
~~5. Maintenance, repair, and replacement during the design life with or without operational energy consumption.~~
~~6. Demolition, disposal, recycling, and reuse of the building at the end of its life cycle.~~

~~b. The LCI shall account for emissions to air for the following:~~
~~1. The six principal pollutants for which the USEPA has set National Ambient Air Quality Standards as required by the Clean Air Act and its amendments: carbon monoxide, nitrogen dioxide, lead, sulfur oxides, particulate matter (PM_{10} and $PM_{2.5}$), and ozone.~~
~~2. Greenhouse gases (not including water vapor and ozone) as described in the Inventory of U.S. Greenhouse Gas Emissions and Sinks: carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, hydrochlorofluorocarbons, bromofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, sulfur dioxide, and VOCs.~~
~~3. Hazardous air pollutants listed in the Clean Air Act and its amendments.~~

~~**Step 2:** Compare the two building alternatives using a published third-party impact indicator method that includes, at a minimum the impact categories listed in Section 9.5.1.1. An *LCA* report shall be prepared that meets the requirements for third-party reporting in ISO Standard 14044 and also includes:~~

~~a. A description of the two building alternatives, including:~~
~~1. a description of the system boundary used,~~
~~2. the design life of each building, and~~
~~3. the physical differences between buildings.~~
~~b. The impact indicator method and impact categories used.~~
~~c. The results of the *LCA* indicating a minimum of 5% improvement in the proposed building compared to the~~

~~other building alternative for a minimum of two impact categories, including an explanation of the rationale for the weighting and averaging of the impacts.~~

~~**Step 3:** Conduct a critical review by an external expert independent of those performing the *LCA*.~~

a. Each building alternative shall comply with Sections 6, 7, and 8 of this standard.

b. The service life of the buildings shall be not less than that determined using Table 10.3.2.3, except that the service life of long-life buildings shall be no less than 75 years.

c. Operating energy consumption shall be included or excluded at the discretion of the project team.

d. The LCA tools or software shall include a published third-party impact indicator method.

e. The estimate of structural system material quantities shall be verified by a *design professional* or other approved source.

9.5.1.3 Reporting. ~~The following~~ A report that includes a description of the building alternatives and their physical differences shall be prepared and shall comply with the reporting requirements stated in ASTM E2921. The name and address of the *design professional* or other approved source verifying structural system material quantities shall be included. A critical review shall be performed by an external expert independent of those performing the *LCA*.

The report shall be submitted to the *AHJ*~~:~~

~~a. The *LCA* report.~~

~~b. The~~ and include documentation of critical peer review by a third party, ~~including the~~ results from the review, and the reviewer's name and contact information.

Modify Section 11 as follows.

Reference	Title	Section
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM E2921-16	Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes and Rating Systems	9.5

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FOREWORD

Addendum al modifies the provisions for electric-vehicle charging infrastructure to include an additional option to provide electric conduit from electric service panels to parking lot spaces during new-building construction. This will support the future installation of electric-vehicle charging infrastructure in the most cost-effective manner possible. This language does not include the installation of circuit breakers or electric-vehicle charging infrastructure, but it provides for the installation of the conduit and the proper sizing of the service panel.

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 al to Standard 189.1-2014

Revise Section 5.3.7.3 as follows.

5.3.7.3 *Site* Vehicle Provisions. Where on-site vehicle parking is provided for a building that has a building *occupant load* greater than 100, at least one of the following shall be provided:

a. **Provisions for preferred parking *spaces*.** ~~At least~~ Not less than ~~five percent~~ 5% of the parking *spaces* provided shall be designated as preferred parking for vehicles that meet both the minimum greenhouse gas and air pollution scores as required for USEPA SmartWay designation. Where calculation of the parking spaces yields a fraction, such fractions shall be rounded up to the next whole number. Preferred parking *spaces* shall be located on the shortest route of travel from the parking facility to a *building entrance* but shall not take precedence over parking *spaces* that are required to be accessible for individuals with disabilities. Where buildings have multiple entrances with adjacent parking, parking *spaces* shall be dispersed and located near the entrances. Such parking *spaces* shall be provided with signage approved by the *AHJ* that specifies the permitted usage.

b. **Provisions for electric vehicle charging infrastructure.** The *building project* shall comply with one of the following:

   1. Two or more electric-vehicle charging ~~systems~~ stations shall be available to the building occupants and shall be located not more than 1/4 mi (400 m) from the *building project*.

   2. Electrical raceways shall be installed and extend from one or more of the building's electrical power distribution panels to not less than the number of parking spaces specified in Table 5.3.7.3 to facilitate the future installation of vehicle charging stations. Electrical power distribution panels serving such raceways shall be sized to supply the future charging stations based on a design load of not less than 40 amp per required parking space at a supply voltage of not less than 208/240 VAC.

Table 5.3.7.3 Number of Spaces Required to Have Raceways

Total Number of Parking Spaces Provided	Number of Spaces Required to Have Raceways
1 through 25	1
26 through 50	2
51 through 75	4
76 through 100	5
101 through 150	7
151 through 200	10
201 and over	5% of total

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FOREWORD

Addendum am modifies the roof heat island mitigation section that was previously changed via addendum i. The only change is to adjust the steep-slope roof SRI from 15 to 25, which matches the 2015 IgCC and is slightly less that the LEED V4 SRI of 32.

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 am to Standard 189.1-2014

Revise Section 5.3.5.3 as follows.

5.3.5.3 *Roofs*. This section applies to the building and covered parking *roof* surfaces for *building projects* in *Climate Zones* 1, 2, and 3. A minimum of 75% of the *roof* surface shall be covered with products that

a. have a minimum three-year-aged *SRI* of 64 ~~for a low-sloped *roof*~~ in accordance with Section 5.3.5.4~~. A low-sloped~~ for *roofs* with ~~has~~ a slope of less than or equal to 2:12.
b. have a minimum three-year-aged *SRI* of ~~15~~ 25 ~~for a steep-sloped *roof*~~ in accordance with Section 5.3.5.4~~. A steep-sloped~~ for *roofs* with ~~has~~ a slope of more than 2:12.

The area occupied by one or more of the following shall be excluded from the calculation to determine the roof surface area required to comply with this section:

a. *Roof* penetrations and associated equipment.
b. *On-site renewable energy systems*, including photovoltaics, solar thermal energy collectors and required access around the panels or collectors.
c. Portions of the *roof* used to capture heat for building energy technologies.
d. *Roof* decks and rooftop walkways.
e. Vegetated terrace and roofing systems complying with Section 5.3.5.5.

Exceptions to 5.3.5.3:

1. *Building projects* where an annual energy analysis simulation demonstrates that the total annual building energy cost and total annual *CO2e*, as calculated in accordance with Sections 7.5.2 and 7.5.3, are both a minimum of 2% less for the proposed *roof* than for a *roof* material complying with the SRI requirements of Section 5.3.5.3~~(a)~~.
2. *Roofs* used to shade or cover parking and *roofs* over *semiheated spaces*, provided that they have a minimum initial *SRI* of 29. A default *SRI* value of 35 for new concrete without added color pigment is allowed to be used instead of measurements.

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FOREWORD

Addendum ap to Standard 189.1-2014 updates the normative references in Section 11 and the informative references in Appendix G.

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

Addendum ap to Standard 189.1-2014

Revise Section 11 normative references as follows.

Reference	Title	Section
Air-Conditioning, Heating, and Refrigeration Institute (AHRI) **2111 Wilson Blvd, Suite 500** **Arlington, VA 22201, United States** **1-703-524-8800; www.ahrinet.org**		
ANSI/AHRI 210/240-2008 (with Addenda 1 and 2)	Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment	Appendix ~~C~~B
ANSI/AHRI 310/380-2014~~2004~~	Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-14)	Appendix ~~C~~B
ANSI/AHRI 340/360-2007 (with Addenda 1 and 2)	Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment	Appendix ~~C~~B
ANSI/AHRI 365-2009	Performance Rating of Commercial and Industrial Unitary Air-Conditioning Condensing Units	Appendix B
ANSI/AHRI 390-2003	Performance Rating of Single Packaged Terminal Air-Conditioners and Heat Pumps	Appendix ~~C~~B
ANSI/AHRI 460-2005	Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers	Appendix B
ANSI/AHRI 550/590-2015 (I-P)~~-2011 (with Addenda 1, 2, and 3)~~ ANSI/AHRI 551/591-2015 (SI)~~-2011 (with Addenda 1, 2, and 3)~~	Performance Rating of Water-Chilling and Heat-Pump Water-Heating Packages Using the Vapor Compression Cycle	Appendix ~~C~~B
ANSI/AHRI 560-2000	Absorption Water Chilling and Water Heating Packages	Appendix ~~C~~B
ANSI/AHRI 1200-2013 (I-P)~~2010~~	Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets	Appendix ~~C~~B
ANSI/AHRI 1230-2010 (with Addendum 2~~1~~)	Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment	Appendix ~~C~~B
American National Standards Institute (ANSI) **25 West 43rd Street** **New York, NY 20036, United States** **1-212-642-4900; www.ansi.org**		
ANSI Z21.10.3-2015~~2011~~	Gas Water Heaters, Volume 3, Storage Water Heaters~~,~~ with Input Ratings above 75,000 Btu/h, Circulating and ~~with~~ Instantaneous ~~Water Heaters~~	Appendix ~~C~~B
ANSI Z21.47-2012	Gas-Fired Central Furnaces ~~(Except Direct Vent and Separated Combustion System Furnaces)~~	Appendix ~~C~~B
ANSI Z83.8-2013	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces	Appendix ~~C~~B

Reference	Title	Section
American Society of Mechanical Engineers (ASME) Three Park Avenue New York, NY 10016-5990, United States 1-800-843-2763 and 1-973-882-1170; www.asme.org		
ASME A112.18.1-2012/CSA B125.1-12	Plumbing Supply Fittings	6.3.2.1
ASME A112.19.2-2013/CSA B45.1-13	Ceramic Plumbing Fixtures~~Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals~~	6.3.2.1
ASME A112.19.14-2013~~2006~~	Six-Liter Water Closets Equipped with a Dual Flushing Device	6.3.2.1
ASME A112.19.19-2006	Vitreous China Nonwater Urinals	6.3.2.1
ASHRAE 1791 Tullie Circle NE Atlanta, GA 30329, United States 1-404-636-8400; www.ashrae.org		
ANSI/ASHRAE Standard 55-2013~~2010~~	Thermal Environmental~~Comfort~~ Conditions for Human Occupancy	8.3.2, 10.3.1.2.1
ANSI/ASHRAE Standard 62.1-2016~~2013~~	Ventilation for Acceptable Indoor Air Quality	3.2, 7.4.3.2, 8.3, 10.3.1.4, 10.3.2.1.4
ANSI/ASHRAE/IES Standard 90.1-2016~~2013~~	Energy Standard for Buildings Except Low-Rise Residential Buildings	3.1, 3.2, 5.3.3.1, 5.3.3.3, 7.3.1, 7.4.1, 7.4.2, 7.4.3, 7.4.4, 7.4.5, 7.4.6, 7.4.7, 7.4.8, Appendix A, Appendix B Appendix C, ~~Appendix D~~
ANSI/ASHRAE Standard 111-2008	Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems	8.3.1.2.2, 10.3.2.1.4
ANSI/ASHRAE Standard 146-2011	Method of Testing and Rating Pool Heaters	Appendix B
ANSI/ASHRAE Standard 154-2011~~2003~~	Ventilation for Commercial Cooking Operations	
ANSI/ASHRAE Standard 160-2009	Criteria for Moisture-Control Design Analysis in Buildings	8.3.6
ANSI/ASHRAE Standard 169-2013~~2006~~	Climatic~~Weather~~ Data for Building Design Standards	Appendix A
ANSI/ASHRAE/ASHE Standard 170-2013~~2008~~	Ventilation of Health Care Facilities	8.3.1
ANSI/ASHRAE/ACCA Standard 180-2012~~2008~~	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems	3.2, 10.3.2.2
Association of Home Appliance Manufacturers (AHAM) 1111 19th Street NW, Suite 402 Washington, DC, 20036, United States 1-202-872-5955; www.aham.org		
ANSI/AHAM RAC-1-R2015~~2008~~	Room Air Conditioners	Appendix ~~C~~B
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM C518-15~~10~~	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	Appendix ~~C~~B
ASTM C1371-15~~04a(2010)~~	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers	5.3.2.4
ASTM C1549-09(2014)	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	5.3.2.4
ASTM D1003-13~~11e1~~	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics	8.4.1.1.3, 8.4.1.3

Reference	Title	Section
ASTM D5197-09e1	Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)	10.3.1.4
ASTM E90-09	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	8.3.3.3
ASTM E408-13~~71(2008)~~	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques	5.3.2.4
ASTM E413-16~~10~~	Classification for Rating Sound Insulation	8.3.3.3
ASTM E779-10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	10.3.1.2.5
ASTM E1332-10a	Standard Classification for Rating~~the Determination of~~ Outdoor-Indoor Sound Attenuation~~Transmission Class~~	8.3.3.3
ASTM E1903-11	Standard Practice~~Guide~~ for Environmental Site Assessments: Phase II Environmental Site Assessment Process	3.2
ASTM E1918-06(2015)	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field	5.3.2.4
ASTM E1980-11	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces	5.3.2.4
The Business and Institutional Furniture Manufacturer's Association (BIFMA) 678 Front Avenue NW, Suite 150 Grand Rapids, MI 49504-5368, United States 1-616-285-3963; www.bifma.org; email@bifma.org		
ANSI/BIFMA M7.1-2011 (R2016)	Standard Test Method For Determining VOC Emissions From Office Furniture Systems, Components and Seating	8.4.2.5 and 8.5.2
ANSI/BIFMA X7.1-2011 (R2016)	Standard for Formaldehyde and TVOC Emissions of Low-Emitting Office Furniture Systems and Seating	8.4.2.5
ANSI/BIFMA e3-2014~~2012~~	Furniture Sustainability Standard	8.4.2.5, 9.4.1.4.3
California Air Resources Board (CARB) 1001 "I" Street P.O. Box 2815 Sacramento, CA 95812, United States 1-916-322-2990; www.arb.ca.gov/homepage.htm		
CARB SCM for Architectural Coatings-2007	California Air Resources Board (ARB) Suggested Control Measure for Architectural Coatings	8.4.2.2.2
No-Added Formaldehyde Based Resins	Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products. California Code of Regulations, Title 17, Sections 93120-93120.12	8.5.2
California Department of Public Health (CDPH) Indoor Air Quality Section 850 Marina Bay Parkway Richmond, CA 94804, United States 1-510-620-2802; www.cdph.ca.gov/programs/IAQ and www.cal-iaq.org		
CDPH/EHLB/Standard Method V1.1	Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers—Version 1.1	8.4.2.1.1, 8.4.2.2.1, 8.4.2.3, 8.4.2.4, 8.4.2.6, 8.5.2, Table 10.3.1.4, ~~Appendix F~~

Reference	Title	Section
Canadian General Standards Board Place du Portage III, 6B1 11 Laurier Street Gatineau, Quebec K1A 1G6 Canada 819-956-0425 www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html		
CAN/CGSB 149.10-M86	Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method	10.3.1.2.5
CAN/CGSB 149.15-96	Determination of the Overall Envelope Airtightness of Buildings by the Fan Pressurization Method Using the Building's Air Handling Systems	10.3.1.2.5
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) International Environment House 11 Chemin des Anémones CH-1219 Châtelaine, Geneva, Switzerland +41-(0)22-917-81-39/40		
CITES- 1973, amended 1979 and 1983	Convention on International Trade in Endangered Species of Wild Fauna and Flora	9.3.2
Cooling Roof Rating Council (CRRC) 449 15th Street, Suite 400 Oakland, CA 94612 United States 1-866-465-2523; www.coolroofs.org		
ANSI/CRRC S100 (2016)~~Standard-1-2012~~	Standard Test Methods for Determining Radiative Properties of Materials	5.3.2.4
Cooling Technology Institute (CTI) PO Box 681807 Houston, TX 77268 ~~2611 FM 1960West, Suite A-101~~ ~~Houston, TX 77068-3730; P.O. Box 73383~~ ~~Houston, TX 77273-3383~~ 1-281-583-4087; www.cti.org		
CTI ATC-105 (00)	Acceptance Test Code for Water Cooling Towers	Appendix ~~C~~B
CTI ATC-105S (11)	Acceptance Test Code for Closed-Circuit Cooling Towers	Appendix ~~C~~B
CTI ATC-106 (11)	Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers	Appendix ~~C~~B
CTI STD-201RS (151~~3~~)	Standard for the Certification of Water Cooling Tower Thermal Performance~~ Rating of Evaporative Heat Rejection Equipment~~	Appendix ~~C~~B
CTI STD-201OM (151~~3~~)	Operations Manual for Thermal Performance Certification of Evaporative Heat Rejection Equipment	Appendix ~~C~~B
~~**Cooling Tower Technology Institute (CTI) P.O Box 73383 Houston, TX 77273, United States 1-281-583-4087; www.cti.org**~~		
~~CTI ATC-105 (2/2000)~~	~~Acceptance Test Code~~	~~Appendix C~~
~~CTI STD 201 (1/2009)~~	~~Standard for the Certification of Water Cooling Tower Thermal Performance~~	~~Appendix C~~

Reference	Title	Section
Green-e c/o Center for Resource Solutions 1012 Torney Ave., Second Floor San Francisco, CA 94129, United States 1- 415-561-2100; www.green-e.org		
Version 2.8, April 1, 2016~~1.6, Dec 5, 2008~~	Green-e Energy National Standard for Renewable Electricity Products	7.4.1.1(2)
Green Seal 1001 Connecticut Avenue, NW, Suite 827 Washington, DC 20036-5525, United States 1-202-872-6400; www.greenseal.org		
GS-11, 3.2, October 26, 2015~~July 12, 2013~~	Environmental Standard for Paints and Coatings	8.4.2.2.2
GS-36, 2.1, July 12, 2013	Standard for Adhesives for Commercial Use~~Adhesives~~	8.4.2.1.2
GS-42 2.3, July 7, 2015~~July 12, 2013~~	~~Environmental~~ Standard for Commercial and Institutional Cleaning Services	10.3.2.1.4.5
Illuminating Engineering Society of North America 120 Wall Street, Floor 17 New York, NY 10005-4001, United States 1-212-248-5017, www.ies.org		
TM-15-2011 including addendum "a"	Luminaire Classification System for Outdoor Luminaires	5.3.3.2
International Association of Plumbing and Mechanical Officials (IAPMO) 5001 East Philadelphia Street Ontario, CA 91761, United States 1-909-472-4100; www.iapmo.org		
Z124.9-2004	Plastic Urinal Fixtures	6.3.2.1
International Organization for Standardization (ISO) ISO Central Secretariat, 1 rue de Varembee, Case postale 56 CH-1211 Geneva 20, Switzerland +41-22-749-01-11; www.iso.org		
ISO-13256-1-1998	Water-Source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-Air and Brine-to-Air Heat Pumps	Appendix ~~C~~B
ISO-13256-2-1998	Water-Source Heat Pumps—Testing and Rating for Performance—Part 2: Water-to-Water and Brine-to-Water Heat Pumps	Appendix B
ISO 14025-2006	Environmental Labels and Declarations—Type III Environmental Declarations—Principles and Procedures	9.4.1.4
ISO 14040-2006	Environmental Management—Life Cycle Assessment—Principles and Framework	9.4.1.4
ISO 14044-2006	Environmental Management—Life Cycle Assessment—Requirements and Guidelines	9.5.1, 9.5.1.2
ISO 21930-2007	Sustainability in Building Construction—Environmental Declaration of Building Products	9.4.1.4
ISO/IEC Guide 59-1994	Code of Good Practice for Standardization	9.4.1.3.1
Irrigation Association (IA) 6540 Arlington Boulevard Falls Church, VA 22042-6638, United States 1-703-536-7080; www.irrigation.org		
Smart Water Application Technology (SWAT) Climatologically Based Controllers 8th Draft Testing Protocol—September 2008~~November 2006~~	Smart Water Application Technology (SWAT), Turf and Landscape Irrigation Equipment Climatologically Based Controllers	6.3.1.3

Reference	Title	Section
National Archives and Records Administration Office of the Federal Register 800 North Capital, N.W. Suite 700 Washington DC, 20408 http://www.gpo.gov/about/		
42 USC§ 6291	Title 42—THE PUBLIC HEALTH AND WELFARE CHAPTER 77—ENERGY CONSERVATION SUBCHAPTER III—IMPROVING ENERGY EFFICIENCY Part A—Energy Conservation Program for Consumer Products Other than Automobiles Sec. 6291—Definitions	Appendix ~~C~~B, Table B-17
National Electrical Manufacturers Association (NEMA) 1300 North 17th Street, Suite ~~1752~~900 Rosslyn, VA 22209, United States 1-703-841-3200; www.nema.org		
~~ANSI/NEMA MG-1-2011~~	~~Motors and Generators~~	~~Appendix C~~
NEMA DC 3, Annex A-2013~~2010~~	Energy-Efficiency Requirements for Programmable Thermostats	7.4.7.4
National Fire Protection Association 1 Battery March Park Quincy, MA 02169-7471 United States 1-617-770-0700; www.nfpa.org		
NFPA 70 -2014~~2011~~	National Electrical Code	5.3.3
Natural Stone Council P.O. Box 539 Hollis, NH 03049, United States 978-391-4130; www.naturalstonecouncil.org; info@genuinestone.org		
NSC 373-2013	Sustainable Production of ~~Sustainability Assessment for~~ Natural Dimension Stone	9.4.1.4
NSF International 789 Dixboro Road Ann Arbor, MI 48105, United States 734-769-8010; www.nsf.org; info@nsf.org		
NSF/ANSI 140-2015~~2013~~	Sustainability Assessment for Carpet	9.4.1.4
NSF/ANSI 332-2015~~2012~~	Sustainability Assessment for Resilient Floor Coverings	9.4.1.4
NSF/ANSI 336-2011	Sustainability Assessment for Commercial Furnishings Fabric	9.4.1.4
NSF/ANSI 342-2014~~2012~~	Sustainability Assessment for Wallcoverings Products	9.4.1.4
NSF/ANSI 347-2012	Sustainability Assessment for Single Ply Roofing Membranes	9.4.1.4
South Coast Air Quality Management District (SCAQMD) California Air Resources Board 1001 "I" Street P.O. Box 2815 Sacramento, CA 95812, United States 1-916-322-2990; www.arb.ca.gov		
SCAQMD Rule 1113, Amended February 5, 2016~~June 3, 2011~~	Architectural Coatings	8.4.2.2
SCAQMD Rule 1168, Amended January 7, 2005	Adhesive and Sealant Applications	8.4.2.1

Reference	Title	Section
Tile Council of North America 100 Clemson Research Boulevard Anderson, SC 29625, United States 864-646-8453; www.tcnatile.com; info@tileusa.com		
ANSI A138.1-2011~~2~~	Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials	9.4.1.4
Underwriters Laboratories Inc. 333 Pfingsten Road Northbrook, IL 60062, United States 847-272-8800; www.ul.com; cec.us@us.ul.com		
UL 100-2012	Standard for Sustainability for Gypsum Boards and Panels	UL 100-2012
UL 102-2012	Standard for Sustainability for Door Leafs	UL 102-2012
UL 727-2006	Standard for Oil-Fired Central Furnaces	Appendix ~~C~~B
UL 731-2012	Standard for Oil-Fired Unit Heaters	Appendix ~~C~~B
United States Congress Washington, DC 20515, United States 1-202-224-3121; http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:h6enr.txt.pdf and www.govtrack.us/data/us/bills.text/110/h/h6.pdf		
42 USC§ 6291	Title 42—The Public Health and Welfare Chapter 77—Energy Conservation Subchapter III—Improving Energy Efficiency Part A—Energy Conservation Program for Consumer Products other than Automobiles Sec. 6291—Definitions	Appendix B
EPAct 2005 HR6 Public Law 109-58	The Energy Policy Act (EPAct) of 2005	7.4.3.1, 7.4.7.3
EISA 2007 HR6 Public Law 110-140	The Energy Independence and Security Act of 2007	7.4.3, 7.4.7
United States Department of Agriculture (USDA) BioPreferred Program 1400 Independence Avenue, SW Washington, DC 20250, United States 1-202-720-2791; www.biopreferred.gov		
7 CFR Part 3201 Subpart B, (Includes Rounds 1–7) August 29, 2011; Round 8, April 4, 2012; Round 9, November 19, 2012; Round 10, June 11, 2013	Guidelines for Designating Biobased Products for Federal Procurement; Designated Items	9.4.1.3
United States Department of Energy (U.S. DOE) Energy Information Administration Washington, DC 20585, United States 1-202-586-5000; www.eia.doe.gov/emeu/cbecs/contents.html and http://tonto.eia.doe.gov/state		
EIA Average Energy Prices	State and U.S. Historical Data	Appendix ~~D~~C
Title 10 – Energy Chapter II – Department of Energy – Part 430	Energy Conservation Program for Consumer Products	Appendix ~~C~~B
Title 10 – Energy Chapter II – Department of Energy – Part 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment	Appendix ~~C~~B

Reference	Title	Section
United States Environmental Protection Agency (EPA) Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460, United States 1-919-541-0800; www.epa.gov ENERGY STAR ® 1-888-782-7937 WaterSense 1-866-987-7367 and 1-202-564-2660		
Clean Air Act of 1970 and as amended in 1990	Clean Air Act	9.5.1.2
Code of Federal Regulations, Title 40 Part 50 (40 CFR 50), as amended July 1, 2004	National Primary and Secondary Ambient Air Quality Standards	8.3.1.3, 9.5.1.2
EPA-420-F-07-063, November 2007	Green Vehicle Guide: You Have Green Options!~~SmartWay Program Requirements for Certified Passenger Vehicles, http://epa.gov/greenvehicles/Aboutratings.do#aboutsmartway~~	5.3.7
February 16, 2012 ~~January 21, 2005~~	NPDES General Permit for Stormwater Discharges From Construction Activities	10.3.1.3
Version 6.1, August 12, 2014~~Version 5.2, July 1, 2009 Version 6.0, September 10, 2013 (Effective date June 2, 2014)~~	ENERGY STAR Program Requirements for Computers	7.4.7
Version 2.0, June 26, 2013~~April 1, 2013~~	ENERGY STAR Program Requirements for Imaging Equipment	7.4.7
Version 4.0, February 20, 2015~~Version 3.0, June 22, 2012~~	ENERGY STAR Program Requirements and Criteria for Room Air Conditioners	7.4.7
Version 5.0, September, 15, 2015~~Version 4.1, January 1, 2009~~	ENERGY STAR Program Requirements for ASHPs and Central Air Conditioners	7.4.7
Version 3.0, December, 20, 2013~~Version 2.1, April 1, 2002~~	ENERGY STAR Program Requirements for Boilers	7.4.7
Version 2.0, May 9, 2013	ENERGY STAR Program Requirements for Water Coolers	7.4.7
Version 2.0 December 31, 2015~~Version 1.0, August 28, 2013~~	ENERGY STAR Program Requirements for Lamps (Light Bulbs)	7.4.7
Version 7.1, May 20, 2015~~Version 6.1, January 25, 2013~~	ENERGY STAR Program Requirements for Clothes Washers	6.3.2.2, 7.4.7
Version 2.0, June 25~~July 18~~, 2012	ENERGY STAR Program Requirements for Commercial Dishwashers	6.4.2.2, 7.4.7
Version 2.0, April 22, 2011	ENERGY STAR Program Requirements for Commercial Fryers	7.4.7
Version 2.0, February 1, 2013	ENERGY STAR Program Requirements for Commercial Ice Makers	6.4.2.2, 7.4.7
Version 1.2, August 1, 2003	ENERGY STAR Program Requirements for Commercial Steam Cookers	7.4.7
Version 7.0, May 2016~~Version 6.0, January 16, 2013~~	ENERGY STAR Program Requirements for Displays	7.4.7
Version 3.0, May 1, 2013	ENERGY STAR Program Requirements for Audio and Video	7.4.7
Version 3.0, October 1, 2012	ENERGY STAR Program Requirements for Dehumidifiers	7.4.7
Version 6.0, April 29, 2015 ~~Version 5.2, June 5, 2013~~	ENERGY STAR Program Requirements Product Specification for Residential Dishwashers	6.3.2.2, 7.4.7
Version 4.0, June 13, 2011	ENERGY STAR Program Requirements for Furnaces	7.4.7
Version 3.1, January 1, 2012	ENERGY STAR Program Requirements for Geothermal Heat Pumps	7.4.7

Reference	Title	Section
Version 2.0, October 1, 2011~~November 15, 2010~~	ENERGY STAR Program Requirements for Hot Food Holding Cabinets	7.4.7
~~Version 1.1, September 12, 2011~~	~~ENERGY STAR Program Requirements for Products with Battery Charger Systems (BCSs)~~	~~7.4.7~~
Version 3.1~~3.0~~, March 1, 2013	ENERGY STAR Program Requirements for Refrigerated Beverage Vending Machines	7.4.7
Version 5.0, ~~May 31, 2013 (Effective Date~~ September 15, 2014~~)~~	ENERGY STAR Program Requirements for Refrigerators and Freezers	7.4.7
Version 3.0, April 1, 2012~~August 15, 2011~~	ENERGY STAR Program Requirements for Residential Ceiling Fans	7.4.7
Version 3.0, July 18, 2014~~Version 2.0, October 11, 2012~~	ENERGY STAR Program Requirements for Residential Water Heaters	7.4.7
Version 3.0, December 20, 2013~~2.3, June 25, 2012~~	ENERGY STAR Program Requirements for Roof Products	5.3.2.3
Version 1.2, July 1, 2004	ENERGY STAR Program Requirements for Room Air Cleaners	7.4.7
Version 3.2, April 1, 2012~~December 23, 2011~~	ENERGY STAR Program Requirements for Residential Ventilating Fans	7.4.7
Version 1.0, August 1, 2012	ENERGY STAR Program Requirements for Uninterruptible Power Supplies	7.4.7
Version 3.0, October 1, 2014 ~~2.1, April 1, 2009~~	ENERGY STAR Program Requirements for Commercial Refrigerators and Freezers	7.4.7
Version 3.0, October 1, 2014~~2.2, November 1, 2008~~	ENERGY STAR Program Requirements for Telephony	7.4.7
Version 7.0, October 30, 2015~~6.0, September 6, 2012~~	ENERGY STAR Program Requirements for Televisions	7.4.7
Version 1.0, October 1, 2007	WaterSense Tank-Type High-Efficiency Lavatory Specification	6.3.2.1
Version 1.2, June 2, 2014~~1.1, May 19, 2011~~	WaterSense Tank-Type High-Efficiency Toilet Specification	6.3.2.1
EPA 402-R-93-071, September 1993	USEPA Map of Radon Zones	8.3.5
EPA 430-R-13-002~~1~~, April 15, 2016~~April 2011~~	Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014~~2011~~	9.5.1
Version 5.0, May 13, 2016~~3.0, October 2, 2012~~	ENERGY STAR Program Requirements for Set-Top Boxes	7.4.7
Version 2.0, May 29, 2015~~1.2, December 21, 2012~~	ENERGY STAR Program Requirements for Luminaires	7.4.7.3
Version 1.2, May 8, 2009~~June 26, 2013~~	ENERGY STAR Program Requirements for Commercial Griddles	7.4.7
Version 2.2, October 7, 2015~~2.0, April 1, 2013~~	ENERGY STAR Program Requirements for Commercial Ovens	7.4.7
EPA 625/R-96/0106, January 1999	Compendium of Methods for the Determination of Toxic Organic Pollutants in Ambient Air, Sections TO-1, TO-11, TO-17	10.3.1.4
United States Environmental Protection Agency (EPA) Atmospheric Research and Exposure Assessment Laboratory Research Triangle Park, NC 27711, United States 1-919-541-2258; www.epa.gov		
EPA 625/R-96/0106, January 1999	Compendium of Methods for the Determination of Toxic Organic Pollutants in Ambient Air, Sections TO-1, TO-11, TO-17	10.3.1.4

Reference	Title	Section
World Trade Organization (WTO) Centre William Rappard Rue de Lausanne 154, CH-1211 Geneva 21, Switzerland 41-22-739-51-11; www.wto.org		
WTO TBT-1994	WTO Technical Barriers to Trade (TBT) Agreement Annex 3 Code of Good Practice for the Preparation, Adoption and Application of Standards	9.4.1.3.1

Revise Informative Appendix G informative references as follows.

Reference	Title	Section
American Institute of Architects (AIA) 1735 New York Avenue NW Washington, DC 20006, United States 1-800-AIA-3837 or 202-626-7300; www.aia.org		
AIA National/AIA California Council	Integrated Project Delivery: A Guide, v. 1-2007	Appendix FH
American Institute of Steel Construction 130 East Randolph, Suite 2000~~One East Wacker Drive, Suite 700~~ Chicago, Illinois 60601, United States 1-312-670-2400; www.aisc.org		
Brochure	Steel Takes LEED® with Recycled Content	9.4.1.1
ASHRAE 1791 Tullie Circle NE Atlanta, GA 30329, United States 1-404-636-8400; www.ashrae.org		
ASHRAE Guideline 0-20132005	The Commissioning Process	10.3.1.1
ASHRAE Guideline 1.1-2007	HVAC&R Technical Requirements ~~to Support~~ for the Commissioning Process	10.3.1.1
ASHRAE Guideline 4-2008 (RA 2013)	Preparation of Operating and Maintenance Documentation for Building Systems	10.3.1.1
ASHRAE Standard 62.1-20162013 (Appendix CB)	Ventilation for Acceptable Indoor Air Quality	Table 10.3.1.4
ASHRAE Handbook, 2013	Fundamentals	Appendix CD
ASHRAE Handbook, 20152011	HVAC Applications	Appendix FH
Association of Pedestrian and Bicycle Professionals PO Box 93 Cedarburg, WI 53012, United States 1-262-375-6180; www.apbp.org		
	Bicycle Parking Guidelines, 2nd Edition, 2010	5.3.5.2
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM C755-10 (2015)	Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation, Appendix X1 Problem Analysis	8.3.6
ASTM E1331-1509	Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry	8.4.1.2
ASTM E1477 - 98a(20132008)	Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers	8.4.1.2
ASTM E2813-12e1	Standard Practice for Building Enclosure Commissioning	10.3.1.2.5

Reference	Title	Section
British Standards Institute 389 Chiswick High Road London, W4 4AL, United Kingdom +44 845 086 9001 www.bsigroup.com		
BS 8493:2008+A1:2010	Light reflectance value (LRV) of a surface. Method of test.	8.4.1.2
California Environmental Protection Agency, Office of Environmental Health Hazard Assessment Post Office Box 4010 Sacramento, CA 95812-4010, United States 1-916-324-7572; www.oehha.ca.gov		
http://www.oehha.org/air/allrels.html	All OEHHA Acute, 8-hour and Chronic Reference Exposure Levels (chRELs) as of June 2014~~Air Toxics Hot Spots Program Risk Assessment Guidelines. Technical Support Document for the Derivation of Noncancer Reference Exposure Levels~~	8.4.2, 8.5.2
Canadian Standards Association (CSA) 5060 Spectrum Way, Suite 100 Mississauga, Ontario, L4W 5N6, Canada 1-800-463-6727 and 1-416-747-4000; www.csa.ca		
CSA S478-95 (R2007)	Guideline on Durability for Buildings	9.4.1, 10.3.2.3
Carpet and Rug Institute 730 College Drive Dalton, Georgia 30720, United States 1-706-278-3176; www.carpet-rug.org		
		8.4.2.3
~~**Cool Roof Rating Council 1610 Harrison Street Oakland, California 94612, United States 1-510-482-4421; www.coolroofs.org**~~		
~~CCRC-1-2008~~	~~Cool Roof Council Product Rating Program~~	~~5.3.2.4~~
Forest Stewardship Council (FSC) 1155 30th Street NW, Suite 300 Washington, DC 20007, United States 1-202-342-0413; www.fsc.org		
		9.4.1.3.1
Illuminating Engineering Society of North America, 120 Wall Street, Floor 17 New York, NY 10005-4001 1-212-248-5017, www.ies.org		
IDA/IES Model Lighting Ordinance	Model Lighting Ordinance (MLO)	5.3.3.2
Institute of Transportation Engineers 1099 14th Street NW, Suite 300 West Washington, DC 20005-3438, United States 1-202-289-0222; www.ite.org		
4th Edition, 2004	Parking Generation	10.3.2.4
Market Transformation to Sustainability (MTS) 1511 Wisconsin Avenue, N.W. Washington, D.C. 20007, United States 1-202-338-3131; www.sustainableproducts.com		
MTS 1.0 WSIP Guide-2007	Whole Systems Integrated Process Guide for Sustainable Buildings and Communities	Appendix ~~H~~F
National Institute of Building Sciences (NIBS) 1090 Vermont Avenue, NW, Suite 700 Washington, DC 20005-4905, United States 1-202-289-7800; www.nibs.org		
NIBS Guideline 3-2012	Building Enclosure Commissioning Process BECx	10.3.1.2.5

Reference	Title	Section
National Renewable Energy Laboratory (NREL) 1617 Cole Blvd. Golden, CO 80401-3393, United States 1-303-275-3000; www.nrel.gov		
NREL/TP-550-38617	Source Energy and Emissions Factors for Energy Use in Buildings	Table 7.5.3
Resilient Floor Covering Institute 115 Broad Street, Suite 201 LaGrange, GA 30240, United States 1-706-882-3833; www.rfci.com		
		8.4.2.3
Sheet Metal and Air Conditioning Contractors National Association (SMACNA) 4201 Lafayette Center Drive Chantilly, VA 20151, Unites States 1-703-803-2980		
ANSI/SMACNA 008-2008	IAQ Guidelines for Occupied Buildings under Construction, Second Edition	10.3.1.4(a)
State of California, Department of General Services, Procurement Division Ziggurat Building 707 Third Street West Sacramento, CA 95605-2811, United States 1-916-376-5000		
RFP DGS-56275	Section 5.7, "Indoor Air Quality Requirements for Open Office Panel Systems"	Appendix ~~E~~D
Steel Recycling Institute 680 Andersen Drive Pittsburgh, PA 15220, United States 1-412-922-2772; www.recycle-steel.org		
Brochure	Steel Takes LEED® With Recycled Content	9.4.1.1
Sustainable Forestry Initiative, Inc. (SFI) 1600 Wilson Blvd, Suite 810 Arlington, VA 22209, United States 1-703-875-9500; www.sfiprogram.org		
		9.4.1.3.1
UL GREENGUARD Gold 2211 Newmarket Parkway, #110 Marietta, GA 30067, United States 1-800-427-9681; www.ul.com/environment		
UL2818-2013	Greenguard Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishing	8.4.2, 8.5.2
UL2821-2013	Greenguard Certification Program Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes and Furnishings	8.4.2, 8.5.2
United States Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) 4770 Buford Hwy NE Atlanta, GA 30341, United States 1-800-232-4636; www.atsdr.cdc.gov		
www.atsdr.cdc.gov/mrls	Minimal Risk Levels (MRLs)	Table 10.3.1.4
United States Department of Energy (DOE) Washington, DC 20585, United States 1-202-586-5000; www.energyplus.gov		
	EnergyPlus (or predecessors BLAST or DOE-2)	Appendix ~~D~~C

Reference	Title	Section
United States Environmental Protection Agency (EPA) **1200 Pennsylvania Ave NW** **Washington, DC 20460, United States** **1-888-782-7937 and 1- 202-775-6650; www.energystar.gov**		
	Portfolio Manager	10.3.2.1.3.2
United States General Services Administration (GSA) **1800 F Street, NW** **Washington, DC 20405, United States** **1-800-488-3111 and 1-202-501-1100; www.gsa.gov**		
U.S. GSA-2005	The Building Commissioning Guide	10.3.1

(This foreword 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.)

FOREWORD

Addendum aq updates requirements in Standard 189.1 for functional performance testing and for building systems commissioning. These changes update the standard to reflect trends and terminology in the evolving commissioning industry and are based on consideration of the content of the 2015 International Green Construction Code. This addendum provides clarity to the commissioning reporting requirements by adding new sections detailing what to include in commissioning plans and associated reports. The addendum also further extends the threshold for full commissioning from buildings over 5000 ft^2 to buildings up to 10,000 ft^2. For buildings less than 10,000 ft^2, certain building systems that exceed the size thresholds included in the addendum must include at least functional performance testing.

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 aq to Standard 189.1-2014

Modify Section 3 as follows.

~~acceptance representative~~ functional and performance testing provider (FPT provider): an entity identified by the *owner* who ~~leads, plans, schedules, and coordinates~~ manages the activities needed to implement the building ~~acceptance testing~~ *functional and performance testing (FPT)* activities. ~~The *acceptance representative* may be a qualified employee or consultant of the *owner*. The individual serving as the *acceptance representative* shall be independent of the project design and construction management, though this individual may be an employee of a firm providing those services.~~

commissioning (Cx) ~~authority (CxA)~~ provider: an entity identified by the *owner* and approved by the *AHJ* who ~~leads, plans, schedules, and coordinates~~ manages the commissioning team to implement the building *commissioning process*.

Informative Note: This entity is sometimes known as a commissioning authority, CxA, or approved agency. (See *commissioning [Cx] process*.)

functional and performance testing (FPT): testing performed to ensure that designated systems of the project meet the intended design performance requirements.

owner's project requirements (OPR): a ~~written~~ document that ~~details~~ specifies the functional requirements of a project and the expectations of how it will be used and operated~~. These include~~, including project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, training requirements, documentation requirements, and supporting information.

generally accepted engineering standard: ~~see ANSI/ASHRAE/IES Standard 90.1.~~ a specification, rule, guide, or procedure in the field of engineering, or related thereto, recognized and accepted as authoritative.

Informative Note: Definition for *generally accepted engineering standard* is from ANSI/ASHRAE/IES Standard 90.1-2016.

Modify Section 10 as follows.

10.1 Scope. This section specifies requirements for construction and plans for operation, including the *commissioning (Cx) process*, building ~~acceptance~~ *functional and performance testing* (FPT) ~~testing~~, measurement and *verification*, energy use reporting, durability, transportation management, erosion and sediment control, construction, and indoor air quality during construction.

10.2 Compliance. All of the provisions of Section 10 are mandatory provisions.

10.3 Mandatory Provisions

10.3.1 Construction

10.3.1.1 Building ~~Acceptance~~ Systems *Functional and Performance Testing*. ~~Acceptance~~ *FPT* ~~testing~~ shall be performed on all buildings ~~in accordance with~~ systems specifically referenced in this section using *generally accepted engineering standards* ~~and handbooks~~ acceptable to the *AHJ*.

An ~~an acceptance testing~~ *FPT* process and system performance requirements shall be incorporated into the ~~design and construction of the *building project*~~ *construction documents* and construction schedule of the *building project* ~~that verifies~~ to verify systems performance. ~~specified in this section perform in accordance with *construction documents*~~.

10.3.1.1.1 *FPT* Requirements. A *functional and performance testing* process shall be performed for the following:

a. Heating, ventilating, air conditioning, and refrigeration systems (mechanical and passive) and associated controls that exceed total system capacities of 180,000 Btu/h (53,000 W) for cooling, 300,000 Btu/h (88,000 W) for heating, or 10,000 cfm (5000 L/s) for ventilation.
b. Lighting systems over 5 kW in total capacity, including automatic and daylighting controls, manual daylighting controls, occupancy-sensing devices, time switching, and automatic shut-off controls.
c. Domestic water-heating systems rated at over 50,000 Btu/h (15,000 W).
d. Water pumping and mixing systems over 5 hp (4 kW).
e. Irrigation systems that use more than 1000 gal (4000 L) per day.

10.3.1.1.1.1 Activities Prior to Building Permit for Facilities Using the *FPT* Process. The following activities shall be completed before a permit is issued for any system requiring *FPT* ~~Complete the following~~:

a. Designate ~~a project *acceptance representative*~~ *FPT providers* ~~to lead, review, and oversee~~ ~~completion of accep-~~

~~tance testing activities~~. For systems that are required to comply with Section 10.3.1.1.1, *FPT providers* shall be *owner's* qualified employees, independent *Cx providers*, or qualified designers experienced with *FPT* on the designated systems. *FPT providers* shall be independent of the building system design and construction function and shall possesses the necessary experience and testing equipment.

~~a. *Construction documents* shall indicate who is to perform acceptance tests and the details of the tests to be performed.~~

b. ~~*Acceptance representative*~~ *FPT providers* shall review the *construction documents* to verify that the relevant sensor locations, devices, and control sequences are properly ~~documented~~ specified~~.~~, performance and testing criteria are included, and equipment to be tested is accessible for testing and maintenance.

10.3.1.1.1.2 Activities Prior to Building Occupancy for Facilities Using the *FPT* Process. Before issuance of a certificate of occupancy, the *FPT providers* shall ~~C~~complete the following activities:

a. ~~Verify proper~~ ~~i~~Installation and start-up of the specified systems shall be verified.

b. ~~Perform acceptance tests. For each acceptance test, complete test forms and include a signature and license number, as appropriate, for~~ *FPT* of systems shall be verified. ~~the party who has performed the test.~~

Exception to 10.3.1.1.2 (b): Systems for which operation is seasonally dependent, and which cannot be fully commissioned in accordance with the *Cx plan* at the time of occupancy, shall be commissioned at the earliest operation time postoccupancy as determined by the *FPT providers*.

c. The preparation of ~~Verify that a systems manual~~ operation and maintenance (O&M) documentation and warranty information shall be verified. ~~has been prepared that includes operation and maintenance (O&M) documentation and full warranty information and provides operating staff~~ O&M documentation, including the information needed to understand~~, and optimally~~ operate, and maintain the building systems, shall be provided to the building *owner* and facility manager.

~~**10.3.1.1.3 Systems.** The following systems, if included in the *building project*, shall have acceptance testing:~~

~~a. Mechanical systems: heating, ventilating, air conditioning, indoor air quality (IAQ), and refrigeration systems (mechanical and/or passive) and associated controls.~~

~~b. Lighting systems: *automatic* daylighting controls, manual daylighting controls, occupancy sensing devices, and *automatic* shut-off controls.~~

~~c. *Fenestration* control systems: *Automatic* controls for shading devices and *dynamic glazing*.~~

~~d. Renewable energy systems.~~

~~e. Water measurement devices, as required in Section 6.3.3.~~

~~f. Energy measurement devices, as required in Section 7.3.3.~~

10.3.1.1.4.1.3 Documentation. ~~The *owner* shall retain completed acceptance test forms.~~ The completed project design and *FPT* documentation shall be provided to the *owner* and shall be retained with the project records.

10.3.1.2 *Building Project Commissioning Process.* ~~For buildings that exceed 5000 ft2 (500 m2) of gross floor area, commissioning shall be performed in accordance with this section using ANSI/ASHRAE/IES Standard 202 or other *generally accepted engineering standards* and handbooks acceptable to the *AHJ*. Buildings undergoing the *Cx process* will be deemed to comply with the requirements of Section 10.3.1.1, "Building Acceptance Testing."~~

~~A~~The *Cx process* shall ~~be incorporated into the predesign, design, construction, and first year occupancy of the *building project* that verifies that the delivered building and its components, assemblies, and systems comply with the documented *owner's project requirements* (*OPR*).~~ be performed in accordance with this section using ANSI/ASHRAE/IES Standard 202 or other *generally accepted engineering standards* acceptable to the *AHJ*. The *Cx provider* shall verify that a *Cx process* has been incorporated into the design phases of the project and that commissioning shall be incorporated into the *construction documents*. The *Cx process* documents that the building and its commissioned components, assemblies, and systems comply with the *OPR*. ~~Procedures, documentation, tools, and training shall be provided to the building operating staff to sustain features of the building assemblies and systems for the service life of the building. This material shall be assembled and organized into a systems manual that provides necessary information to the building operating staff to operate and maintain all commissioned systems identified within the *building project*.~~ The project requirements, including *OPR*, *BoD*, design and construction record documentation, training plans and records, O&M plans and procedures, and Cx reports shall be assembled in a systems manual that provides information for building operating and maintenance staff.

10.3.1.2.1 Systems to be Commissioned. For buildings that exceed 10,000 ft^2 (1000m^2) of gross floor area, the *commissioning process* shall be included in the design and construction of the *building project*. The following systems and associated controls, where included in the building project, shall be commissioned:

a. Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and/or passive), and associated controls.

b. Lighting systems: automatic and manual daylighting controls, occupancy sensing devices, and automatic shut-off controls, time switching, and other lighting control devices.

c. Domestic hot water systems and controls.

d. Water pumping and mixing systems over 5 hp (4kW) and purification systems.

e. Irrigation system performance that use more than 1000 gallons (4000 L) per day.

f. Renewable energy systems, and energy storage systems.

g. Energy and building management and demand control systems.

10.3.1.2.~~1~~.2 Commissioning Activities Prior to Building Permit. The following activities shall be completed prior to issuance of a building permit:

a. A copy of the *Cx Plan* in accordance with ANSI/ASHRAE/IES Standard 202 shall be submitted for review with the building permit application.

~~a.~~b ~~Designate a project *commissioning authority* (*CxA*)~~ An *approved commissioning provider* shall be designated by the *owner* to manage ~~lead, review, and oversee completion of the~~ *Cx process* activities prior to completion of ~~schematic design~~ *construction documents*. The *commissioning provider* shall have the necessary training, experience, and equipment and be independent from the design team and the contractor responsible for the work being commissioned. The *commissioning provider* shall disclose possible conflicts of interest so that objectivity can be confirmed. The commissioning team shall include a *FPT provider* who may also be the *commissioning provider*.

~~b. The *owner*, in conjunction with the design team as necessary, shall develop the *OPR* during the predesign phase. The *OPR* shall be updated during the design phase as necessary by the design team, in conjunction with the *owner* and the Cx team. The *OPR* will be distributed to all parties participating in project programming, design, construction, and operations, and to the Cx team members.~~

~~c. The design team shall develop the *Basis of Design (BoD)*. The *BoD* document shall include all the information required in Section 6.2, "Documentation," of ANSI/ASHRAE Standard 55.~~

~~d. The *CxA* shall review both the *OPR* and *BoD* to ensure that no conflicting requirements or goals exist and that the *OPR* and *BoD*, based on the professional judgment and experience of the *CxA*, are sufficiently detailed for the project being undertaken.~~

~~e.~~c. Construction phase commissioning requirements shall be incorporated into project specifications and other *construction documents* developed by the design team.

~~f. The *CxA* shall conduct two focused *OPR* reviews of the *construction documents*, the first at near 50% design completion, and the second of the final *construction documents* prior to delivery to the contractor. The purpose of these reviews is to verify that the documents achieve the construction phase *OPR* and that the *BoD* document fully supports the *OPR* with sufficient details.~~

~~g. Develop and implement a *commissioning (Cx) plan* containing all required forms and procedures for the complete testing of all equipment, systems, and controls included in Section 10.3.1.2.4.~~

10.3.1.2.~~2~~.3 Commissioning Activities Prior to Building Occupancy. The following activities shall be completed prior to issuance of a certificate of occupancy:

a. For the systems being commissioned, v~~V~~erify ~~the installation and performance of the systems to be commissioned, ~~~~that commissioning has been completed, installation has been verified, *FPT* has been performed, and that reporting includes documentation of test results, including completion of the *construction checklist* and *verification*.~~

Exception to 10.3.1.2.~~2~~.3(a): Systems ~~that, because their~~ for which operation is seasonally dependent, and which cannot be fully commissioned in accordance with the *Cx plan* at the time of occupancy~~. These systems,~~ shall be commissioned at the earliest operation time ~~after~~ post-occupancy ~~when operation of systems is allowed to be fully demonstrated~~ as determined by the ~~*CxA*~~ *Cx provider*.

~~b. It shall be verified that the *owner* requirements for the training of operating personnel and building occupants is completed. Where systems cannot be fully commissioned at the time of occupancy because of seasonal dependence, the training of personnel and building occupants shall be completed when the systems' operation can be fully demonstrated by the *CxA*.~~

~~c.~~b. ~~Complete~~ The owner shall be provided with a preliminary ~~Cx~~ commissioning report per compliance with Section 10.3.1.3. A copy of the Cx preliminary report shall be submitted to the *AHJ* if requested.

~~d.~~c. ~~Verify that~~ The *commissioning* provider shall verify the *owner* has been provided with a systems manual ~~has been prepared~~ that includes ~~O&M documentation~~ the information needed to understand and operate the commissioned systems as designed, ~~and full~~ including warranty information ~~and provides operating staff the information needed to understand and operate the commissioned systems as designed.~~ for the commissioned systems. The systems manual with design and operational information shall be available for building operator and maintenance training.

10.3.1.2.~~3~~.4 Postoccupancy Commissioning Activities. ~~Complete t~~The *Cx plan* shall contain postoccupancy commissioning requirements in accordance with ANSI/ASHRAE/IES Standard 202. The *Cx provider* shall provide the *owner* with a complete systems manual, all record documents, and a complete final commissioning report in accordance Standard 202. ~~following:~~

~~a. Complete any commissioning activities called out in the *Cx plan* for systems whose commissioning can only be completed subsequent to building occupancy, including trend logging and off season testing.~~

~~b. Verify that the *owner* requirements for training operating personnel and building occupants are completed for those systems whose seasonal operational dependence mean they were unable to be fully commissioned prior to building occupancy.~~

~~c. Complete a final Cx report.~~

~~**10.3.1.2.4 Systems.** The following systems and associated controls, if included in the *building project*, shall be commissioned:~~

~~a. Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and/or passive).~~

~~b. *Building envelope* systems, components, and assemblies to verify the airtightness and thermal and moisture integrity. *Building envelope* airtightness commissioning shall also comply with Section 10.3.1.2.5.~~

~~c. Lighting systems.~~
~~d. *Fenestration* control systems: *Automatic* controls for shading devices and *dynamic glazing*.~~
~~e. Irrigation.~~
~~f. Plumbing.~~
~~g. Domestic and process water pumping and mixing systems.~~
~~h. *Service water heating* systems.~~
~~i. Renewable energy systems.~~
~~j. Water measurement devices, as required in Section 6.3.3.~~
~~k. Energy measurement devices, as required in Section 7.3.3.~~

10.3.1.3 Project Commissioning Documents

10.3.1.3.1 Commissioning (Cx) Plan. A *Cx plan* shall be developed by a *Cx provider* in accordance with ANSI/ASHRAE/IES Standard 202 for all systems to be commissioned and/or tested.

10.3.1.3.2 Design Review Report. The *Cx provider* shall provide to the *owner* and design teams a commissioning design review report that complies with ANSI/ASHRAE/IES Standard 202 and details compliance with the *OPR*. This commissioning design review shall not be considered a design peer review or a code or regulatory review.

10.3.1.3.3 Preliminary Commissioning Report. The *Cx provider* shall provide a preliminary commissioning report that includes the following information:

a. Performance of commissioned equipment, systems, and assemblies.

b. Issue and resolution logs, including itemization of deficiencies found during testing and commissioning that have not been corrected at the time of report preparation.

c. Deferred tests that cannot be performed at the time of report preparation.

d. Documentation of the training of operating personnel and building occupants on commissioned systems and a plan for the completion of any deferred trainings that were unable to be fully commissioned at the time of report preparation.

e. A plan for the completion of commissioning, including climatic and other conditions required for performance of the deferred tests.

10.3.1.3.4 Final Commissioning Report. The *Cx provider* shall provide to the owner, prior to project completion, a final commissioning report that complies with ANSI/ASHRAE/IES Standard 202.

10.3.1.4.~~2.~~5 *Building Envelope* Airtightness. *Building envelope* airtightness shall comply with one of the following:
[. . .]

(This foreword 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.)

FOREWORD

Addendum as updates the acoustical requirements of Standard 189.1. Its development included comparison with the International Green Construction Code, Acoustical Society of America, Facilities Guideline Institute, and LEED, and benefited from the participation of ASHRAE TC 2.6, Sound and Vibration Control.

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 as to Standard 189.1-2014

Modify Section 3.2 as shown.

~~yearly average day-night average sound levels:~~ ~~level of the time-mean-square A-weighted sound pressure averaged over a one-year period with ten decibels (dB) added to sound levels occurring in each night-time period from 2200 hours to 0700 hours, expressed in decibels.~~

equivalent continuous sound level (L_{eq}): see ANSI/ASA S 1.1, Section 3.1.

maximum sound pressure level (L_{max}): greatest frequency-weighted and exponential-time-weighted sound level within a stated time interval.

hourly average sound pressure level (L_{eq}): time-mean-square frequency-weighted sound pressure level for one hour.

Modify Section 3.3 as shown.

CAC	ceiling attenuation class
dBA	decibel, A-weighting
dBC	decibel, C-weighting
Hz	hertz
IIC	impact insulation class
ISR	impact sound rating
L_{max}	maximum sound pressure level
L_{eq}	equivalent continuous sound level
NIC	noise isolation class
NNIC	normalized noise isolation class
NISR	normalized impact sound rating
STC	sound transmission class
cSTC	composite sound transmission class
T_{60}	reverberation time in seconds

Delete Section 8.3.3 in total and replace it with the new Section 8.3.3 as shown.

~~8.3.3 Acoustical Control~~

~~8.3.3.1 Exterior Sound.~~ ~~*Wall* and *roof* ceiling assemblies that are part of the *building envelope* shall have a composite outdoor-indoor transmission class (OITC) rating of 40 or greater or a composite sound transmission class (STC) rating of 50 or greater, and *fenestration* that is part of the *building envelope* shall have an OITC or STC rating of 30 or greater for any of the following conditions:~~

~~a. Buildings within 1000 ft (300 m) of *expressways*.~~
~~b. Buildings within 5 mi (8 km) of airports serving more than 10,000 commercial jets per year.~~
~~c. Where *yearly average day-night average sound levels* at the property line exceed 65 dB.~~

~~**Exception to 8.3.3.1:** Buildings that may have to adhere to functional and operational requirements such as factories, stadiums, storage, enclosed parking structure, and utility buildings.~~

~~8.3.3.2 Interior Sound.~~ ~~Interior *wall* and floor/ceiling assemblies separating interior rooms and *spaces* shall be designed in accordance with all of the following:~~

~~a. *Wall* and floor-ceiling assemblies separating adjacent *dwelling units*, *dwelling units* and public *spaces*, adjacent tenant *spaces*, tenant *spaces* and public places, and adjacent *classrooms* shall have a composite STC rating of 50 or greater.~~
~~b. *Wall* and floor-ceiling assemblies separating hotel rooms, motel rooms, and patient rooms in nursing homes and hospitals shall have a composite STC rating of 45 or greater.~~
~~c. *Wall* and floor-ceiling assemblies separating *classrooms* from rest rooms and showers shall have a composite STC rating of 53 or greater.~~
~~d. *Wall* and floor-ceiling assemblies separating *classrooms* from music rooms, mechanical rooms, cafeteria, gymnasiums, and indoor swimming pools shall have a composite STC rating of 60 or greater.~~

~~8.3.3.3 Outdoor-Indoor Transmission Class (OITC) and Sound Transmission Class (STC).~~ ~~OITC values for assemblies and components shall be determined in accordance with ASTM E1332. STC values for assemblies and components shall be determined in accordance with ASTM E90 and ASTM E413.~~

8.3.3 Acoustical Control. The provisions of this section shall govern acoustical control for the building envelope, the interior spaces within the building or structure, and the design of the related mechanical equipment and systems. School spaces identified in ANSI/ASA S12.60 shall comply with ANSI/ASA S12.60. Healthcare spaces, as defined in the *FGI Guidelines*, shall comply with the *FGI Guidelines*. All other spaces shall be designed in accordance with Sections 8.3.3.1 through 8.3.3.5.

8.3.3.1 Documentation. Construction documents and supplemental information necessary to verify compliance with

Table 8.3.3.2 Maximum Interior Background Sound Pressure Levels from Building Systems and Exterior Sound Sources[a]

	Hourly Average Sound Pressure Level (L_{eq})		Maximum Sound Pressure Level (L_{max} [slow time weighting])	
Room Type	**dBA**	**dBC**	**dBA**	**dBC**
Residential sleeping areas (nighttime[b])	35	60	45	70
Residential living and sleeping areas (daytime)	40	60	50	70
Hotel and motel guest rooms or suites and dormitories	40	60	50	70
Meeting and banquet rooms	35	60	45	70
Corridors and lobbies	45	65	60	75
Service and support areas	45	65	60	75
Enclosed offices	35	60	45	70
Conference rooms	35	60	45	70
Teleconference rooms	30	55	40	65
Open-plan offices	45	65	55	75
Courtrooms—unamplified speech	35	60	45	70
Courtrooms—amplified speech	40	60	50	70
Laboratories—minimal speech communication	55	75	65	85
Laboratories—extensive phone use and speech communication	50	70	60	80
Laboratories—group teaching	40	60	50	70
Religious—general assembly with music program	30	55	40	65
Library study and reading areas	35	60	45	70
Gymnasiums and natatoriums without speech amplification	50	70	60	80
Gymnasiums and natatoriums with speech amplification	55	75	65	85

a. For high-noise exterior events, refer to Section 8.3.3.1.2.1.
b. "Nighttime" is defined as the time between 10 p.m. and 7 a.m.

this standard, such as calculations, worksheets, laboratory test reports, field test reports, compliance forms, vendor literature, or other data, shall be reviewed by a person experienced in the field of acoustics and who shall report compliance or noncompliance with the required acoustical performance. The construction documents and any reports shall show all the pertinent data and features of the building, equipment, and systems in sufficient detail to permit a determination of compliance by the *AHJ* and to indicate compliance with the requirements of this standard.

8.3.3.1.1 Test Methods. The laboratory tested performance for STC for wall, partition, window, and ceiling/floor assemblies shall be tested in accordance with ASTM E90, and the laboratory tested performance for IIC for floor/ceiling assemblies shall be tested in accordance with ASTM E492. All assemblies shall be sealed according to ASTM C919 and in accordance with the laboratory tested assembly details and materials. Field-tested assemblies used in the analysis shall be tested in accordance with ASTM E336 and ASTM E1007.

8.3.3.2 Interior Background Noise Requirements. The building envelope; interior spaces within the building; and building systems, including mechanical, electrical, and plumbing systems, shall be designed and constructed such that the interior sound pressure levels created by the combination of building systems noise and exterior sound sources, under normal operation with windows closed and no active sound masking systems, do not exceed the values specified in Table 8.3.3.2. The hourly average sound pressure level L_{eq} and maximum sound pressure level L_{max} shall not exceed the values listed in Table 8.3.3.2. Outdoor noise levels used in the design shall be provided in the construction documents.

8.3.3.2.1 High-Noise Exterior Events. Hourly average sound pressure levels L_{eq} shall be permitted to exceed the values specified in Table 8.3.3.2 by not more than 5 dB where the excess sound pressure is attributed to high-noise exterior events that occur more than ten times per day, and by not more than 10 dB where the excess sound pressure is attributed to high-noise exterior events that occur ten times or fewer per day. Maximum sound pressure levels L_{max} shall be permitted to exceed the values specified in Table 8.3.3.2 by not more than 10 dB where the excess sound pressure is attributed to high-noise exterior events that occur more than ten times per day. Maximum sound pressure levels L_{max} shall be permitted to exceed the values specified in Table 8.3.3.2, without limitation, where the excess sound pressure is attributed to high-noise exterior events that occur ten times or fewer per day.

8.3.3.2.2 Conformance. Conformance to the requirements in Section 8.3.3.2 shall be demonstrated either through the design requirements of Section 8.3.3.2.3 or the testing requirements of Section 8.3.3.2.4.

Table 8.3.3.3 Minimum Sound & Impact Sound Ratings

Room Type	cSTC[c,d]	IIC
Dwelling unit (apartment, condominium, duplex, hotel guest room, etc.)	55	55
Retail or restaurant	50	45
Exercise, gym or pool[b]	55	50[a]
Mechanical, electrical, and elevator machinery rooms[b]	60	N/A[e]
Conference and teleconference rooms	50	50
Enclosed offices	45	45
Open offices	N/A[e]	45

a. The IIC value listed addresses footfall noise but not exercise-related vibration-borne sound. Exercise-related vibration-borne sound shall comply with the requirements of Section 8.3.3.2.
b. Minimum STC and IIC values are not required between adjacent rooms of the same room type.
c. For operable partitions and walls containing doors, windows, or both, the minimum STC ratings shall be 5 less than the values listed in Table 8.3.3.3.
d. The minimum cSTC values shall be 5 less than the cSTC values in Table 8.3.3.3 for walls between spaces and corridors and between spaces and open offices. The minimum cSTC values shall be 15 less than the cSTC values specified in Table 8.3.3.3 for walls having doors that open to corridors or open offices.
e. Not applicable.

8.3.3.2.3 Interior Background Noise—Design. Conformance with the provisions of this section shall be demonstrated.

8.3.3.2.3.1 Building Envelope. The composite sound transmission class (cSTC) for the building envelope shall be calculated and used in determining the maximum interior background sound pressure levels for room types listed in Table 8.3.3.2.

8.3.3.2.3.2 Interior Systems. Interior noise from HVAC systems shall be calculated for room types listed in Table 8.3.3.2 and used in determining the maximum interior background sound pressure levels for the room types listed in Table 8.3.3.2.

8.3.3.2.3.3 Penetrations and Fenestrations. All penetrations through, and fenestrations within, sound rated assemblies shall be sealed in accordance to ASTM C919 and installed per the manufacturer's recommendations.

8.3.3.2.3.4 Inspection. Construction of acoustical items required in Sections 8.3.3.2.3 through 8.3.3.2.3.3 shall be visually inspected by an approved agency.

8.3.3.2.4 Interior Background Noise—Testing. Acceptance testing shall be performed in accordance with Section 10.3.1.1.5. Noise from construction activities, emergency vehicles, and sirens need not be considered.

8.3.3.3 Interior Sound Transmission. Interior wall and floor-ceiling assemblies separating adjacent interior *spaces* shall be designed and constructed to provide airborne sound isolation that complies with the minimum STC values specified in Table 8.3.3.3. For wall and floor-ceiling assemblies separating different room types, the greater of the two STC values shall apply. Floor-ceiling assemblies separating adjacent interior *spaces* shall be designed and constructed to provide impact sound isolation that complies with the minimum IIC values specified in Table 8.3.3.3. For floor-ceiling assemblies separating different room types, the IIC value associated with the room on the story below shall apply.

8.3.3.3.1 Conformance. Conformance to the requirements in Section 8.3.3.3 shall be demonstrated either through the design requirements of Section 8.3.3.3.2 or testing requirements of Section 8.3.3.3.3.

8.3.3.3.2 Interior Sound Transmission—Design. Wall and floor-ceiling assemblies shall comply with the following:

a. Assemblies shall be required to provide sound isolation in accordance with this section and shall adjoin other intersecting sound isolating assemblies along all perimeter edges so as to provide continuity of sound isolation.
b. All partitions between spaces with different uses shall be full-height partitions or shall extend to a ceiling system with a CAC rating equal to or greater than the wall cSTC rating, and all floor-ceiling assemblies shall be full-span assemblies connected to the walls/partitions.
c. Assemblies shall be sealed at all potential flanking paths and around all penetrations according to ASTM C919 and installed in accordance with the sealant manufacturer's recommendations to achieve the assembly's required performance rating.

8.3.3.3.2.1 Inspection. Construction of acoustical items required in Section 8.3.3.3.2 shall be visually inspected by an approved agency.

8.3.3.3.3 Interior Sound Transmission—Testing. Acceptance testing shall be performed in accordance with Section 10.3.1.1.5.

8.3.3.4 Interior Sound Reverberation. The reverberation time T_{60} for designated spaces shall be calculated in accordance with ANSI/ASA S12.60-2010, Part 1, Annex A for the octave bands 500, 1000, and 2000 Hz and shall not exceed the values specified in Table 8.3.3.3 for fully furnished rooms.

8.3.3.5 Property Line Sound Levels. Design and construction of mechanical systems for control of sound levels at the property line shall be in accordance with either the design provisions of Section 8.3.3.5.1 or the testing provisions of Section 8.3.3.5.2.

8.3.3.5.1 Property Line Sound Levels—Design. HVAC and other mechanical systems on the premises shall be designed to have a maximum hourly average sound pressure level L_{eq} less than or equal to the values in Table 8.3.3.5.1 at grade level and up to the highest potential window location on all property lines adjoining receiving properties. When generators are used for emergency power only, they shall be exempt from this criterion.

8.3.3.5.2 Property Line Sound Levels—Testing. Sound produced by HVAC or other mechanical systems on the premises shall not exceed the values in Table 8.3.3.5.2 at grade level and up to the highest window location on all property lines adjoining receiving properties. Where a generator is used only to provide emergency power, and all periodic operational testing is performed between the hours of 7:00 a.m.

Table 8.3.3.4 Maximum Reverberation Time

Room Types	T_{60}, sec
Meeting and Banquet Rooms < 3,000 ft^3 (85 m^3)	0.8
Meeting and Banquet Rooms 3,000 ft^3 (85 m^3) up to 8,000 ft^3 (225 m^3)	1.0
Meeting and Banquet Rooms > 8,000 ft^3 (225m^3) up to 30,000 ft^3 (850 m^3)	1.2
Meeting and Banquet Rooms > 30,000 ft^3 (850 m^3)	1.5
Enclosed offices	0.6
Conference /Teleconference rooms	0.6
Open-plan offices	0.6
Courtrooms - Unamplified speech	0.7
Courtrooms – Amplified speech	1.0
Testing/research Labs (Little speech communication)	1.0
Labs (Extensive phone use and speech communication)	0.6
Library study and reading areas	1.0
Gymnasiums and natatoriums	2.0

Table 8.3.3.5.1 Property Line Maximum Sound Levels—Prescriptive Option

Initiating Property	Receiving Property	Hourly Average Sound Pressure Level (L_{eq})
All, except factory or industrial	All, except factory or industrial	50
Factory or industrial	All, except factory or industrial	55
Factory or industrial	Factory or industrial	75

Table 8.3.3.5.2 Property Line Maximum Sound Levels—Tested Performance Option

		Hourly Average Sound Pressure Level (L_{eq})	
		Daytime	Nighttime
Initiating Property	Receiving Property	7:00 a.m. to 10:00 p.m.	10:00 p.m. to 7:00 a.m.
All, except factory or industrial	All, except factory or industrial	60	50
Factory or industrial	All, except factory or industrial	65	55
Factory or industrial	Factory or industrial	75	75

and 10:00 p.m., the sound produced by emergency generator during nighttime hours need only comply with the daytime maximum sound level values specified in Table 8.3.3.5.2. Acceptance testing shall be performed in accordance with Section 10.3.1.1.5.1.3.

Modify Section 10 as shown.

10.3.1.1.5 Acoustical Control

10.3.1.1.5.1 Acoustical Field Measurement. Where required by Section 8, the acceptance testing specified in Sections 10.3.1.1.5.1.1 through 10.3.1.1.5.1.2 shall be completed.

10.3.1.1.5.1.1 Interior Background Sound Levels. The interior sound level shall be measured in accordance with ANSI S12.72 using a sound level meter in slow response setting as defined in ANSI/ASA S1.4. The testing shall include not less than 10% of the rooms of each type specified in Table 8.3.3.2 that has a prescribed maximum hourly average sound pressure level L_{eq} dBA of 40 or less. The measured performance of the spaces shall not exceed the values specified in Table 8.3.3.2 by greater than 5 dBA or 5 dBC.

10.3.1.1.5.1.2 Interior Sound Transmission. The testing of interior sound transmission shall be in accordance with ASTM E336, Noise Isolation Class (NIC), and ASTM E 1007, Impact Sound Rating (ISR). Tested NIC values shall not be more than 5 less than the cSTC values, and the ISR values shall not be less than the IIC values in Table 8.3.3.3. Testing shall be performed on not less than 10% of the partitions between rooms of each type in Table 8.3.3.3 that has a prescribed cSTC or IIC of 50 or higher.

10.3.1.1.5.1.3 Property Line Sound. Testing shall be performed at the locations and times of day or night that are estimated to be the most likely to fail the testing and shall be performed with all equipment operating under normal 100% load operation. If daytime test results comply with the nighttime requirements, nighttime testing is not required. The testing shall be in accordance with ANSI/ASA S1.13. The testing results shall comply with the property line noise levels in Table 8.3.3.5.2. At the discretion of the *AHJ*, noise that is not created on the source property need not be included in the reported test results.

Modify Section 11 as shown.

Reference	Title	Section
Acoustical Society of America (ASA) 1305 Walt Whitman Road Suite 300 Melville, NY 11747-4300 (516) 576-2360; http://acousticalsociety.org		
ANSI/ASA S1.4-2014	Sound Level Meters	10.3.1.1.5.1.1
ANSI/ASA S1.13-2005 (R2010)	Measurement of Sound Pressure Levels in Air	10.3.1.1.5.1.3
ANSI/ASA S12.60-2010	Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools	8.3.3, 8.3.3.4
ANSI/ASA S12.60-2009	Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 2: Relocatable Classroom Factors	3 8.3.3
ANSI/ASA 12.72-2015	Measuring the Ambient Noise Level in a Room	10.3.1.1.5.1.1
[. . .]		
The American Society for Healthcare Engineering of the American Hospital Association (ASHE) 155 N. Wacker Drive, Suite 400 Chicago, IL 60606 312-422-3800; www.ASHE.org		
2014 FGI Guidelines: Hospitals and Outpatient Facilities	Guidelines for Design and Construction of Hospitals and Outpatient Facilities	8.3.3
2014 FGI Guidelines: Residential Health, Care and Support Facilities	Guidelines for Design and Construction of Residential Health, Care, and Support Facilities	8.3.3
[. . .]		
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM C919-12	Standard Practice for Use of Sealants in Acoustical Applications.	8.3.3.1.1, 8.3.3.2.3.3, 8.3.3.3.2
ASTM E90-09	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	8.3.3.1.1
ASTM E336-14	Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings	8.3.3.1.1, 10.3.1.1.5.1.2
ASTM E492-09s	Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine	8.3.3.1.1
~~ASTM 413-10~~	~~Classification for Rating Sound Insulation~~	~~8.3.3.3~~
ASTM E1007-14	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission through Floor-Ceiling Assemblies and Associated Support Structures	8.3.3.1.1
~~ASTM E1332-10a~~	~~Sound Classification for the Determination of Outdoor-Indoor Transmission Class~~	~~8.3.3.3~~

(This foreword 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.)

FOREWORD

Addendum au provides additional requirements for irrigation systems to improve water use efficiency, based in part on consideration of requirements included in the IgCC.

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 au to Standard 189.1-2014

Modify or add definitions in Section 3.2 as follows.

evapotranspiration (ET): the sum of evaporation from soil and plant surfaces and transpiration of water through leaf stomata.~~Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and water bodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves.~~

ET_c: *evapotranspiration* of the plant material derived by multiplying ET^o by the appropriate plant factor or coefficient.

ET_o: ~~maximum~~reference *evapotranspiration* for a cool-season grass as ~~defined~~calculated by the standardized Penman-Monteith equation based on ~~or from the National Weather Service~~weather station data~~where available.~~

ground cover: plantings other than turfgrass that are low-growing and form dense vegetation over the soil area.

hydrozone: an irrigated area of landscape in which the plants have similar water needs and are irrigated by the same type of emission devices.

~~***hydrozoning:*** to divide the landscape irrigation system into sections in order to regulate each zone's water needs based on plant materials, soil, and other factors.~~

irrigation station: a set of irrigation emission devices supplied water by a single control valve. Also referred to as an "irrigation zone."

Modify Section 6 as follows.

6.3.1.2 Irrigation System Design. ~~*Hydrozoning* of *automatic* irrigation systems to water different plant materials, such as *turfgrass* versus shrubs, is required. Landscaping sprinklers shall not be permitted to spray water directly on a building or within 3 ft (1 m) of a building.~~The design of the irrigation system shall be performed by an accredited or certified irrigation professional and shall be in accordance with the following:

a. Irrigation systems
   1. shall be based on *hydrozones*. *Turfgrass* areas shall be on their own irrigation stations.
   2. shall have backflow prevention in accordance with the plumbing code.
   3. shall have a master valve on municipally supplied water sources that allows pressurization of the irrigation mainline only when irrigation is scheduled.
   4. shall have a flow sensor and monitoring equipment that will shut off the control valve if the flow exceeds normal flow from an irrigation station.
   5. shall prevent piping from draining between irrigation events.
b. Irrigation emission devices shall comply with ASABE/ICC 802, *Landscape Irrigation Sprinkler and Emitter Standard*.
c. Irrigation sprinklers
   1. shall not spray water directly on buildings or hardscape area.
   2. shall have matched precipitation rate nozzles within an irrigation station.
   3. shall be prohibited on landscape areas having any dimension less than 4 ft (1220 mm).
   4. shall have an application rate less than or equal to 0.75 in. (19 mm) per hour on slopes greater than 1 unit vertical in 4 units horizontal.
   5. shall be limited to use with *turfgrass* or *ground cover* areas with vegetation maintained at 8 in. (203 mm) or less in height.
   6. where of the pop-up configuration, shall have a pop-up height of not less than 4 in (100 mm).
d. Microirrigation zones
   1. shall be equipped with pressure regulators, filters, and flush assemblies.
   2. shall have indicators that allow confirmation of operation by visual inspection.

6.3.1.3 Controls. Any irrigation system for the project *site* shall be controlled by a qualifying *smart controller* that uses *evapotranspiration* (*ET*) and weather data to adjust irrigation schedules and that complies with the minimum requirements or an on-site rain or moisture sensor that automatically shuts the system off after a predetermined amount of rainfall or sensed moisture in the soil. Qualifying *smart controllers* shall be labeled according to USEPA *WaterSense Specification for Weather-Based Irrigation Controllers*, or tested in accordance with ~~meet the minimum requirements, as listed below, when tested in accordance with of~~ Irrigation Association SWAT Climatologically -Based Controllers, 8th ~~Draft~~ Testing Protocol. *Smart controllers* that use *ET* data shall provide~~use~~ the following ~~inputs for calculating appropriate~~ irrigation amounts:

a. *Irrigation adequacy*—80% minimum ET_c.
b. *Irrigation excess*—not to exceed 10% of ET_c.

Exception to 6.3.1.3: A temporary irrigation system used exclusively for the establishment of new landscape shall be exempt from this requirement. Temporary irrigation systems shall be removed or permanently disabled at such time as the *landscape establishment period* has expired.

6.3.1.3.1 The following settings and schedule for the irrigation control system shall be posted on or adjacent to the controller:

a. Precipitation rate of each *irrigation station*
b. Plant factors for each *hydrozone*
c. Soil type
d. Rain sensor settings
e. Soil moisture sensor settings, where installed
f. Peak demand schedule including run times, cycle starts, and soak times
g. Maximum runtimes to prevent water runoff

Modify Section 11 as follows.

American Society of Agricultural and Biological Engineers (ASABE) **2950 Niles Road** **Saint Joseph, MI 49085, United States** **1-269-429-0300; www.asabe.org**		
ASABE/ICC 802-2014	Landscape Irrigation Sprinkler and Emitter Standard	6.3.1.2
[. . .]		
Irrigation Association (IA) **~~6540 Arlington Boulevard~~ 8280 Willow Oaks Corporate Drive, Suite 400** **~~Falls Church~~ Fairfax, VA ~~22042-6638~~22031, United States** **1-703-536-7080; www.irrigation.org**		
Smart Water Application Technolog~~y~~ies (SWAT) Climatologicall~~y~~ Based Controllers, 8th ~~Draft~~ Testing Protocol~~—November 2006~~September 2008	Smart Water Application Technolog~~y~~ies (SWAT), Turf and Landscape Irrigation ~~Equipment~~System Smart Controllers, Climatologically Based Controllers	6.3.1.3
[. . .]		
United States Environmental Protection Agency (US~~E~~EPA) **Ariel Rios Building** **1200 Pennsylvania Avenue, NW** **Washington, DC 20460, United States** **1-919-541-0800; www.epa.gov** **ENERGY STAR® 1-888-782-7937** **WaterSense 1-866-987-7367 and 1-202-564-2660**		
WaterSense Specification for Weather-Based Irrigation Controllers, Version 1.0, November 3, 2011	WaterSense Specification for Weather-Based Irrigation Controllers	6.3.1.3

(This foreword 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.)

FOREWORD

Addendum av simplifies the application of lighting power allowances in ASHRAE/USGBC/IES Standard 189.1 and increases their stringency, while maintaining the same provisions for illuminance. Currently the standard applies LPD factors that are multiples of the LPDs in ASHRAE/IES Standard 90.1. This proposal would directly tabulate the LPDs in Standard 189.1, removing the need to look up the LPD values in Standard 90.1 and then multiply those values by Standard 189.1 LPD factors.

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 av to Standard 189.1-2014

Modify Section 7.4.6.1 as shown.

7.4.6 Lighting. The lighting shall comply with Section 9 of ANSI/ASHRAE/IES Standard 90.1 and the following modifications and additions.

7.4.6.1 Lighting Power Allowance

7.4.6.1.1 Interior Lighting Power Densities (LPDs). The interior *lighting power allowance* shall be determined using either Section 9.5 or Section 9.6 of ANSI/ASHRAE/IES Standard 90.1 with the following modifications:

a. For those areas where the Building Area Method is used, the LPD from Table 9.5.1 of ANSI/ASHRAE/IES Standard 90.1 shall be ~~multiplied by the corresponding LPD Factor from~~ replaced with the corresponding LPD in Table 7.4.6.1A.

b. For those areas where the Space-by-Space Method is used, the LPD from Table 9.6.1 of ANSI/ASHRAE/IES Standard 90.1 shall be ~~multiplied by the corresponding LPD Factor from~~ replaced with the corresponding LPD in Table 7.4.6.1B.

c. Room geometry adjustment when using the Space-by-Space Method: Standard 90.1, Section 9.6.4, shall be replaced with the following. For corridor/transition spaces less than 8 ft (2.4 m) wide, or individual spaces where room cavity ratio (RCR) calculated for the empty room is documented to be greater than the RCR threshold for that space type shown in Table 7.4.6.1B, the allowed LPD shall be 1.2 times the LPD in Table 7.4.6.1B. RCR shall be calculated as described in Standard 90.1, Section 9.6.4.

d. Additional lighting power when using the Space-by-Space Method: For those areas where the Space-by-Space Method is used, the additional increase in the interior lighting power allowed by Standard 90.1, Section 9.6.2, for specific lighting functions shall be replaced by the requirements and allowances of this section. Additional power shall be allowed only if the specified lighting is installed and automatically controlled separately from the general lighting and is designed and installed to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases:

   1. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance or for highlighting art or exhibits, provided that the additional lighting power shall not exceed 0.5W/ft^2 (5.4 W/m^2) of such spaces.
   2. For lighting equipment installed in sales areas and specifically designed and directed to highlight merchandise, calculate the additional lighting power as follows:

Additional interior lighting power allowance =
750 W + [Retail area 1 × 0.40 W/ft^2 (4.3 W/m^2)]
+ [Retail area 2 × 0.40 W/ft^2 (4.3 W/m^2)]
+ [Retail area 3 × 1.00 W/ft^2 (10.8 W/m^2)]
+ [Retail area 4 × 1.50 W/ft^2 (16.1 W/m^2)]

where

Retail area 1	=	the floor area for all products not listed in Retail Areas 2, 3, or 4
Retail area 2	=	the floor area used for the sale of vehicles, sporting goods, and small electronics
Retail area 3	=	the floor area used for the sale of furniture, clothing, cosmetics, and artwork
Retail area 4	=	the floor area used for the sale of jewelry, crystal, and china

Exception to Section 7.4.6.1.1(d)(2): Other merchandise categories included in Retail areas 2 through 4 where the authority having jurisdiction has approved the documented need for additional lighting power based on visual inspection, contrast, or other critical display.

Update list lettering of the following items in Section 7.4.6.1.1 (no changes to text).

~~c.~~e. Control factors from Table 9.6.3 in ANSI/ASHRAE/IES Standard 90.1 shall not be used for any control methodologies required in this standard.

~~d.~~f. An additional lighting power allowance shall be credited for institutional tuning [. . .]

Delete current Tables 7.4.6.1A and 7.4.6.1B and replace with the tables shown.

Table 7.4.6.1A Lighting Power Densities Using the Building Area Method

Building Area Type[a]	LPD, W/ft^2	LPD, W/m^2
Automotive facility	0.64	6.9
Convention center	0.51	5.5
Courthouse	0.74	8.0
Dining: Bar lounge/leisure	0.69	7.4
Dining: Cafeteria/fast food	0.66	7.1
Dining: Family	0.61	6.6
Dormitory	0.52	5.6
Exercise center	0.61	6.6
Fire station	0.50	5.4
Gymnasium	0.67	7.2
Health care clinic	0.68	7.3
Hospital	0.86	9.3
Hotel/Motel	0.70	7.5
Library	0.72	7.8
Manufacturing facility	0.60	6.5
Motion picture theater	0.62	6.7
Multifamily	0.49	5.3
Museum	0.68	7.3
Office	0.69	7.4
Parking garage	0.12	1.3
Penitentiary	0.67	7.2
Performing arts theater	0.85	9.1
Police station	0.68	7.3
Post office	0.62	6.7
Religious facility	0.70	7.5
Retail	0.91	9.8
School/university	0.67	7.2
Sports arena	0.76	8.2
Town hall	0.72	7.8
Transportation	0.51	5.5
Warehouse	0.41	4.4
Workshop	0.83	8.9

a. In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply.

TABLE 7.4.6.1B Lighting Power Density Allowances and RCR Thresholds Using the Space-by-Space Method

Informative Note: This table is divided into two sections. The first section covers space types that can be commonly found in multiple-building types. The second part covers space types that are typically found in a single-building type.

Common Space Types[a]	LPD, W/ft^2	LPD, W/m^2	RCR Threshold
Atrium			
<20 ft (6.1 m) in height	0.023/ft total height	0.81/m total height	NA
≥20 ft (6.1m) and ≤ 40 ft (12.2 m) in height	0.023/ft total height	0.81/m total height	NA
>40 ft (12.2 m) in height	0.30 + 0.015/ft total height	3.2 + 0.53/m total height	NA
Audience Seating Area			
Auditorium	0.67	7.2	6
Convention center	0.65	7.0	4
Gymnasium	0.43	4.6	6
Motion picture theater	0.64	6.9	4
Penitentiary	0.44	4.7	4
Performing arts theater	1.34	14.4	8
Religious building	0.98	10.5	4
Sports arena	0.42	4.5	4
All other audience seating areas	0.40	4.3	4
Banking Activity Area	0.79	8.5	6
Breakroom (See Lounge/Breakroom)			
Classroom/Lecture Hall/Training Room			
Penitentiary	1.06	11.4	4
All other classrooms/lecture halls/training rooms	0.74	8.0	4
Conference/Meeting/Multipurpose Room	0.93	10.0	6
Confinement Cells	0.52	5.6	6
Copy/Print Room	0.50	5.4	6
Corridor[b]			
Facility for the visually impaired (and not used primarily by the staff)[c]	0.81	8.7	width < 8 ft (2.4 m)
Hospital	0.81	8.7	width < 8 ft (2.4 m)
Manufacturing facility	0.28	3.0	width < 8 ft (2.4 m)
All other corridors	0.58	6.2	width < 8 ft (2.4 m)
Courtroom	0.98	10.5	6
Computer Room	1.16	12.5	4

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
b. In corridors, the extra lighting power density allowance is permitted when the width of the corridor is less than 8 ft (2.4 m) and is not based on the RCR, see Section 7.4.6.1.1(b).
c. A "Facility for the visually impaired" is a facility that can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and is licensed or will be licensed by local/state authorities for either senior long-term care, adult daycare, senior support, and/or people with special visual needs.
d. For accent lighting, see Section 7.4.6.1.1(c).
e. Sometimes referred to as a "Picking area."
f. Not used. To keep footnote numbering consistent with ASHRAE Standard 90.1.
g. Electrical/mechanical rooms. An additional 0.50 W/ft2 (5.4 W/m^2) shall be allowed, provided that the additional lighting is controlled separately from the base allowance of 0.39 W/ft^2 (4.2 W/m^2). The additional 0.50 W/ft^2 (5.4 W/m^2) allowance shall not be used for any other purpose.
h. Class of play as defined by IES RP-6.

TABLE 7.4.6.1B Lighting Power Density Allowances and RCR Thresholds Using the Space-by-Space Method

Informative Note: This table is divided into two sections. The first section covers space types that can be commonly found in multiple-building types. The second part covers space types that are typically found in a single-building type.

Common Space Types[a]	LPD, W/ft^2	LPD, W/m^2	RCR Threshold
Dining Area			
Penitentiary	0.72	7.8	6
Facility for the visually impaired (and not used primarily by staff)[c]	1.48	15.9	4
Bar/lounge or leisure dining	0.62	6.7	4
Cafeteria or fast food dining	0.53	5.7	4
Family dining	0.54	5.8	4
All other dining areas	0.53	5.7	4
Electrical/Mechanical Room[g]	0.39	4.2	6
Emergency Vehicle Garage	0.53	5.7	4
Food Preparation Area	0.92	9.9	6
Guest Room	0.75	8.1	6
Laboratory			
In or as a classroom	1.04	11.2	6
All other laboratories	1.24	13.3	6
Laundry/Washing Area	0.43	4.6	4
Loading Dock, Interior	0.51	5.5	6
Lobby			
Facility for the visually impaired (and not used primarily by the staff)[c]	1.30	14.0	4
Elevator	0.52	5.6	6
Hotel	0.68	7.3	4
Motion picture theater	0.38	4.1	4
Performing arts theater	0.82	8.8	6
All other lobbies	0.86	9.3	4
Locker Room	0.45	4.8	6
Lounge/Breakroom			
Healthcare facility	0.53	5.7	6
All other lounges/breakrooms	0.44	4.7	4
Office			
Enclosed and ≤ 250 ft^2 (23 m^2)	0.85	9.1	8
Enclosed and >250 ft^2 (23 m^2)	0.85	9.1	8
Open plan	0.78	8.4	4

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
b. In corridors, the extra lighting power density allowance is permitted when the width of the corridor is less than 8 ft (2.4 m) and is not based on the RCR, see Section 7.4.6.1.1(b).
c. A "Facility for the visually impaired" is a facility that can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and is licensed or will be licensed by local/state authorities for either senior long-term care, adult daycare, senior support, and/or people with special visual needs.
d. For accent lighting, see Section 7.4.6.1.1(c).
e. Sometimes referred to as a "Picking area."
f. Not used. To keep footnote numbering consistent with ASHRAE Standard 90.1.
g. Electrical/mechanical rooms. An additional 0.50 W/ft2 (5.4 W/m^2) shall be allowed, provided that the additional lighting is controlled separately from the base allowance of 0.39 W/ft^2 (4.2 W/m^2). The additional 0.50 W/ft^2 (5.4 W/m^2) allowance shall not be used for any other purpose.
h. Class of play as defined by IES RP-6.

TABLE 7.4.6.1B Lighting Power Density Allowances and RCR Thresholds Using the Space-by-Space Method

Informative Note: This table is divided into two sections. The first section covers space types that can be commonly found in multiple-building types. The second part covers space types that are typically found in a single-building type.

Common Space Types[a]	LPD, W/ft^2	LPD, W/m^2	RCR Threshold
Parking Area, Interior	0.11	1.2	4
Pharmacy Area	1.23	13.2	6
Restroom			
Facility for the visually impaired (and not used primarily by the staff)[c]	0.81	8.7	8
All other restrooms	0.75	8.1	8
Sales Area[d]	1.06	11.4	6
Seating Area, General	0.38	4.1	4
Stairway	The space containing the stairway shall determine the LPD requirements for the stairway.		
Stairwell	0.50	5.4	10
Storage Room			
<50 ft^2 (4.6m^2)	0.86	9.3	6
≥50 ft^2 (4.6m^2) and ≤ 1000 ft^2 (93 m^2)	0.43	4.6	6
All other storage rooms	0.43	4.6	6
Vehicular Maintenance Area	0.53	5.7	4
Workshop	1.09	11.7	6

Building Type Specific Space Types[a]	LPD, W/ft^2	LPD, W/m^2	RCR Threshold
Facility for the Visually Impaired[c]			
Chapel (used primarily by residents)	0.89	8.9	4
Recreation room/common living room (and not used primarily by staff)	1.53	15.3	6
Automotive (See "Vehicular Maintenance Area")			
Convention Center—Exhibit Space	0.69	7.43	4
Dormitory—Living Quarters	0.46	4.95	8
Fire Station—Sleeping Quarters	0.19	2.05	6
Gymnasium/Fitness Center			
Exercise area	0.50	5.4	4
Playing area	0.75	8.1	4
Healthcare Facility			
Exam/treatment room	1.16	12.5	8

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
b. In corridors, the extra lighting power density allowance is permitted when the width of the corridor is less than 8 ft (2.4 m) and is not based on the RCR, see Section 7.4.6.1.1(b).
c. A "Facility for the visually impaired" is a facility that can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and is licensed or will be licensed by local/state authorities for either senior long-term care, adult daycare, senior support, and/or people with special visual needs.
d. For accent lighting, see Section 7.4.6.1.1(c).
e. Sometimes referred to as a "Picking area."
f. Not used. To keep footnote numbering consistent with ASHRAE Standard 90.1.
g. Electrical/mechanical rooms. An additional 0.50 W/ft2 (5.4 W/m^2) shall be allowed, provided that the additional lighting is controlled separately from the base allowance of 0.39 W/ft^2 (4.2 W/m^2). The additional 0.50 W/ft^2 (5.4 W/m^2) allowance shall not be used for any other purpose.
h. Class of play as defined by IES RP-6.

TABLE 7.4.6.1B Lighting Power Density Allowances and RCR Thresholds Using the Space-by-Space Method

Informative Note: This table is divided into two sections. The first section covers space types that can be commonly found in multiple-building types. The second part covers space types that are typically found in a single-building type.

Building Type Specific Space Types[a]	LPD, W/ft^2	LPD, W/m^2	RCR Threshold
Imaging room	0.98	10.5	6
Medical supply room	0.54	5.8	6
Nursery	0.94	10.1	6
Nurse's station	0.75	8.1	6
Operating room	1.87	20.1	6
Patient room	0.45	4.8	6
Physical therapy room	0.85	9.1	6
Recovery room	0.89	9.6	6
Library			
Reading area	0.77	8.3	4
Stacks	1.08	11.6	4
Manufacturing Facility			
Detailed manufacturing area	0.86	9.3	4
Equipment room	0.61	6.6	6
Extra high bay area (>50 ft [15.2 m] floor-to-ceiling height)	0.73	7.9	4
High bay area (25 ft [7.6 m] to 50 ft [15.2 m] floor-to-ceiling height)	0.58	6.2	4
Low bay area (<25 ft [7.6 m] floor-to-ceiling height)	0.61	6.6	4
Museum			
General exhibition area	0.61	6.6	6
Restoration room	0.77	8.3	6
Performing Arts Theater—Dressing Room	0.35	3.8	6
Post Office—Sorting Area	0.66	7.1	4
Religious Buildings			
Fellowship hall	0.42	4.5	4
Worship/pulpit/choir area	0.98	10.5	4
Retail Facilities			
Dressing/fitting room	0.49	5.3	8
Mall concourse	0.79	8.5	4
Sports Arena—Playing Area[h]			
Class I facility	2.26	24.3	4

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
b. In corridors, the extra lighting power density allowance is permitted when the width of the corridor is less than 8 ft (2.4 m) and is not based on the RCR, see Section 7.4.6.1.1(b).
c. A "Facility for the visually impaired" is a facility that can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and is licensed or will be licensed by local/state authorities for either senior long-term care, adult daycare, senior support, and/or people with special visual needs.
d. For accent lighting, see Section 7.4.6.1.1(c).
e. Sometimes referred to as a "Picking area."
f. Not used. To keep footnote numbering consistent with ASHRAE Standard 90.1.
g. Electrical/mechanical rooms. An additional 0.50 W/ft2 (5.4 W/m^2) shall be allowed, provided that the additional lighting is controlled separately from the base allowance of 0.39 W/ft^2 (4.2 W/m^2). The additional 0.50 W/ft^2 (5.4 W/m^2) allowance shall not be used for any other purpose.
h. Class of play as defined by IES RP-6.

TABLE 7.4.6.1B Lighting Power Density Allowances and RCR Thresholds Using the Space-by-Space Method

Informative Note: This table is divided into two sections. The first section covers space types that can be commonly found in multiple-building types. The second part covers space types that are typically found in a single-building type.

Building Type Specific Space Types[a]	LPD, W/ft^2	LPD, W/m^2	RCR Threshold
Class II facility	1.45	15.6	4
Class III facility	1.08	11.6	4
Class IV facility	0.72	7.8	4
Transportation Facility			
Baggage/carousel area	0.40	4.3	4
Airport concourse	0.22	2.4	4
Terminal ticket counter	0.48	5.2	4
Warehouse—Storage Area			
Medium-to-bulky, palletized items	0.27	2.9	4
Smaller, hand-carried items[e]	0.65	7.0	6

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
b. In corridors, the extra lighting power density allowance is permitted when the width of the corridor is less than 8 ft (2.4 m) and is not based on the RCR, see Section 7.4.6.1.1(b).
c. A "Facility for the visually impaired" is a facility that can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and is licensed or will be licensed by local/state authorities for either senior long-term care, adult daycare, senior support, and/or people with special visual needs.
d. For accent lighting, see Section 7.4.6.1.1(c).
e. Sometimes referred to as a "Picking area."
f. Not used. To keep footnote numbering consistent with ASHRAE Standard 90.1.
g. Electrical/mechanical rooms. An additional 0.50 W/ft2 (5.4 W/m^2) shall be allowed, provided that the additional lighting is controlled separately from the base allowance of 0.39 W/ft^2 (4.2 W/m^2). The additional 0.50 W/ft^2 (5.4 W/m^2) allowance shall not be used for any other purpose.
h. Class of play as defined by IES RP-6.

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FOREWORD

Addendum aw adds two new mandatory requirements to Section 8, "Indoor Environmental Quality," with regard to occupant control of operable methods of glare control and of automatic daylight-responsive controls. The glare control requirement mandates that, in several specific space types, operable methods and devices of glare control be provided capable of blocking the specular transmittance of the fenestration assembly by a minimum of 97%, with the capability to allow occupants to manually adjust these glare control methods and devices, including the ability to temporarily override automatic controls. This proposal also allows occupants to have the capability to temporarily override automatic daylight responsive controls and automatic glare control for up to two hours.

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 aw to Standard 189.1-2014

Modify Section 3.2 as shown.

view fenestration: fenestration that complies with all of the following:

a. It provides building occupants with a view to the outdoors or to an interior daylit atrium.
b. It has undiffused glazing with a haze value less than 3%, as determined in accordance with ASTM D1003.
c. It has a center-of-glass visible transmittance (VT) of not less than 20%.
d. The product of the center-of-glass VT and the openness factor of screens, patterned films, and ceramic frits is not less than 20%.
e. Where *dynamic glazing* is provided, such glazing has a center-of-glass visible transmittance (VT) of not less than 20% at the highest end of its range.
f. Where nonoperable opaque window treatments are provided, such as blinds, shades, and louvers, such treatments do not obstruct more than 40% of the fenestration glazing area.

specular visible transmittance: the fraction of incident flux (lumens) that passes directly through a surface or medium

Add new sections as shown.

Table 8.4.1.2A Daylit Spaces

Classroom/training room
Conference/meeting/multipurpose room, except in convention centers
Lounge/breakroom
Enclosed office and open plan office
Library reading area
Patient rooms and physical therapy rooms within a healthcare facility

8.3.8 Glare Control. *View fenestration* for the *spaces* listed in Table 8.4.1.2A shall comply with this section.

View fenestration shall have one or more operable glare control devices capable of reducing the *specular visible transmittance* of the fenestration assembly to 3% or less. Such glare control devices shall allow an occupant or control system to change the device's position or light transmission level in order to address glare in the *space*. Operable glare control devices include movable interior window blinds, curtains, and shades; movable exterior louvers, screens, awnings, shades, and blinds; and dynamic glazing. Where fabric shades are used, the openness factor, also known as "direct-direct transmittance," shall be tested according to Standard EN14500.

Exceptions to 8.3.8:

1. For buildings located greater than 20 degrees latitude north or south of the equator, *view fenestration* oriented within 10 degrees of true north in northern hemisphere locations or within 10 degrees of true south in southern hemisphere location.
2. Where permanent interior or exterior obstructions, such as buildings, structures, overhangs and fins, have a *specular visible transmittance* of not greater than 3% and block a direct beam of sunlight from passing through the *view fenestration* at a point in the middle of the *view fenestration* both horizontally and vertically, at the peak solar altitude and four hours before and after the peak solar altitude on the summer solstice and the spring equinox as determined by sun-angle studies.
3. *Spaces* that have an *annual sunlight exposure* of not more than 93 fc (1000 lux) of direct sunlight illumination for more than 250 hours per year for less than 3% of the floor area.

8.3.9 Occupant Override. Occupants shall have the capability to temporarily override automatic methods of glare control for periods not exceeding two hours.

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Modify Section 11 as shown.

Reference	Title	Section
ASTM International **100 Barr Harbor Dr.** **West Conshohocken, PA 19428-2959, United States** **1-610-832-9585; www.astm.org**		
ASTM D1003-13~~11e1~~	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics	3.2, 8.4.1.1.3, 8.4.1.3
European Committee for Standardization (CEN) **Avenue Marnix 17—B-1000** **Brussels, Belgium** **+32 2 550 08 11; www.cen.eu**		
EN14500:2008	Blinds and shutters—Thermal and visual comfort—Test and calculation methods	8.3.8
Illuminating Engineering Society of North America 120 Wall Street, Floor 17 New York, New York 10005-4001 USA +1 212 248 5017, www.ies.org		
LM–83-12	Approved Method: IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE)	8.3.8

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FOREWORD

Addendum ax modifies the existing requirements on water features by focusing on those circumstances, malfunctioning automatic water refilling values, which are most likely to use excessive water.

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 ax to Standard 189.1-2014

Modify Section 6.4.3 as follows.

6.4.3 Special Water Features. Water use shall comply with the following:

a. Ornamental fountains and other ornamental water features shall be supplied either by *alternate on-site sources of water* or by municipally *reclaimed water* delivered by the local water utility acceptable to the *AHJ*. Fountains and other features equipped with automatic water refilling valves shall be equipped with (1) makeup water meters, (2) leak detection devices that shut off water flow if a leak of more than 1.0 gal/h (3.8 L/h) is detected, and (3) equipment to recirculate, filter, and treat all water for reuse within the system.

Exception to 6.4.3(a): Where *alternate on-site sources of water* or municipally *reclaimed water* are not available within 500 ft (150 m) of the *building project site*, *potable water* is allowed to be used for water features with less than 10,000 gallon (38,000 L) capacity.

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FOREWORD

Addendum ay adds requirements for dual plumbing in new buildings so that nonpotable waters (when available) can be used to flush toilets and urinals. This requirement is expected to add less than 10% to the plumbing costs in new construction, but it is usually cost prohibitive to replumb an existing building to accommodate alternate water sources. Toilets and urinals represent approximately 30% of water use in commercial buildings and offer a large opportunity to preserve potable water resources.

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 ay to Standard 189.1-2014

Add the following new sections as shown.

6.4.4 Dual Water Supply Plumbing

6.4.4.1 Where sufficient supply of *reclaimed water* or *alternate on-site sources of water* is available or planned to be available within 5 years of completed building construction, the water supply system within the building shall be installed to allow the supply of reclaimed or alternative water to all urinals and water closets.

Exceptions to 6.4.4.1:

1. Existing buildings under renovation, where the water supply to the urinals and water closets within the building is to remain intact, shall not be required to supply nonpotable water to urinals and water closets.
2. Urinals and water closets designed to operate without the use of water shall not be required to have alternate or reclaimed water supply to the fixture.

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FOREWORD

Addendum az adds exceptions to the calculation of the area of greenfield sites that must consist of biodiverse plantings other than turfgrass. Such plantings are required by the standard to realize the benefits of such plantings, relative to turfgrass, for pollinators, birds, and other wildlife, and to reduce the negative impacts from power tools, fertilizers, and herbicides. These exceptions recognize common functional purposes of turfgrass by excepting certain areas from the calculation of the area that must meet the requirement for biodiverse plantings.

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Addendum az to Standard 189.1-2014

Revise section 5.3.3.2 as shown.

5.3.3.2 Greenfield Sites. On a *greenfield site*:

a. **More than 20% existing native or adapted plants:** Where more than 20% of the area of the predevelopment *site* has existing *native plants* or *adapted plants*, a minimum of 20% of the area of *native plants* or *adapted plants* shall be retained.

b. **Less than 20% existing native or adapted plants:**

1. Where 20% or less of the area of the predevelopment *site* has existing *native plants* or *adapted plants*, a minimum of 20% of the *site* shall be developed or retained as vegetated area. Such vegetated areas include bioretention facilities, rain gardens, filter strips, grass swales, vegetated level spreaders, constructed *wetlands*, planters, and open space with plantings.

2. A minimum of 60% of ~~such~~ the vegetated area shall consist of *biodiverse planting* of *native plants* and/or *adapted plants* other than *turfgrass*.

Exception to 5.3.3.2(b)(2): The following areas shall not be included in the calculations: dedicated sports fields, driving ranges, burial grounds, vegetated pavers, and the minimum fire lanes required by the jurisdiction.

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FOREWORD

This addendum updates the broad reference in Section 8.3.1 to a wide range of requirements in both Standard 62.1 and Standard 170 to more narrowly cite the specific sections of those standards that are relevant to Standard 189.1. Also, since dwelling units were removed from the scope of ANSI/ASHRAE Standard 62.1 and added to the scope of Standard 62.2 in the 2016 versions of those standards, this addendum adds reference to ANSI/ASHRAE Standard 62.2-2016, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, for ventilation requirements in residential dwelling units.

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 ba to Standard 189.1-2014

Modify Section 8.3 as follows.

8.3.1 Indoor Air Quality. ~~The building~~ Buildings shall comply with the design requirements of Sections 4 through ~~6~~7 of ANSI/ASHRAE Standard 62.1, including applicable normative appendices, with the ~~following~~ modifications and additions indicated herein. Health care facilities shall comply with the design requirements of ANSI/ASHRAE/ASHE Standard 170, including applicable normative appendices, with the modifications and additions indicated herein. *Residential dwelling units* shall comply with the design requirements of Sections 4 through 8 of ANSI/ASHRAE Standard 62.2, with the modifications and additions indicated herein.

~~When a requirement is~~ Requirements provided in Sections 8.3.1.1 through 8.3.1.7 ~~below, this~~ supersede~~s~~ ~~the~~ such requirements in ANSI/ASHRAE Standard 62.1, ~~or~~ ANSI/ASHRAE/ASHE 170, and ANSI/ASHRAE 62.2. ~~whichever is applicable to the building.~~

8.3.1.1 Minimum Ventilation Rates. In health care facilities, the ventilation requirements of ANSI/ASHRAE/ASHE Standard 170 shall apply. In *residential dwelling units*, the *dwelling unit* ventilation rates and local exhaust airflow rates as required by ANSI/ASHRAE Standard 62.2 shall apply. ANSI/ASHRAE Standard 62.2, Section 4.1.2, shall not apply. In all other cases, ~~The Ventilation Rate Procedure of~~ ANSI/ASHRAE Standard 62.1, Sections 6.1.1 and 6.2, shall be used to determine minimum zone and intake outdoor airflow rates. ANSI/ASHRAE Standard 62.1, Sections 6.1.2 and 6.1.3, shall not apply. ~~In health care facilities, the *minimum outdoor airflow rates* required by ANSI/ASHRAE/ASHE Standard 170 shall apply.~~

Informative Note: ANSI/ASHRAE Standard 62.1, Sections 6.1.1 and 6.2, define the Ventilation Rate Procedure for determining ventilation rates.

Add the following reference to Section 11.

Reference	Title	Section
ASHRAE **1791 Tullie Circle NE** **Atlanta, GA 30329, United States** **1-404-636-8400; www.ashrae.org**		
ANSI/ASHRAE Standard 62.2-2016	Ventilation and Acceptable Indoor Air Quality in Residential Buildings	8.3.1, 8.3.1.1

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FOREWORD

Addendum bb adds a new requirement to Section 7 to display energy use in support of existing requirements in Section 10.3.2.1.3.2, "Track and Assess Energy Consumption." The goal of this new requirement is to provide information to assist in reducing building energy use. This requirement does not dictate the type of display or where it is to be located, thereby allowing the use of on-line displays.

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Addendum bb to Standard 189.1-2014

Modify Section 7.3.3.2 as follows.

7.3.3.2 Energy Consumption Data Collection and Display. All building measurement devices shall be configured to automatically communicate the energy data to the data acquisition system. ~~At a minimum,~~ Measurement devices shall provide daily data and shall record hourly energy profiles. Such hourly energy profiles shall be capable of being used to assess building performance at least monthly. The hourly energy profiles shall be displayed.

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FOREWORD

Standard 189.1 has criteria for carbon dioxide equivalent (CO_2e) emissions. Table 7.5.2B of the standard contains CO_2e emission rates for various energy sources, including electricity and natural gas, the two energy sources predominantly used in buildings. Addendum bd updates the values in this table.

The emissions associated with the burning of each fuel include not only carbon dioxide (CO_2) but also methane (CH_4) and nitrous oxide (N_2O). The CH_4 and N_2O emissions are smaller but more potent for a given unit of emissions. The CO_2e values published in this addendum include all three direct emissions. The rate of emissions for each fuel is taken from NREL/TP-550-38617, June 2007. Emissions of CH_4 and N_2O are then weighted by the 100-year cumulative forcing published in IPCC AR5.

In addition to direct emissions related to combustion, greenhouse gas emissions also result from the extraction of fossil fuels from the earth, their refinement, and their transportation to the point of combustion. The values in the table include these upstream emissions based on NREL/TP-550-38617, June 2007.

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 bd to Standard 189.1-2014

Modify Table 7.5.2B as shown.

Table 7.5.2B *CO_2e* Emission Factors

Building Project **Energy Source**	***CO_2e*, lb/~~k~~MWh ~~(kg/kMWh)~~**	***CO_2e*, kg/MWh**
Grid-delivered electricity and other fuels not specified in this table	~~1.387 (0.630)~~ 1348	612
LPG or propane	~~0.600 (0.272)~~ 601	273
Fuel oil (residual)	~~0.751 (0.341)~~ 685	311
Fuel oil (distillate)	~~0.706 (0.320)~~ 663	301
Coal	~~0.836 (0.379)~~ 820	372
Gasoline	~~0.689 (0.313)~~ 681	309
Natural gas	~~0.483 (0.219)~~ 509	231
District chilled water	~~0.332 (0.151)~~ 323	146
District steam	~~0.812 (0.368)~~ 855	388
District hot water	~~0.767 (0.348)~~ 807	366

Note: The values in this table represent national averages for the United States and include both direct and indirect emissions.

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FOREWORD

Addendum be requires that the products of combustion from any equipment or system that is permanently installed indoors be vented to the outside. While some building codes and standards permit the products of combustion to be discharged indoors, for instance from unvented gas-fired appliances, those documents consist of minimum requirements in contrast to the high-performance goals of ASHRAE Standard 189.1. For example, ASHRAE Standard 62.1 allows unvented appliances to be installed in accordance with manufacturer instructions. Also, while the International Fuel Gas Code (IFGC) 2012 *allows unvented room heaters, it prohibits them from being the sole source of comfort heating in a dwelling unit, limits them to an input rating of 40,000 Btu/h (11.7 kW) or less, and prohibits them in assembly, educational, and institutional occupancies. It also has a limitation for room heaters of 20 Btu/h per ft^3 (207 W/m^3) and requires an oxygen-depletion safety shut-off system.*

Addendum be proposes to go beyond the minimum requirements in Standard 62.1 and the cited codes. Combustion appliances emit water vapor, carbon dioxide, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates, and other pollutants, depending on the specific fuel source and appliance characteristics. When installed and operated properly, contaminants from unvented combustion appliances are not likely to exceed concentrations of concern listed in Appendix B2 of ASHRAE Standard 62.1, which is an informative list of indoor air contaminant guidelines in existence. (Standard 62.1 does not contain any requirements for contaminant concentration limits.) However, those contaminants do contribute to the overall indoor contaminant load in the building. In order for a building with unvented equipment to achieve air quality equal to that of a building without such equipment, additional ventilation and/or contaminant removal is required. Increasing indoor pollutant levels and/or the energy needed for increased ventilation to control these levels runs counter to the goal of Standard 189.1 to achieve higher levels of indoor environmental quality performance and enhanced energy efficiency.

The requirements proposed herein are similar to the 2015 IgCC (International Green Construction Code), which includes a prohibition of unvented appliances. This addendum applies to any appliances that emit byproducts of combustion, and contains several exceptions for ovens and ranges in residential spaces and for specific ANSI-certified heaters. The addendum also includes a requirement that both gas and electric cooking ranges in residential spaces use a vented range hood (not just general kitchen exhaust) to comply with ASHRAE Standard 62.2.

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Addendum be to Standard 189.1-2014

Modify Section 8.3.1 as follows.

8.3.1.5 Venting of Combustion Products

8.3.1.5.1 Vented Combustion. *Permanently installed* appliances shall have products of combustion vented to the outdoors.

Exceptions to 8.3.1.5.1:

1. Ovens and ranges in *residential* spaces.
2. Heaters certified to ANSI Z83.19/CSA 2.35, mounted greater than or equal to 10 ft (3 m) above the occupied floor.
3. Heaters certified to ANSI Z83.4/CAN 3.7.
4. Heaters certified to ANSI Z21.11.2, provided that the aggregate input rating of all such appliances does not exceed 1000 Btu/h per 1500 ft^3 (700 W per 100 m^3) of *space* volume.

8.3.1.5.2 Ranges in Residential Spaces. Gas and electric ranges in *residential* spaces shall comply with ASHRAE Standard 62.2, Section 5.1, using a range hood.

8.3.1.~~5~~6 Building Entrances. [. . .]

Add the following entries to Section 11.

Reference	Title	Section
ASHRAE **1791 Tullie Circle NE** **Atlanta, GA 30329, United States** **1-404-636-8400; www.ashrae.org**		
ANSI/ASHRAE Standard 62.2-2016	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings	8.3.1.5
American National Standards Institute (ANSI) **25 West 43rd Street** **New York, NY 20036, United States** **1-212-642-4900; www.ansi.org**		
ANSI Z83.19-2009/CSA 2.35-2009	Gas-fired high-intensity infrared heaters	8.3.1.5
ANSI Z83.4-2015/CSA 3.7-2015	Non-recirculating direct gas-fired industrial air heaters	8.3.1.5
ANSI Z21.11.2-2013	Gas-fired room heaters, volume II, unvented room heaters	8.3.1.5

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FOREWORD

Addendum bh revises the requirements in ASHRAE/USGBC/IES Standard 189.1, Table B-1, Electrical-Operated Unitary Air Conditioners and Condensing Units, to adjust the efficiency metrics for industry improvements for these products. The strategy used industry-established efficiency metrics rather than new metrics that would result in requirements to develop new products.

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 bh to Standard 189.1-2014

Delete current Table B-1 (I-P and SI) and replace with the new versions as shown.

TABLE B-1 (Supersedes Table 6.8.1-1 in ANSI/ASHRAE/IES Standard 90.1)
Electrical-Operated Unitary Air Conditioners and Condensing Units (I-P)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, air cooled	<65,000 Btu/h (one phase)	All	Split systems	15.0 SEER 12.5 EER	AHRI 210/240
			Single packaged	15.0 SEER 12.0 EER	
	<65,000 Btu/h (three phase)	All	Split systems	15.0 SEER 12.5 EER	
			Single packaged	15.0 SEER 12.0 EER	
Through-the-wall, air cooled	<30,000 Btu/h	All	Split systems	12.0 SEER	
			Single packaged	12.0 SEER	
Small duct, high velocity, air cooled	<65,000 Btu/h (one phase)	All	Split systems	12.0 SEER	
Small duct, high velocity, air cooled	<65,000 Btu/h (three phase)	All	Split systems	12.0 SEER	
Air conditioners, air cooled	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split systems and single package	12.2 EER 14.0 IEER	AHRI 340/360
		All other	Split systems and single package	12.0 EER 13.8 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split systems and single package	12.2 EER 13.2 IEER	
		All other	Split systems and single package	12.0 EER 13.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split systems and single package	10.8 EER 12.3 IEER	
		All other	Split systems and single package	10.6 EER 12.1 IEER	
	≥760,000 Btu/h	Electric resistance (or none)	Split systems and single package	10.4 EER 11.6 IEER	
		All other	Split systems and single package	10.2 EER 11.4 IEER	
Air conditioners, water cooled	<65,000 Btu/h	All	Split systems and single package	14.0 EER 15.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 15.3 IEER	AHRI 340/360
		All other	Split systems and single package	13.8 EER 15.1 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.8 IEER	
		All other	Split systems and single package	13.8 EER 14.6 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.8 IEER	
		All other	Split systems and single package	13.8 EER 14.6 IEER	
	≥760,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.8 IEER	
		All other	Split systems and single package	13.8 EER 14.6 IEER	

a. Section 11 contains a details on the referenced test procedures, including year and version of the test procedure.

TABLE B-1 (Supersedes Table 6.8.1-1 in ANSI/ASHRAE/IES Standard 90.1)
Electrical-Operated Unitary Air Conditioners and Condensing Units (I-P) *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, evaporatively cooled	<65,000 Btu/h	All	Split systems and single package	14.0 EER 15.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 15.3 IEER	AHRI 340/360
		All other	Split systems and single package	13.8 EER 15.1 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.8 IEER	
		All other	Split systems and single package	13.8 EER 14.6 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.8 IEER	
		All other	Split systems and single package	13.8 EER 14.6 IEER	
	≥760,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.8 IEER	
		All other	Split systems and single package	13.8 EER 14.6 IEER	
Condensing units, air cooled	≥135,000 Btu/h			Not applicable match with indoor coil	AHRI 365
Condensing, water or evaporatively cooled	≥135,000 Btu/h			Not applicable match with indoor coil	

a. Section 11 contains a details on the referenced test procedures, including year and version of the test procedure.

Table B-1 (Supersedes Table 6.8.1-1 in ANSI/ASHRAE/IES Standard 90.1) Electrical-Operated Unitary Air Conditioners and Condensing Units (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, air cooled	<19 kW (one phase)	All	Split systems	4.40 $SCOP_C$ 3.66 COP_C	AHRI 210/240
			Single packaged	4.40 $SCOP_C$ 3.52 COP_C	
	<19 kW (three phase)	All	Split systems	4.40 $SCOP_C$ 3.52 COP_C	
			Single packaged	4.10 $SCOP_C$ 3.40 COP_C	
Through-the-wall, air cooled	<9 kW	All	Split systems	3.52 $SCOP_C$	
			Single packaged	3.52 $SCOP_C$	
Small duct, high velocity, air cooled	<19 kW (one phase)	All	Split systems	3.52 $SCOP_C$	
	<19 kW (three phase)	All	Split systems	3.52 $SCOP_C$	
Air conditioners air cooled	≥19 kW and <40 kW	Electric resistance (or none)	Split systems and single package	3.58 COP_C 4.10 $ICOP_C$	ARI 340/360
		All other	Split systems and single package	3.52 COP_C 4.04 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	Split systems and single package	3.58 COP_C 3.87 $ICOP_C$	
		All other	Split systems and single package	3.52 COP_C 3.81 $ICOP_C$	
	≥70 kW and <223 kW	Electric resistance (or none)	Split systems and single package	3.17 COP_C 3.60 $ICOP_C$	
		All other	Split systems and single package	3.11 COP_C 3.55 $ICOP_C$	
	≥223 kW	Electric resistance (or none)	Split systems and single package	3.05 COP_C 3.40 $ICOP_C$	
		All other	Split systems and single package	2.99 COP_C 3.34 $ICOP_C$	
Air conditioners, water cooled	<19 kW	All	Split systems and single package	4.10 COP_C 4.48 $ICOP_C$	AHRI 210/240
	≥19 kW and <140 kW	Electric resistance (or none)	Split systems and single package	4.10 COP_C 4.48 $ICOP_C$	AHRI 340/360
		All other	Split systems and single package	4.04 COP_C 4.43 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	Split systems and single package	4.10 COP_C 4.34 $ICOP_C$	
		All other	Split systems and single package	4.04 COP_C 4.28 $ICOP_C$	
	≥70 kW and <223 kW	Electric resistance (or none)	Split systems and single package	4.10 COP_C 4.34 $ICOP_C$	
		All other	Split systems and single package	3.99 COP_C 4.28 $ICOP_C$	
	≥223 kW	Electric resistance (or none)	Split systems and single package	4.10 COP_C 4.34 $ICOP_C$	
		All other	Split systems and single package	4.04 COP_C 4.28 $ICOP_C$	

a. Section 11 contains a details on the referenced test procedures, including year and version of the test procedure.

Table B-1 (Supersedes Table 6.8.1-1 in ANSI/ASHRAE/IES Standard 90.1)
Electrical-Operated Unitary Air Conditioners and Condensing Units (SI) *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, evaporatively cooled	<19 kW	All	Split systems and single package	4.10 COP_C 4.48 $ICOP_C$	AHRI 210/240
	≥19 kW and <140 kW	Electric resistance (or none)	Split systems and single package	4.10 COP_C 4.48 $ICOP_C$	AHRI 340/360
		All other	Split systems and single package	4.04 COP_C 4.43 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	Split systems and single package	3.96 COP_C 4.19 $ICOP_C$	
		All other	Split systems and single package	3.90 COP_C 4.13 $ICOP_C$	
	≥70 kW and <223 kW	Electric resistance (or none)	Split systems and single package	3.96 COP_C 4.19 $ICOP_C$	
		All other	Split systems and single package	3.90 COP_C 4.13 $ICOP_C$	
	≥223 kW	Electric resistance (or none)	Split systems and single package	3.96 COP_C 4.19 $ICOP_C$	
		All other	Split systems and single package	3.90 COP_C 4.13 $ICOP_C$	
Condensing units, air cooled	≥40 kW			Not applicable match with indoor coil	AHRI 365
Condensing, water or evaporatively cooled	40 kW			Not applicable match with indoor coil	

a. Section 11 contains a details on the referenced test procedures, including year and version of the test procedure.

(This foreword 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.)

FOREWORD

Addendum bi modifies Table B-5, which defines the requirements for single packaged vertical air conditioners, single packaged vertical heat pumps, room air conditioners, and room air-conditioner heat pumps.

The efficiencies are revised as follows:

- *SVAC efficiencies are revised to match the efficiency levels for unitary products as defined in Tables 6.8.1-1 and 6.8.1-2 of ASHRAE/IES Standard 90.1-2016, which are greater than the efficiencies for SPVAC products as listed in ASHRAE/IES Standard 90.1-2016, Table 6.8.1-4.*
- *The room air-conditioner requirements are modified to match EnergyStar requirements as of October 26, 2015. These include the use of the new CEER metric, as defined in AHAM RAC-1-2015. EnergyStar also defines a requirement for connected equipment smart room air conditioners that are connected to utility programs and are allowed a different CEER value (5% lower because they may use a bit more energy in stand-by mode). This option requires compliance with the requirements of EnergyStar 4.0.*

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 bi to Standard 189.1-2014

Add the following new definition to Section 3 as shown.

combined energy efficiency ratio (CEER* [I-P]*) (CCOP$_C$* SI*): the combined energy efficiency is a ratio of the total cooling in one year divided by the total energy from active, stand-by, and OFF modes, as defined in AHAM Standard RAC-1; Btu/h/W (W/W).

Delete the current I-P Table B-5 and replace with the new Table B-5 as shown.

Table B-5 (Supersedes Table 6.8.1-4 in ANSI/ASHRAE/IES Standard 90.1)
Single Packaged Vertical Air Conditioners, Single Packaged Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements (I-P)

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency Base	Minimum Efficiency Connected[b]	Test Procedure[a]
SPVAC (cooling mode)	<65,000 Btu/h	95°F db/75°F wb *outdoor air*	14.0 SEER		AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	95°F db/75°F wb *outdoor air*	11.2 EER 12.9 IEER		AHRI 340/360
	≥135,000 Btu/h and <240,000 Btu/h	95°F db/75°F wb *outdoor air*	11.0 EER 12.4 IEER		
SPVHP (cooling mode)	<65,000 Btu/h	95°F db/75°F wb *outdoor air*	14.0 SEER		AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	95°F db/75°F wb *outdoor air*	11.0 EER 12.2 IEER		AHRI 340/360
	≥135,000 Btu/h and <240,000 Btu/h	95°F db/75°F wb *outdoor air*	10.6 EER 11.6 IEER		
SPVHP (heating mode)	<65,000 Btu/h	47°F db/43°F wb *outdoor air*	8.0 HSPF		AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	47°F db/43°F wb *outdoor air*	3.3 COP_H		AHRI 340/360
	≥135,000 Btu/h and <240,000 Btu/h	47°F db/43°F wb *outdoor air*	3.2 COP_H		
Room air conditioners, with louvered sides	<6000 Btu/h		12.1 *CEER*	11.5 *CEER*	ANSI/AHAM RAC-1
	≥6000 Btu/h and <8000 Btu/h		12.1 *CEER*	11.5 *CEER*	
	≥8000 Btu/h and <14,000 Btu/h		12.0 *CEER*	11.5 *CEER*	
	≥14000 Btu/h and <20,000 Btu/h		11.8 *CEER*	11.2 *CEER*	
	≥20000 Btu/h and <28,000 Btu/h		10.3 *CEER*	9.8 *CEER*	
	≥28,000 Btu/h		9.9 *CEER*	9.4 *CEER*	
Room air conditioners, without louvered sides	<6000 Btu/h		11.0 *CEER*	10.5 *CEER*	
	≥6000 Btu/h and <8,000 Btu/h		11.0 *CEER*	10.5 *CEER*	
	≥8000 Btu/h and <11,000 Btu/h		10.6 *CEER*	10.1 *CEER*	
	≥11,000 Btu/h and <14,000 Btu/h		10.5 *CEER*	10.0 *CEER*	
	≥14,000 Btu/h and <20,000 Btu/h		10.2 *CEER*	9.7 *CEER*	
	≥20,000 Btu/h		10.3 *CEER*	9.8 *CEER*	
Room air conditioner heat pump, with louvered sides	<20,000 Btu/h		10.8 *CEER*	10.3 *CEER*	
	≥20,000 Btu/h		10.2 *CEER*	9.7 *CEER*	
Room air conditioner heat pump, without louvered sides	<14,000 Btu/h		10.2 *CEER*	9.7 *CEER*	
	≥14,000 Btu/h		9.6 *CEER*	9.1 *CEER*	
Room air conditioner, casement only	All capacities		10.5 *CEER*	10.0 *CEER*	
Room air conditioner, casement-slider	All capacities		11.4 *CEER*	10.8 *CEER*	

a. Section 11 contains details for the referenced test procedure, including the referenced year version of the test procedure.
b. Connected room air conditioners that are connected to utility programs are allowed a lower *CEER* value but must be in compliance with and certified per EnergyStar version 4.0 requirements for connected equipment.

Delete the current SI Table B-5 and replace with the new Table B-5 as shown.

Table B-5 (Supersedes Table 6.8.1-4 in ANSI/ASHRAE/IES Standard 90.1)
Single Packaged Vertical Air Conditioners, Single Packaged Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements (SI)

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency Base	Minimum Efficiency Connected[b]	Test Procedure[a]
SPVAC (cooling mode)	<19 kW	35°C db/23.9°C wb *outdoor air*	4.10 $SCOP_C$		AHRI 210/240
	≥19 kW and <40 kW	35°C db/23.9°C wb *outdoor air*	3.28 COP_C 3.78 $ICOP_C$		AHRI 340/360
	≥40 kW and <70 kW	35°C db/23.9°C wb *outdoor air*	3.22 COP_C 3.63 $ICOP_C$		
SPVHP (cooling mode)	<19 kW	35°C db/23.9°C wb *outdoor air*	4.10 $SCOP_C$		AHRI 210/240
	≥19 kW and <40 kW	35°C db/23.9°C wb *outdoor air*	3.22 COP_C 3.58 $ICOP_C$		AHRI 340/360
	≥40 kW and <70 kW	35°C db/23.9°C wb *outdoor air*	3.11 COP_C 3.40 $ICOP_C$		
SPVHP (heating mode)	<19 kW	8.3°C db/6.1°C wb *outdoor air*	2.34 $SCOP_H$		AHRI 210/240
	≥19 kW and <40 kW	8.3°C db/6.1°C wb *outdoor air*	3.30 COP_H		AHRI 340/360
	≥40 kW and <70 kW	8.3°C db/6.1°C wb *outdoor air*	3.2 COP_H		
Room air conditioners, with louvered sides	<1.8 kW		3.55 $CCOP_C$	3.37 $CCOP_C$	ANSI/AHAM RAC-1
	≥1.8 kW and <2.3 kW		3.55 $CCOP_C$	3.37 $CCOP_C$	
	≥2.3 kW and <4.1 kW		3.52 $CCOP_C$	3.37 $CCOP_C$	
	≥4.1 kW and <5.9 kW		3.46 $CCOP_C$	3.28 $CCOP_C$	
	≥5.9 kW and <8.2 kW		3.02 $CCOP_C$	2.87 $CCOP_C$	
	≥8.2 kW		2.90 $CCOP_C$	2.75 $CCOP_C$	
Room air conditioners, without louvered sides	<1.8 kW		3.22 $CCOP_C$	3.08 $CCOP_C$	
	≥1.8 kW and <2.3 kW		3.22 $CCOP_C$	3.08 $CCOP_C$	
	≥2.3 kW and <3.2 kW		3.11 $CCOP_C$	2.96 $CCOP_C$	
	≥3.2 kW and <4.1 kW		3.08 $CCOP_C$	2.93 $CCOP_C$	
	≥4.1 kW and <5.9 kW		2.99 $CCOP_C$	2.84 $CCOP_C$	
	≥5.9 kW		3.02 $CCOP_C$	2.87 $CCOP_C$	
Room air conditioner heat pump, with louvered sides	<5.9 kW		3.17 $CCOP_C$	3.02 $CCOP_C$	
	≥5.9 kW		2.99 $CCOP_C$	2.84 $CCOP_C$	
Room air conditioner heat pump, without louvered sides	<4.1 kW		2.99 $CCOP_C$	2.84 $CCOP_C$	
	≥4.1 kW		2.81 $CCOP_C$	2.67 $CCOP_C$	
Room air conditioner, casement only	All capacities		3.08 $CCOP_C$	2.93 $CCOP_C$	
Room air conditioner, casement-slider	All capacities		3.34 $CCOP_C$	3.17 $CCOP_C$	

a. Section 11 contains details for the referenced test procedure, including the referenced year version of the test procedure.
b. Connected room air conditioners that are connected to utility programs are allowed a lower *CEER* value but must be in compliance with and certified per EnergyStar version 4.0 requirements for connected equipment.

(This foreword 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.)

FOREWORD

Addendum bj updates requirements in ASHRAE/USGBC/IES Standard 189.1, Table B-6, "Warm Air Furnace and Combination Warm Air Furnaces/Air-Conditioning Units, Warm Air Duct Furnaces, and Unit Heaters."

The addendum updates residential nonweatherized gas furnace efficiencies from 78% AFUE to 81% AFUE, with an effective date of January 1, 2015, to bring it into alignment with DOE rules. This is the only efficiency change made.

Additionally, the addendum updates footnotes and format to bring Standard 189.1 into alignment with ASHRAE/IES Standard 90.1-2016.

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 bj to Standard 189.1-2014

Delete the existing I-P Table B-6 and replace it with the following new table.

Table B-6 (Supersedes Table 6.8.1-5 in ANSI/ASHRAE/IES Standard 90.1)
Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters (I-P)—Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Warm-air furnace, gas fired (weatherized)	<225,000 Btu/h	Maximum capacity[c]	81% AFUE[b]	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
	≥225,000 Btu/h		80% E_t[d]	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, gas fired (nonweatherized)	<225,000 Btu/h	Maximum capacity[c]	90% AFUE or 92% E_t[b,d]	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
	≥225,000 Btu/h		92% E_t[d]	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, oil fired (weatherized)	<225,000 Btu/h	Maximum capacity[c]	78% AFUE[b,d]	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
	>225,000 Btu/h		81% E_t[d]	Section 42, Combustion, UL 727
Warm-air furnaces, oil fired (nonweatherized)	<225,000 Btu/h	Maximum capacity[c]	85% AFUE or 87% E_t[b,d]	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
	≥225,000 Btu/h		87% E_t[d]	Section 42, Combustion, UL 727
Warm-air duct furnace, gas fired (weatherized)	All capacities	Maximum capacity[c]	80% E_c[e]	Section 2.10, Efficiency, ANSI Z83.8
Warm-air duct furnace, gas fired (nonweatherized)	All capacities	Maximum capacity[c]	90% E_c[e]	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heater, gas fired (nonweatherized)	All capacities	Maximum capacity[c]	80% E_c[e,f]	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heater, oil fired (weatherized)	All capacities	Maximum capacity[c]	90% E_c[e,f]	Section 40, Combustion, UL 731

a. Section 11 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Combination units not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (three-phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating.
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_c = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.
f. As of August 8, 2008, according to the Energy Policy Act of 2005, units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

Delete the existing SI Table B-6 and replace it with the following new table.

Table B-6 (Supersedes Table 6.8.1-5 in ANSI/ASHRAE/IES Standard 90.1)
Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters (SI)—Minimum Efficiency Requirements

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Warm-air furnace, gas fired (weatherized)	<65.9 kW	Maximum capacity[c]	78% AFUE or 80% E_t[b,d]	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
	≥65.9 kW		80% E_t[d]	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, gas fired (nonweatherized)	<65.9 kW	Maximum capacity[c]	90% AFUE or 92% E_t[b,d]	DOE 10 CFR Part 430 or Section 2.39, Thermal Efficiency, ANSI Z21.47
	≥65.9 kW		92% E_t[d]	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-air furnace, oil fired (weatherized)	<65.9 kW	Maximum capacity[c]	78% AFUE or 80% E_t[b,d]	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
	>65.9 kW		81% E_t[d]	Section 42, Combustion, UL 727
Warm-air furnace, oil fired (nonweatherized	<65.9 kW	Maximum capacity[c]	85% AFUE or 87% E_t[b,d]	DOE 10 CFR Part 430 or Section 42, Combustion, UL 727
	≥65.9 kW		87% E_t[d]	Section 42, Combustion, UL 727
Warm-air duct furnaces, gas fired (weatherized)	All capacities	Maximum capacity[c]	80% E_c[e]	Section 2.10, Efficiency, ANSI Z83.8
Warm-air duct furnaces, gas fired (nonweatherized)	All capacities	Maximum capacity[c]	90% E_c[e]	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, gas fired (nonweatherized)	All capacities	Maximum capacity[c]	80% E_c[e,f]	Section 2.10, Efficiency, ANSI Z83.8
Warm-air unit heaters, oil fired (weatherized)	All capacities	Maximum capacity[c]	90% E_c[e,f]	Section 40, Combustion, UL 731

a. Section 11 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Combination units not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (three-phase power or cooling capacity greater than or equal to 19 kW) may comply with either rating.
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_c = combustion *efficiency* (100% less flue losses). See test procedure for detailed discussion.
f. As of August 8, 2008, according to the Energy Policy Act of 2005, units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic flue damper*.

(This foreword 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.)

FOREWORD

Addendum bk modifies Tables B-12, Electrically Operated Variable-Refrigerant-Flow (VRF) Air Conditioners Minimum Efficiency, and table B-13, Electrically Operated Variable-Refrigerant-Flow (VRF) Heat-Pump Air Conditioners Minimum Efficiency, to reflect changes made to ASHRAE/IES Standard 90.1 VRF efficiency requirements and to the CEE higher-tier specification for VRF products.

As ASHRAE/USGBC/IES Standard 189.1 is a higher-tier standard, the committee's approach has been to use previously defined higher-tier efficiency requirements rather than arbitrary higher efficiency levels that currently do not exist in the industry. Therefore, for this change, a combination of CEE requirements are used where higher-level requirements are previously defined, and, where CEE requirements do not exist, the requirements of Standard 90.1-2016 are used.

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 bk to Standard 189.1-2014

Modify Tables B-12 and B-13 as shown for I-P and SI units.

Table B-12 (Supersedes Table 6.8.1-9 in ANSI/ASHRAE/IES Standard 90.1) Electrically Operated Variable-Refrigerant-Flow Air Conditioners Minimum Efficiency (I-P)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF air conditioners, air cooled	<65,000 Btu/h	All	VRF multisplit system	~~14.0~~ 15.0 SEER ~~12.0~~ 12.5 EER	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	VRF multisplit system	11.7 EER 14.9 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	11.7 EER 14.4 IEER	
	≥240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	10.5 EER 13.0 IEER	

a. Section 11 contains details for the referenced test procedure, including year version of the test procedure.

Table B-12 (Supersedes Table 6.8.1-9 in ANSI/ASHRAE/IES Standard 90.1) Electrically Operated Variable-Refrigerant-Flow Air Conditioners Minimum Efficiency (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF air conditioners, air cooled	<19 kW	All	VRF multisplit system	~~4.10~~ 4.40 $SCOP_C$ ~~3.52~~ 3.36 COP_C	AHRI 1230
	≥19 kW and <40 kW	Electric resistance (or none)	VRF multisplit system	3.43 COP_C 4.37 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	VRF multisplit system	3.43 COP_C 4.22 $ICOP_C$	
	≥70 kW	Electric resistance (or none)	VRF multisplit system	3.08 COP_C 3.81 $ICOP_C$	

a. Section 11 contains details for the referenced test procedure, including year version of the test procedure.

Table B-13 (Supersedes Table 6.8.1-10 in ANSI/ASHRAE/IES Standard 90.1)
Electrically Operated Variable-Refrigerant-Flow Heat Pump Air Conditioners Minimum Efficiency (I-P)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF air cooled, (cooling mode)	<65,000 Btu/h	All	VRF multisplit system	~~14.0~~ 15.0 SEER ~~12.0~~ 12.5 EER	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	VRF multisplit system	11.3 EER ~~14.2~~ 14.6 IEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	VRF multisplit system with heat recovery	11.1 EER ~~14.0~~ 14.4 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	10.9 EER ~~13.7~~ 13.9 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	VRF multisplit system with heat recovery	10.7 EER ~~13.5~~ 13.7 IEER	
	≥240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	10.3 EER ~~12.5~~ 12.7 IEER	
	≥240,000 Btu/h	Electric resistance (or none)	VRF multisplit system with heat recovery	10.1 EER ~~12.3~~ 12.5 IEER	
VRF water source (cooling mode)	<65,000 Btu/h	All	VRF multisplit system 86°F entering water	14.0 EER 16.0 IEER	AHRI 1230
	<65,000 Btu/h	All	VRF multisplit system with heat recovery 86°F entering water	13.8 EER 15.8 IEER	
	≥65,000 Btu/h and <135,000 Btu/h	All	VRF multisplit system 86°F entering water	14.0 EER 16.0 IEER	
	≥65,000 Btu/h and <135,000 Btu/h	All	VRF multisplit system with heat recovery 86°F entering water	13.8 EER 15.8 IEER	
	≥135,000 Btu/h	All	VRF multisplit system 86°F entering water	11.6 EER 14.0 IEER	
	≥135,000 Btu/h	All	VRF multisplit system with heat recovery 86°F entering water	11.2 EER 13.8 IEER	
VRF groundwater source (cooling mode)	<135,000 Btu/h	All	VRF multisplit system 59°F entering water full load	16.2 EER	AHRI 1230
	<135,000 Btu/h	All	VRF multisplit system with heat recovery 59°F entering water	16.0 EER	
	≥135,000 Btu/h	All	VRF multisplit system 59°F entering water	13.8 EER	
	≥135,000 Btu/h	All	VRF multisplit system with heat recovery 59°F entering water	13.6 EER	
VRF ground source (cooling mode)	<135,000 Btu/h	All	VRF multisplit system 77°F entering water	13.4 EER	AHRI 1230
	<135,000 Btu/h	All	VRF multisplit system with heat recovery	13.2 EER	
	≥135,000 Btu/h	All	VRF multisplit system 77°F entering water	11.0 EER	
	≥135,000 Btu/h	All	VRF multisplit system with heat recovery 77°F entering water	10.8 EER	

a. Section 11 contains details for the referenced test procedure, including year version of the test procedure.

Table B-13 (Supersedes Table 6.8.1-10 in ANSI/ASHRAE/IES Standard 90.1)
Electrically Operated Variable-Refrigerant-Flow Heat Pump Air Conditioners Minimum Efficiency (I-P) *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF air cooled (heating mode)	<65,000 Btu/h (cooling capacity)	—	VRF multisplit system	8.5 HSPF	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)	—	VRF multisplit system 47°F db/43°F wb outdoor air	3.40 COP_H	
			17°F db/15°F wb outdoor air	2.40 COP_H	
	≥135,000 Btu/h (cooling capacity)	—	VRF multisplit system 47°F db/43°F wb outdoor air	3.20 COP_H	
			17°F db/15°F wb outdoor air	2.10 COP_H	
VRF water source (heating mode)	<135,000 Btu/h (cooling capacity)	—	VRF multisplit system 68°F entering water	4.60 COP_H	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	—	VRF multisplit system 68°F entering water	4.20 COP_H	
VRF groundwater source (heating mode)	<135,000 Btu/h (cooling capacity)	—	VRF multisplit system 50°F entering water	3.60 COP_H	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	—	VRF multisplit system 50°F entering water	3.30 COP_H	
VRF ground source (heating mode)	<135,000 Btu/h (cooling capacity)	—	VRF multisplit system 32°F entering fluid	3.10 COP_H	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	—	VRF multisplit system 32°F entering fluid	2.80 COP_H	

a. Section 11 contains details for the referenced test procedure, including year version of the test procedure.

Table B-13 (Supersedes Table 6.8.1-10 in ANSI/ASHRAE/IES Standard 90.1)
Electrically Operated Variable-Refrigerant-Flow Heat Pump Air Conditioners Minimum Efficiency (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF air cooled (cooling mode)	<19 kW	All	VRF multisplit system	~~4.10~~ 4.40 $SCOP_C$ ~~3.52~~ 3.66 COP_C	AHRI 1230
	≥19 kW and <40 kW	Electric resistance (or none)	VRF multisplit system	3.31 COP_C ~~4.16~~ 4.28 $ICOP_C$	
	≥19 kW and <40 kW	Electric resistance (or none)	VRF multisplit system with heat recovery	3.25 COP_C ~~4.10~~ 4.22 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	VRF multisplit system	3.19 COP_C ~~4.02~~ 4.07 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	VRF multisplit system with heat recovery	3.14 COP_C ~~3.96~~ 4.02 $ICOP_C$	
	≥70 kW	Electric resistance (or none)	VRF multisplit system°	3.02 COP_C ~~3.66~~ 4.02 $ICOP_C$	
	≥70 kW	Electric resistance (or none)	VRF multisplit system with heat recovery	2.96 COP_C ~~3.06~~ 3.66 $ICOP_C$	
VRF water source (cooling mode)	<19 kW	All	VRF multisplit systems 86°F entering water	4.10 COP_C 4.69 $ICOP_C$	AHRI 1230
	<19 kW	All	VRF multisplit systems with heat recovery 86°F entering water	4.04 COP_C 4.63 $ICOP_C$	
	≥19 kW and <40 kW	All	VRF multisplit system 86°F entering water	4.10 COP_C 4.69 $ICOP_C$	
	≥19 kW and <40 kW	All	VRF multisplit system with heat recovery 86°F entering water	4.04 COP_C 4.63 $ICOP_C$	
	≥40 kW	All	VRF multisplit system 86°F entering water	3.40 COP_C 4.10 $ICOP_C$	
	≥40 kW	All	VRF multisplit system with heat recovery 86°F entering water	3.28 COP_C 4.04 $ICOP_C$	
VRF groundwater source (cooling mode)	<40 kW	All	VRF multisplit system 59°F entering water full load	4.75 COP_C	AHRI 1230
	<40 kW	All	VRF multisplit system with heat recovery 59°F entering water full load	4.69 COP_C	
	≥40 kW	All	VRF multisplit system 59°F entering water	4.04 COP_C	
	≥40 kW	All	VRF multisplit system with heat recovery 59°F entering	3.99 COP_C	
VRF ground source (cooling mode)	<40 kW	All	VRF multisplit system 77°F entering water	3.93 COP_C	AHRI 1230
	<40 kW	All	VRF multisplit system with heat recovery 77°F entering water	3.87 COP_C	
	≥40 kW	All	VRF multisplit system 77°F entering water	3.22 COP_C	
	≥40 kW	All	VRF multisplit system with heat recovery 77°F entering water	3.17 COP_C	

a. Section 11 contains details for the referenced test procedure, including year version of the test procedure.

Table B-13 (Supersedes Table 6.8.1-10 in ANSI/ASHRAE/IES Standard 90.1)
Electrically Operated Variable-Refrigerant-Flow Heat Pump Air Conditioners Minimum Efficiency (SI) *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
VRF air cooled (heating mode)	<19 kW (cooling capacity)	—	VRF multisplit system	2.49 $SCOP_H$	AHRI 1230
	≥19 kW and <40 kW (cooling capacity)	—	VRF multisplit system 47°F db/43°F wb outdoor air	3.40 COP_H	
			17°F db/15°F wb outdoor air	2.40 COP_H	
	≥40 kW (cooling capacity)	—	VRF multisplit system 47°F db/43°F wb outdoor air	3.20 COP_H	
			17°F db/15°F wb outdoor air	2.10 COP_H	
VRF water source (heating mode)	<40 kW (cooling capacity)	—	VRF multisplit system 68°F entering water	4.60 COP_H	AHRI 1230
	≥40 kW (cooling capacity)	—	VRF multisplit system 68°F entering water	4.20 COP_H	
VRF groundwater source (heating mode)	<40 kW (cooling capacity)	—	VRF multisplit system 50°F entering water	3.60 COP_H	AHRI 1230
	≥40 kW (cooling capacity)	—	VRF multisplit system 50°F entering water	3.30 COP_H	
VRF ground source (heating mode)	<40 kW (cooling capacity)	—	VRF multisplit system 32°F entering fluid	3.10 COP_H	AHRI 1230
	≥40 kW (cooling capacity)	—	VRF multisplit system 32°F entering fluid	2.80 COP_H	

a. Section 11 contains details for the referenced test procedure, including year version of the test procedure.

(This foreword 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.)

FOREWORD

Addendum bl updates the efficiency requirements in Table B-9 to reflect changes in efficiency metrics. The strategy was to use industry-established efficiency metrics rather than new metrics that would result in requirements to develop new products.

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 bl to Standard 189.1-2014

Delete Table B-9 (I-P and SI) and replace with the revised version as shown.

Table B-9 (Supersedes Table 7.8 in ANSI/ASHRAE/IES Standard 90.1)
Performance Requirements for Service Water Heating Equipment (I-P)

Equipment Type	Size Category (Input)	Rated Storage Volume and Input Rating (if applicable)	Draw Pattern	Performance Required[a]	Test Procedure[b]
Electric table-top water heaters[c]	≤12 kW	≥20 gal and ≤120 gal	Very small	UEF ≥ 0.6323-0.0058V	DOE 10 CFR Part 430
			Low	UEF ≥ 0.9188-0.0031V	
			Medium	UEF ≥ 0.9577-0.0023V	
			High	UEF ≥ 0.9844-0.0016V	
Electric resistance storage water heaters		≥20 gal and ≤55 gal	Very small	UEF ≥ 0.8808-0.0008V	DOE 10 CFR Part 430
			Low	UEF ≥ 0.9254-0.0003V	
			Medium	UEF ≥ 0.9307-0.0002V	
			High	UEF ≥ 0.9349-0.0001V	
		>55 gal		Must use heat-pump water heater	
Electric resistance grid-enabled water heaters		>75 gal	Very small	UEF ≥ 1.0136-0.0028V	DOE 10 CFR Part 430
			Low	UEF ≥ 0.09984-0.0014V	
			Medium	UEF ≥ 0.9853-0.0010V	
			High	UEF ≥ 0.9720-0.0007V	
Heat-pump water heaters		≤55 gal		EF ≥ 2.00, FHR ≥ 50 gal	DOE 10 CFR Part 430
		>55 gal		EF ≥ 2.20, FHR ≥ 50 gal	
Gas-fired storage water heaters	≤75,000 Btu/h	≤55 gal		EF ≥ 0.67, FHR ≥ 67 gal	DOE 10 CFR Part 430
		>55 gal		EF ≥ 0.77, FHR ≥ 67 gal	
	>75,000 Btu/h	≤140 gal		E_t ≥ 0.94 or EF ≥ 0.93 and SL ≤ 0.84 × (Q/800 + 110√V), Btu/h	ANSI Z21.10.3
Gas instantaneous water heaters	>50,000 Btu/h and <200,000 Btu/h[d]	≥4000 (Btu/h)/gal and <2 gal		EF ≥ 0.90 and GPM ≥ 2.5 over a 77°F rise	DOE 10 CFR Part 430
	≥75,000 Btu/h[c]	≤140 gal and ≥4000 (Btu/h)/gal		E_t ≥ 0.94 or EF ≥ 0.93 SL = 0.84 × (Q/800 + 110√V), Btu/h	ANSI Z21.10.3
Oil storage water heaters	≤105,000 Btu/h	≤50 gal	Very small	EF = 0.2509-0.0012V	DOE 10 CFR Part 430
			Low	EF = 0.5330-0.0016V	
			Medium	EF = 0.6078-0.0016V	
			High	EF = 0.6815-0.0014V	
	>105,000 Btu/h	<4000 (Btu/h)/gal		E_t ≥ 80% and SL ≤ (Q/800 + 110√V), Btu/h	ANSI Z21.10.3
Oil instantaneous water heaters	≤210,000 Btu/h	≤50 gal		EF ≥ 0.59-0.0019V	DOE 10 CFR Part 430
	>210,000 Btu/h	≥4000 (Btu/h)/gal and <10 gal		E_t ≥ 80%	ANSI Z21.10.3
	>210,000 Btu/h	≥4000 (Btu/h)/gal and ≥10 gal		E_t ≥ 78% and SL ≤ (Q/800 +110√V), Btu/h	
Solar water heater		Electric backup		SEF ≥ 1.8	ANSI Z21.10.3
		Gas backup		SEF ≥ 1.2	
Hot-water supply boilers, gas and oil	>300,000 Btu/h and ≤12,500,000 Btu/h	≥4000 (Btu/h)/gal and <10 gal		E_t ≥ 80%	ANSI Z21.10.3

a. Energy factor (EF) and thermal efficiency (E_t) are minimum requirements, while standby loss (SL) is maximum Btu/h based on a 70°F temperature difference between stored water and ambient requirements. In the EF equation, V is the rated volume in gallons. In the SL equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h.
b. Section 11 contains details on the referenced test procedures, including the year/version of the referenced test procedure.
c. Section G.1 is titled "Test Method for Measuring Thermal Efficiency," and Section G.2 is titled "Test Method for Measuring Standby Loss."
d. UEF is the Uniform Energy Factor and is a dimensionless number that is calculated per DOE 10 CFR part 430 test procedures.

Table B-9 (Supersedes Table 7.8 in ANSI/ASHRAE/IES Standard 90.1)
Performance Requirements for Service Water Heating Equipment (I-P) ***(Continued)***

Equipment Type	Size Category (Input)	Rated Storage Volume and Input Rating (if applicable)	Draw Pattern	Performance Required[a]	Test Procedure[b]
Hot-water supply boilers, gas		≥4000 (Btu/h)/gal and ≥10 gal		$E_t \geq 80\%$ SL ≤ (Q/800 + 110$\sqrt{V}$), Btu/h	ANSI Z21.10.3
Hot-water supply boilers, oil		≥4000 (Btu/h)/gal and ≥10 gal		$E_t \geq 78\%$ SL ≤ (Q/800 + 110$\sqrt{V}$), Btu/h	
Pool heaters, gas	All sizes			$E_t \geq 82\%$	ASHRAE 146
Pool heaters, oil	All sizes			$E_t \geq 78\%$	ASHRAE 146
Heat-pump pool heaters	All sizes	50°F db 44.2°F wb outdoor air 80.0°F entering water		≥4.0 COP	AHRI 1180
Unfired storage tanks	All sizes			≥R-12.5	None

a. Energy factor (EF) and thermal efficiency (E_t) are minimum requirements, while standby loss (SL) is maximum Btu/h based on a 70°F temperature difference between stored water and ambient requirements. In the EF equation, V is the rated volume in gallons. In the SL equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h.
b. Section 11 contains details on the referenced test procedures, including the year/version of the referenced test procedure.
c. Section G.1 is titled "Test Method for Measuring Thermal Efficiency," and Section G.2 is titled "Test Method for Measuring Standby Loss."
d. UEF is the Uniform Energy Factor and is a dimensionless number that is calculated per DOE 10 CFR part 430 test procedures.

Table B-9 (Supersedes Table 7.8 in ANSI/ASHRAE/IES Standard 90.1) Performance Requirements for Service Water Heating Equipment (SI)

Equipment Type	Size Category (Input)	Rated Storage Volume and Input Rating (if applicable)	Draw Pattern	Performance Required[a]	Test Procedure[b]
Electric table-top water heaters[c]	≤12 kW	≥75.7 L and ≤454 L	Very small	UEF ≥ 0.6323-0.0015V	DOE 10 CFR Part 430
			Low	UEF ≥ 0.9188-0.00082V	
			Medium	UEF ≥ 0.9577-0.00061V	
			High	UEF ≥ 0.9844-0.00042V	
Electric resistance storage water heaters		≥75.7 L and ≤208 L	Very small	UEF ≥ 0.8808-0.00021V	DOE 10 CFR Part 430
			Low	UEF ≥ 0.9254-0.000079V	
			Medium	UEF ≥ 0.9307-0.000053V	
			High	UEF ≥ 0.9349-0.000026V	
		>208 L		Must use heat-pump water heater	
Electric resistance grid-enabled water heaters		≥284 L	Very small	UEF ≥ 1.0136-0.00074V	DOE 10 CFR Part 430
			Low	UEF ≥ 0.09984-0.00037V	
			Medium	UEF ≥ 0.9853-0.00026V	
			High	UEF ≥ 0.9720-0.00018V	
Heat-pump water heaters		≤208 L		EF ≥ 2.00, FHR ≥ 190 L	DOE 10 CFR Part 430
		>208 L		EF ≥ 2.20, FHR ≥ 190 L	
Gas-fired storage water heaters	≤22.0 kW	≤208 L		EF ≥ 0.67, FHR ≥ 250 L	DOE 10 CFR Part 430
		>208 L		EF ≥ 0.77, FHR ≥ 250 L	
	>22.0 kWh	≤530 L		E_t ≥ 0.94 or EF ≥ 0.93 and SL ≤ 0.84 × (Q/234 + 56.5√V), W	ANSI Z21.10.3
Gas instantaneous water heaters	>14.6 kW and ≤58.6 kW	≥309.7W/L and <7.6 L		EF ≥ 0.90 and GPM ≥ 2.5 over a 25°C rise	DOE 10 CFR Part 430
	≥22.0 kW	≤530 L and ≥309.7W/L		E_t ≥ 0.94 or EF ≥ 0.93 SL = 0.84 × (Q/234 + 56.5√V), W	ANSI Z21.10.3
Oil storage water heaters	≤30.7 kW	≤190 L	Very small	EF = 0.2509-0.00032V	DOE 10 CFR Part 430
			Low	EF = 0.5330-0.00042V	
			Medium	EF = 0.6078-0.00042V	
			High	EF = 0.6815-0.0037V	
	>30.7 kW	<309.7 W/L		E_t ≥ 80% and SL ≤ (Q/234 + 56.5√V), W	ANSI Z21.10.3
Oil instantaneous water heaters	≤61.5 kW	≤190 L		EF ≥ 0.59-0.00050V	DOE 10 CFR Part 430
	>61.5 kW	≥309.7 W/L and <38 L		E_t ≥ 80%	ANSI Z21.10.3
	>61.5 kW	≥309.7W/L and ≥30 L		E_t ≥ 78% and SL ≤ (Q/234 + 56.5√V), W	
Solar water heater		Electric backup		SEF ≥ 1.8	ANSI Z21.10.3
		Gas backup		SEF ≥ 1.2	

a. Energy factor (EF) and thermal efficiency (E_t) are minimum requirements, while standby loss (SL) is maximum W based on a 21°C temperature difference between stored water and ambient requirements. In the EF equation, V is the rated volume in litres. In the SL equation, V is the rated volume in litres and Q is the nameplate input rate in kW.

b. Section 11 contains details on the referenced test procedures, including the year/version of the referenced test procedure.

c. Section G.1 is titled "Test Method for Measuring Thermal Efficiency," and Section G.2 is titled "Test Method for Measuring Standby Loss."

d. UEF is the Uniform Energy Factor and is a dimensionless number that is calculated per DOE 10 CFR part 430 test procedures.

Table B-9 (Supersedes Table 7.8 in ANSI/ASHRAE/IES Standard 90.1)
Performance Requirements for Service Water Heating Equipment (SI) *(Continued)*

Equipment Type	Size Category (Input)	Rated Storage Volume and Input Rating (if applicable)	Draw Pattern	Performance Required[a]	Test Procedure[b]
Hot-water supply boilers, gas and oil	>88 kW and ≤3660 kW	≥309.7 W/L and <30 L		$E_t \geq 80\%$	ANSI Z21.10.3
Hot-water supply boilers, gas		≥309.7 W/L and ≥30 L		$E_t \geq 80\%$ $SL \leq (Q/234 + 56.5\sqrt{V})$, W	ANSI Z21.10.3
Hot-water supply boilers, oil		≥309.7 W/L and ≥30 L		$E_t \geq 78\%$ $SL \leq (Q/234 + 56.5\sqrt{V})$, W	ANSI Z21.10.3
Pool heaters, gas	All sizes			$E_t \geq 82\%$	ASHRAE 146
Pool heaters, oil	All sizes			$E_t \geq 78\%$	ASHRAE 146
Heat-pump pool heaters	All sizes	10°C db 6.8°C wb outdoor air 26.7°C entering water		≥4.0 COP	ASHRAE 146
Unfired storage tanks	All sizes			≥R-2.2°C·m^2/W	None

a. Energy factor (EF) and thermal efficiency (E_t) are minimum requirements, while standby loss (SL) is maximum W based on a 21°C temperature difference between stored water and ambient requirements. In the EF equation, V is the rated volume in litres. In the SL equation, V is the rated volume in litres and Q is the nameplate input rate in kW.
b. Section 11 contains details on the referenced test procedures, including the year/version of the referenced test procedure.
c. Section G.1 is titled "Test Method for Measuring Thermal Efficiency," and Section G.2 is titled "Test Method for Measuring Standby Loss."
d. UEF is the Uniform Energy Factor and is a dimensionless number that is calculated per DOE 10 CFR part 430 test procedures.

(This foreword 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.)

FOREWORD

Addendum bn updates the soil-gas control requirements in Section 8 to increase the protection of building occupants against radon exposure, specifying the key elements of effective soil-gas control (soil-gas barrier, gas permeable layer, and vent pipe). It also adds postconstruction and periodic testing requirements to Section 10. Radon gas is a radioactive, colorless, odorless, tasteless, cancer-causing soil gas that occurs naturally as a decay product of radium and enters buildings from the earth.

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 bn to Standard 189.1-2014

Modify Section 8.3 as shown.

~~8.3.4 Isolation of the Building from Pollutants in Soil.~~ ~~*Building projects* that include construction or expansion of a ground-level foundation and which are located on *brownfield sites* or in "Zone 1" counties identified to have a significant probability of radon concentrations higher than 4 picocuries/litre on the USEPA map of radon zones, shall have a *soil gas retarding system* installed between the newly constructed *space* and the soil.~~

8.3.4 Soil-Gas Entry Control. Soil-gas entry into enclosed spaces that are immediately above crawlspaces, slabs-on-grade, and basement slabs shall be controlled in accordance with Sections 8.3.4.1 or 8.3.4.2.

Exceptions to 8.3.4:

1. Buildings or portions thereof that are not routinely occupied, such as warehouses and parking structures.
2. Ventilated garages that comply with ANSI/ASHRAE Standard 62.1, Sections 5.15 and 6.5.

8.3.4.1 Soil-Gas Entry Control Systems

8.3.4.1.1 Soil-Gas Barriers. Soil-gas barrier systems shall be provided and shall comply with all of the following:

a. Earthen floors in basements and enclosed crawlspaces shall be covered with a soil-gas retarder membrane. Such membrane shall be sealed to the foundation at the edges. Soil-gas retarder membranes or systems shall be placed between slab floors and the base course gas-permeable layer required by Section 8.3.4.1.2. Soil-gas retarder materials shall meet or exceed the durability requirements of ASTM E1745, and the installation shall comply with ASTM E1643. Damp-proofing or waterproofing materials shall be installed on the exterior surface of foundation walls and shall extend from the top of the footing to above grade.
b. Joints in concrete around the perimeter of each poured slab section shall be permanently sealed with closed-cell gasket materials or equivalent methods that retain closure after the slab has cured.
c. Openings in slab floors; below-grade masonry walls; and membranes, such as those for plumbing, ground water control systems, soil vent pipes, electrical, mechanical piping, and structural supports, shall be sealed at the penetration with caulk that complies with ASTM C920 class 25 or higher equivalent closed-cell gasket materials or other equivalent method.
d. Sumps shall be covered with a rigid lid that is mechanically fastened and sealed with a gasket or caulk that will allow removal of the lid for maintenance.
e. Hollow masonry unit walls shall be designed and constructed as follows:
    1. The first course of masonry units bearing on a footing shall be laid with a full mortar bedding and shall be solid units or fully grouted masonry units.
    2. Where portions of masonry units are below grade and in contact with earth, the course of masonry units that is at or partially below grade shall be made of solid masonry units or fully grouted masonry units. Such course of masonry units need not change elevation to compensate for lower-grade elevations along the building perimeter. Openings in walls that are below such course of solid or fully grouted masonry units, such as window and door openings, shall be surrounded by solid or fully grouted masonry units.

8.3.4.1.2 Gas-Permeable Layer and Soil-Gas Conveyance. There shall be a continuous gas permeable layer under each slab-on-grade and basement slab for the entire area of the slab and under each membrane installed over earth for the entire area of the membrane. Perforated pipe, geotextile matting, or soil-gas collection pits shall be installed below the slab or membrane and shall be connected to exhaust vent pipe as specified in Section 8.3.4.1.3. The gas-permeable layer and soil-gas conveyance pipe shall comply with Table 8.3.4.1.2 and a, b, or c as applicable.

a. **Stone Aggregate Layer.** The gas-permeable layer shall be a uniform layer not less than 4 in. (0.1 m) in depth and shall consist of gravel or crushed stone that meets ASTM C33 requirements for size numbers 5, 56, 57 or 6. Vent pipe openings to unobstructed interstices between stones within the gas-permeable layer shall be not less than the equivalent values indicated in Table 8.3.4.1.2.
b. **Small Stone, Sand, and Soil.** The gas-permeable layer shall be a uniform layer not less than 4 in. (0.10 m) in depth that consists of any of the following:
    1. Small stone aggregates classified in ASTM C33 as size numbers 467,67,7, or 8.
    2. Sand classified in ASTM C33 as size number 9.
    3. Soil that contains less than 35% sand, rock fragment fines, clay, and silt. Such clay and silt shall consist of not more than 10% high-plasticity clay or silt.

Table 8.3.4.1.2 Soil Gas Conveyance Components

System Vent Pipe Nominal Diameter	Minimum Diameter of Pits [a]	Minimum Length of Perforated Pipe or Geotextile Matting [b]
3 in. (0.08 m)	12 in. (0.30 m) diameter pit	18 ft (5.4 m)
4 in. (0.10 m)	16 in. (0.40) diameter pit	32 ft (10 m)
6 in. (0.15 m)	24 in. (0.60 m) diameter pit	71 ft (22 m)

a. Pits shall be not less 4 in. (0.10 m) in depth.
b. Openings in perforated pipe and geotextile matting shall be not less than 1.0 in.^{2}/ft (0.00065 m^2/m) of pipe or matting length.

Perforated pipe or geotextile drainage matting shall be placed at distances not farther than 20 ft (6 m) apart and not farther than 10 ft (3m) away from foundation walls or other surfaces that surround the gas permeable layer. Perforated pipe shall be surrounded by not less than 4 in. (0.10 m) of gas-permeable aggregates that meet ASTM C33 requirements for size numbers 5, 56, 57 or 6. The minimum length and soil-gas inlet openings in the perforated pipe and geotextile matting shall be not less than equivalent values indicated in Table 8.3.4.1.2.

c. **Crawlspace Membranes.** Perforated pipe or equivalent material not less than 10 ft (3 m) in length and 3 in. (0.08 m) in nominal diameter shall be provided under the membrane. The configuration shall allow air movement under the entire area of the membrane.

8.3.4.1.2.1 Soil-Gas Conveyance Clearance and Dimension. Geotextile mats and perforated pipe shall be not less than 12 in. (0.3 m) and not farther than 10 ft (3 m) from foundation walls or other surfaces that surround the gas-permeable layer. Soil-gas inlet openings into the geotextile mats and perforated pipe shall have an area of not less than 1.0 in.^{2}/ft (0.00065 m^2/m) of length. The airway path within geotextile mats and perforated pipe shall be not less than the nominal equivalent area of 3 in. (0.08 cm) pipe inner diameter. Pipe materials below slabs and membranes shall be configured to drain collected water within piping.

8.3.4.1.2.2 Connections to Exhaust Vent Pipes. Exhaust vent piping, as specified in Section 8.3.4.1.3, shall connect to soil-gas inlet configurations within the gas-permeable layer and extend not less than 2 ft (0.6 m) above the top of the slab or membrane. Such pipes shall be temporarily capped or otherwise closed during construction to prevent debris from entering the pipes. The pipe that extends above the slab or membrane shall be labeled with the words "radon vent" or "soil-gas vent" in the prevailing language at the location.

8.3.4.1.3 Soil-Gas Exhaust Vent Pipe. Soil-gas exhaust vent piping shall be provided as follows:

a. **Pipe Placement.** Nonperforated Schedule 40 pipe, as defined by ASTM D1785, shall extend from within the gas-permeable layers to the point of exhaust above the roof. The vent pipe size shall not be reduced at any point between its connection to the gas permeable layers and the exhaust terminal above the roof. Such piping shall be labeled on each floor level of the building with the words "radon vent" or "soil-gas vent," in the prevailing language at the location.

Table 8.3.4.1.3 Vent Pipe Diameter per Vented Area

Vent Pipe Diameter	Maximum Vented Area per Vent Pipe
3 in. (0.08 m)	2500 ft^2 (230 m^2)
4 in. (0.10 m)	4500 ft^2 (420 m^2)
6 in. (0.15 m)	10,000 ft^2 (2300 m^2)

b. **Multiple Vented Areas.** Where interior footings divide a gas-permeable layer into two or more unconnected areas, such areas shall be interconnected by piping below the slab or membrane, or above the slab or membrane. Such piping shall be nonperforated and of a size indicated in Table 8.3.4.1.3.

c. **Provision for Fan.** Soil-gas venting systems shall include a fan or a dedicated space for the future installation of a fan. The fan and soil-gas vent piping on the discharge side of the fan shall not be installed within or under occupied spaces. A dedicated space having a vertical height of not less than 48 in. (1.2 m) and a diameter of not less than 21 in. (0.53 m) shall be provided in the attic or other interior area to accommodate the installation of a fan. The fan inlet and outlet vent pipes shall be centered in such dedicated space. An electrical supply for the fan shall be provided within 6 ft (1.8 m) of the fan location.

d. **Vented Area.** The maximum foundation area served by a soil-gas exhaust vent pipe shall be determined in accordance with Table 8.3.4.1.3.

Exception to 8.3.4.1.3.(d): Where inspections verify compliance with Sections 8.3.4.1.1 through 8.3.4.1.3, the maximum vented area per vent pipe indicated in Table 8.3.4.1 shall be increased by 40%. Where the soil-gas barrier consists of a spray-applied vapor barrier or a geomembrane that provides a homogeneous closure, the maximum vented area per vent pipe shall be increased by an additional 20%.

8.3.4.2 Alternative Methods of Soil-Gas Entry Control. A soil-gas entry control system shall be provided, and such system shall be clearly identified or otherwise noted on *construction documents* and shall be approved by a qualified soil-gas professional and the *building project acceptance representative*.

Add new Section 10.3.1.9 as shown.

10.3.1.9 Soil-Gas Entry. The building shall be tested postconstruction for radon in accordance with ANSI/AARST MALB. The indoor radon concentration shall be below 2.7 pCi/L (100 Bq/m^3). Where radon testing indicates that the indoor radon concentration is 2.7 pCi/L (100 Bq/m^3) or greater, radon mitigation shall be conducted in accordance with ANSI/AARST RMS-LB, and the building shall be retested to verify that the radon concentration is below 2.7 pCi/L (100 Bq/m^3).

Modify Section 10.3.2.1.4.4 as shown.

10.3.2.1.4.4 Indoor Air Quality. The plan for operation shall document procedures for maintaining and monitoring indoor air quality after building occupancy and shall contain the following:

[. . .]

d. For buildings where radon mitigation was required under Section 10.3.1.9, operation, maintenance, and monitoring procedures shall include all of the following:
   1. Quarterly inspection to verify operation of fans and other mechanical components.
   2. Biennial radon testing in accordance with ANSI/AARST MALB to verify that radon concentrations remain below 2.7 pCi/L (100 Bq/m^3). Where radon testing indicates that the indoor radon concentration is 2.7 pCi/L (100 Bq/m^3) or greater, mitigation shall be conducted in accordance with ANSI/AARST RMS-LB, and the building shall be retested to verify that the radon concentration is below 2.7 pCi/L (100 Bq/m^3).

      Where the required effectiveness of mitigation systems has been consistently demonstrated for a period of not less than 8 years, and such systems are inspected quarterly to verify fan operation, radon testing shall be repeated at intervals of not less than every 5 years.
   3. Biennial inspection and repair as needed for mitigation system performance indicators, fans, and visible mitigation system components, including piping, fasteners, supports, labels, and soil-gas barrier closures at exposed membranes, sumps, and other openings between soil and interior space.
   4. Documentation and retention of inspection and repair records and testing reports.

Modify Section 11 as shown.

Reference	Title	Section
American Association of Radon Scientists and Technologists (AARST) 475 South Church Street, Suite 600 Hendersonville, NC 28792 (800) 269-4174; http://aarst-nrpp.com/wp		
ANSI/AARST RMS-LB-2014	Radon Mitigation Standards for Schools and Large Buildings	10.3.1.9, 10.3.2.1.4.4
ANSI/AARST MALB-2014	Protocols for Measuring Radon and Radon Decay Products in School and Large Buildings	10.3.1.9, 10.3.2.1.4.4
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM C33	Standard Specification for Concrete Aggregates	8.3.4.1.2
ASTM C920-14	Standard Specification for Elastomeric Joint Sealants	8.3.4.1.1
ASTM D1785-15	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120	8.3.4.1.3
ASTM E 1643-11	Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs	8.3.4.1.1
ASTM E 1745-11	Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs	8.3.4.1.1

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FOREWORD

Addendum bo broadens and simplifies the existing definition of "sidelighting effective aperture" in ASHRAE/USGBC/IES Standard 189.1 in order to clarify its application in the prescriptive daylighting requirements in Section 8.4.1.2. The changes include the following:

a. *Replaces the term "windows" with "vertical fenestration." "Vertical fenestration" refers to both windows and glazed doors.*
b. *Replaces the term "visible light transmittance" and "VLT" with "visible transmittance" and "VT."*
c. *Defines "VT" directly in the definitions section rather than referring to ASHRAE/IES Standard 90.1, including how VT is determined according to Section 5.8.2.5 of Standard 90.1-2016.*
d. *Adds "VT" to the list of abbreviations and acronyms in Section 3.3.*

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 specifi-

Addendum bo to Standard 189.1-2014

Modify Section 3 as follows. The equation that appears in the shaded section is new text.

3.2 Definitions

sidelighting effective aperture: the relationship of daylight transmitted through ~~windows~~ *vertical fenestration* to the *primary sidelighted areas*. The *sidelighting effective aperture* is calculated according to the following formula:

~~$$\textit{Sidelighting effective aperture} = \frac{\sum \text{Window area} \times \text{Window VLT}}{\text{Area of } \textit{primary sidelighted area}}$$~~

$$\textit{Sidelighting effective aperture} = \frac{\sum \textit{Vertical fenestration} \text{ area} \times \textit{Vertical fenestration} \text{ VT}}{\text{Area of } \textit{primary sidelighted area}}$$

where "~~Window VLT~~ *Vertical fenestration* VT" is the visible ~~light~~ transmittance of ~~windows~~ *vertical fenestration* as determined in accordance with ~~Section 5.8.2.6 of ANSI/ASHRAE/IES Standard 90.1.~~ NFRC 200. For products outside of the scope of NFRC 200, VT is the solar photometric transmittance of the glazing materials as determined in accordance with ASTM E972.

3.3 Abbreviations and Acronyms

VT	visible transmittance

Modify Section 11 as follows.

Reference	Title	Section
ASTM International **100 Barr Harbor Dr.** **West Conshohocken, PA 19428-2959, United States** **1-610-832-9585; www.astm.org**		
ASTM E972-96 (2013)	Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight	3.2
[. . .]		
National Fenestration Rating Council (NFRC) **6305 Ivy Lane, Suite 140,** **Greenbelt, MD 20770-6323**		
ANSI/NFRC 200-2014	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	3.2

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FOREWORD

Addendum bp updates existing requirements for the emissions or VOC content in adhesives and sealants by updating references, adding accreditation requirements for testing laboratories (without changing the emissions testing or limit requirements), and clarifying language related to the VOC content requirements.

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 bp to Standard 189.1-2014

Modify Section 8.4.2.1 as follows.

8.4.2.1 Adhesives and Sealants. Products in this category include carpet, resilient, and wood flooring adhesives; base cove adhesives; ceramic tile adhesives; drywall and panel adhesives; aerosol adhesives; adhesive primers; acoustical sealants; firestop sealants; HVAC air duct sealants, sealant primers; and caulks. All adhesives and sealants used on the interior of the building (defined as inside of the *weatherproofing system* and applied on-site) shall comply with the requirements of either Section 8.4.2.1.1 or 8.4.2.1.2:

8.4.2.1.1 Emissions Requirements. Emissions shall be determined according to CDPH/EHLB/Standard Method V1.1 (commonly referred to as California Section 01350) and shall comply with the limit requirements for either office or *classroom spaces* regardless of the *space* type. The emissions testing shall be performed by an ISO/IEC 17025 accredited laboratory that has the CDPH/EHLB/Standard Method V.1.1, USEPA Method TO-17 and ASTM Standard Method D5197 within the scope of its accreditation. Third-party certifiers shall be accredited to ISO/IEC 17065 and have the relevant certification program in the scope of accreditation.

8.4.2.1.2 VOC Content Requirements. ~~VOC content shall comply with and shall be determined according to the following limit requirements: a.~~The VOC content of ~~A~~adhesives, sealants and sealant primers shall be determined and limited in accordance with~~:~~ SCAQMD Rule 1168. HVAC duct sealants shall be classified as "Other" category within the SCAQMD Rule 1168 sealants table.

~~b.~~The VOC content of~~A~~ aerosol adhesives shall be determined and limited in accordance with~~:~~ Section 3 of Green Seal Standard GS-36.

Exceptions to 8.4.2.1.2: The following solvent welding and sealant products are not required to meet the emissions or the VOC content requirements ~~listed above~~.

1. Cleaners, solvent cements, and primers used with plastic piping and conduit in plumbing, fire suppression, and electrical systems.
2. HVAC air duct sealants when the air temperature of the *space* in which they are applied is less than 40°F (4.5°C).

Modify Section 11 as follows.

Reference	Title	Section
ASTM International **100 Barr Harbor Dr.** **West Conshohocken, PA 19428-2959, United States** **1-610-832-9585; www.astm.org**		
ASTM D5197-09e1	Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)	8.4.2, 10.3.1.4
[. . .]		
California Department of Public Health (CDPH) **Indoor Air Quality Section** **850 Marina Bay Parkway** **Richmond, CA 94804, United States** **1-510-620-2802; www.cdph.ca.gov/programs/IAQ and www.cal-iaq.org**		
CDPH/EHLB/Standard Method v1.1 (2010)	Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers—Version 1.1	8.4.28.4.2.1.1, 8.4.2.2.1, 8.4.2.3, 8.4.2.4, 8.4.2.6, 8.5.2, Table 10.3.1.4, Appendix F
[. . .]		
Green Seal **1001 Connecticut Avenue, NW, Suite 827** **Washington, DC 20036-5525, United States** **1-202-872-6400; www.greenseal.org**		
GS-36 (2.1) July 12, 2013	Standard for Adhesives for Commercial UseAdhesives	8.4.2.1.2
[. . .]		
International Organization for Standardization (ISO) **ISO Central Secretariat, 1 rue de Varembee, Case postale 56** **CH-1211 Geneva 20, Switzerland** **+41-22-749-01-11; www.iso.org**		
ISO/IEC-17025-2005 (Reviewed 2010)	General requirements for the competence of testing and calibration laboratories	8.4.2
ISO/IEC 17065-2012	Conformity assessment—Requirements for bodies certifying products, processes and services	8.4.2
[. . .]		
United States Environmental Protection Agency (USEPA) **Ariel Rios Building** **1200 Pennsylvania Avenue, NW** **Washington, DC 20460, United States** **1-919-541-0800; www.epa.gov** **ENERGY STAR ® 1-888-782-7937** **WaterSense 1-866-987-7367 and 1-202-564-2660**		
USEPA Method TO-17 (1999)	Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes	8.4.2

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FOREWORD

Addendum bq updates the existing requirements for the emissions or VOC content for paints and coating materials by adding accreditation requirements for testing laboratories (without changing the emissions testing or limit requirements), clarifying the language related to the VOC contents requirements, and updating references.

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 bq to Standard 189.1-2014

Modify Section 8.4.2.2 as follows.

8.4.4.2 Paints and Coatings. Products in this category include anticorrosive coatings, basement specialty coatings, concrete/masonry sealers, concrete curing compounds, dry fog coatings, faux finishing coatings, fire-resistive coatings, flat and non-flat topcoats, floor coatings, graphic arts (sign) coatings, high-temperature coatings, industrial maintenance coatings, low solids coatings, mastic texture coatings, metallic pigmented coatings, multicolor coatings, pretreatment wash primers, primers, reactive penetrating sealers, recycled coatings, shellacs (clear and opaque), specialty primers, stains, stone consolidants, swimming-pool coatings, tub- and tile-refining coatings, under coaters, waterproofing membranes, wood coatings (clear wood finishes), wood preservatives, and zinc primers. Paints and coatings used on the interior of the building (defined as inside of the *weatherproofing system* and applied on-site) shall comply with either Section 8.4.2.2.1 or 8.4.2.2.2.

8.4.4.2.1 Emissions Requirements. Emissions shall be determined according to CDPH/EHLB/Standard Method V1.1 (commonly referred to as California Section 01350) and shall comply with the limit requirements for either office or *classroom spaces* regardless of the *space* type. The emissions testing shall be performed by an ISO/IEC 17025 accredited laboratory that has the CDPH/EHLB/Standard Method V.1.1, USEPA Method TO-17 and ASTM Standard Method D5197 within the scope of its accreditation. Third-party certifiers shall be accredited to ISO/IEC 17065 and have the relevant certification program in the scope of accreditation.

8.4.4.2.2 Volatile Organic Compound (VOC) Content Requirements. ~~VOC content shall comply with and be determined according to the following limit requirements:~~

a. The VOC content for ~~F~~flat and nonflat ~~top coats~~ coatings, nonflat high-gloss coatings, specialty coatings, basement specialty coatings, concrete/masonry sealers, fire resistive coatings, floor coatings, low-solids coatings, primers, sealers and undercoaters, ~~and anticorrosive~~ rust preventative coatings, shellacs (clear and opaque), stains, wood coatings, reflective wall coatings, varnishes, conjugated oil varnish, lacquer, and clear brushing lacquer shall be determined and limited in accordance with~~:~~ Green Seal Standard GS-11.

b. The VOC content for ~~Concrete/masonry sealers (waterproofing concrete/masonry sealers),~~ concrete curing compounds, dry fog coatings, faux finishing coatings, ~~fire resistive coatings, floor coatings~~, graphic arts ~~(sign)~~ coatings (sign paints), industrial maintenance coatings, mastic texture coatings, metallic pigmented coatings, multicolor coatings, pretreatment wash primers, reactive penetrating sealers, recycled coatings, ~~shellacs (clear and opaque),~~ specialty primers, ~~stains, wood coatings (clear wood finishes)~~, wood preservatives, and zinc primers shall be determined and limited in accordance with the~~:~~ California Air Resources Board Suggested Control Measure for Architectural Coatings or SCAQMD Rule 1113r.

c. The VOC content for ~~Basement specialty coatings~~, high-temperature coatings~~, low solids coatings~~, stone consolidants, swimming-pool coatings, tub- and tile-refinishing coatings, and waterproofing membrane~~s~~ primers shall be determined and limited in accordance with the~~:~~ California Air Resources Board Suggested Control Measure for Architectural Coatings.

Modify Section 11 as follows.

Reference	Title	Section
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM D5197-09e1	Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)	8.4.2, 10.3.1.4
[. . .]		
California Department of Public Health (CDPH) Indoor Air Quality Section 850 Marina Bay Parkway Richmond, CA 94804, United States 1-510-620-2802; www.cdph.ca.gov/programs/IAQ and www.cal-iaq.org		
CDPH/EHLB/Standard Method v1.1(2010)	Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers—Version 1.1	8.4.28.4.2.1.1, 8.4.2.2.1, 8.4.2.3, 8.4.2.4, 8.4.2.6, 8.5.2, Table 10.3.1.4, Appendix F
[. . .]		
Green Seal 1001 Connecticut Avenue, NW, Suite 827 Washington, DC 20036-5525, United States 1-202-872-6400; www.greenseal.org		
GS-11(3.2), July 12, 2013 October 26, 2016	Environmental Green Seal Standard for Paints , and Coatings, Stains, and Sealers. Section 3.0: "Product-Specific Health and Environmental Requirements"	8.4.2.2.2
[. . .]		
International Organization for Standardization (ISO) ISO Central Secretariat, 1 rue de Varembee, Case postale 56 CH-1211 Geneva 20, Switzerland +41-22-749-01-11; www.iso.org		
ISO/IEC-17025-2005 (Reviewed 2010)	General requirements for the competence of testing and calibration laboratories	8.4.2
ISO/IEC 17065-2012	Conformity assessment—Requirements for bodies certifying products, processes and services	8.4.2
[. . .]		
South Coast Air Quality Management District (SCAQMD) California Air Resources Board 1001 "I" Street P.O. Box 2815 Sacramento, CA 95812, United States 1-916-322-2990; www.arb.ca.gov		
SCAQMD Rule 1113r, Amended June 3, 2011 February 5, 2016	Architectural Coatings	8.4.2.2
[. . .]		
United States Environmental Protection Agency (EPA) Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460, United States 1-919-541-0800; www.epa.gov ENERGY STAR ® 1-888-782-7937 Water Sense 1-866-987-7367 and 1-202-564-2660		
USEPA Method TO-17 (1999)	Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes	8.4.2

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FOREWORD

Addendum br updates the existing requirements for the emissions for floor covering materials by adding accreditation requirements for testing laboratories (without changing the emissions testing or limit requirements), updating product categories to be consistent with CDPH/EHLB v1.1, adding a list of materials that are deemed to comply, and updating references.

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 br to Standard 189.1-2014

Modify Section 8.4.2.3 as follows.

8.4.2.3 Floor Covering Materials. ~~Floor covering materials installed in the building interior shall comply with the following:~~

~~a. Carpet: Carpet shall be tested in accordance with and shown to be compliant with the requirements of CDPH/EHLB/Standard Method v1.1 (commonly referred to as California Section 01350). Products that have been verified and labeled to be in compliance with Section 9 of CDPH/EHLB/Standard Method v1.1 (commonly referred to as California Section 01350) comply with this requirement.~~

~~b. Hard surface flooring in office *spaces* and *classrooms*: Materials shall be tested in accordance with and shown to be compliant with the requirements of CDPH/EHLB/Standard Method v1.1 (commonly referred to as California Section 01350).~~

Emissions of floor covering materials installed in the building interior, and each product layer within a flooring system containing more than one distinct product layer, shall be individually determined according to CDPH/EHLB/Standard Method V1.1 (commonly referred to as "California Section 01350") and shall comply with the limit requirements for either office or *classroom spaces*, regardless of the *space* type. The emissions testing shall be performed by an ISO/IEC 17025 accredited laboratory that has the CDPH/EHLB/Standard Method V.1.1, USEPA TO-17 and ASTM Standard Method D5197 within the scope of its accreditation. Third-party certifiers shall be accredited to ISO/IEC 17065 and have the relevant certification program in the scope of accreditation.

8.4.2.3.1 Deemed to Comply. Floor covering materials that are composed of materials listed in Table 8.4.2.3.1 shall be deemed to comply with the requirements of Section 8.4.2.3. Where these products include integral organic-based surface coatings, binders, or sealants, or are installed using adhesives, sealants, paints, or coatings, those products shall be subject to other requirements of Section 8.4.2.

Table 8.4.2.3.1 Floor Covering Deemed to Comply with VOC Emission Limits

Ceramic and concrete tile
Natural stone
Gypsum plaster
Clay masonry
Concrete masonry
Concrete
Metal

Modify Section 11 as follows.

Reference	Title	Section
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM D5197-09e1	Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)	8.4.2, 10.3.1.4
[. . .]		
California Department of Public Health (CDPH) Indoor Air Quality Section 850 Marina Bay Parkway Richmond, CA 94804, United States 1-510-620-2802; www.cdph.ca.gov/programs/IAQ and www.cal-iaq.org		
CDPH/EHLB/Standard Method v1.1(2010)	Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers—Version 1.1	8.4.2~~8.4.2.1.1, 8.4.2.2.1, 8.4.2.3, 8.4.2.4, 8.4.2.6~~, 8.5.2, Table 10.3.1.4, Appendix F
[. . .]		
International Organization for Standardization (ISO) ISO Central Secretariat, 1 rue de Varembee, Case postale 56 CH-1211 Geneva 20, Switzerland +41-22-749-01-11; www.iso.org		
ISO/IEC-17025-2005 (Reviewed 2010)	General requirements for the competence of testing and calibration laboratories	8.4.2
ISO/IEC 17065-2012	Conformity assessment—Requirements for bodies certifying products, processes and services	8.4.2
[. . .]		
United States Environmental Protection Agency (EPA) Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460, United States 1-919-541-0800; www.epa.gov ENERGY STAR ® 1-888-782-7937 WaterSense 1-866-987-7367 and 1-202-564-2660		
USEPA Method TO-17 (1999)	Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes	8.4.2

(This foreword 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.)

FOREWORD

Addendum bs updates the existing requirements for the emissions for ceiling and wall assemblies by modifying the list of materials covered, adding a separate subsection on insulation, adding a list of materials that are deemed to comply, adding accreditation requirements for testing laboratories (without changing the emissions testing or limit requirements), and updating references.

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 bs to Standard 189.1-2014

Modify Section 8.4.2.6 as follows.

8.4.2.6 Ceiling and *Wall* Assemblies and Systems. ~~These~~ Ceiling and wall assemblies and systems include ~~ceiling and *wall* insulation~~ acoustical treatments, ceiling panels and tiles, gypsum panel products, tackable wall panels and coverings, ~~gypsum *wall* board and panels, and~~ *wall* coverings, and wall and ceiling paneling and planking. Emissions from~~for~~ these assemblies and systems ~~products~~ shall be determined according to CDPH/EHLB/Standard Method V1.1 (commonly referred to as California Section 01350) and shall comply with the limit requirements for either office or *classroom spaces* regardless of the *space* type. The emissions testing shall be performed by an ISO/IEC 17025 accredited laboratory that has the CDPH/EHLB/Standard Method V.1.1, USEPA TO-17 and ASTM Standard Method D5197 within the scope of its accreditation. Third-party certifiers shall be accredited to ISO/IEC 17065 and have the relevant certification program in the scope of accreditation.

Table 8.4.2.6.1 Ceiling and Wall Products Deemed to Comply with VOC Emission Limits

Ceramic and concrete tile
Natural stone
Gypsum plaster
Clay masonry
Concrete masonry
Concrete
Metal

8.4.2.6.1 Deemed to Comply. Ceiling and wall assemblies and systems that are composed of materials listed in Table 8.4.2.6.1 shall be deemed to comply with the requirements of Section 8.4.2.6. Where these products include integral organic-based surface coatings, binders, or sealants, or are installed using adhesives, sealants, paints, or coatings, those products shall be subject to other requirements of Section 8.4.2.

Add new Section 8.4.2.7 as follows.

8.4.2.7 Insulation. Emissions shall be determined according to CDPH/EHLB/Standard Method V1.1 (commonly referred to as California Section 01350) and shall comply with the limit requirements for either office or *classroom spaces*, regardless of the *space* type. The emissions testing shall be performed by an ISO/IEC 17025 accredited laboratory that has the CDPH/EHLB/Standard Method V.1.1, USEPA TO-17 and ASTM Standard Method D5197 within the scope of its accreditation. Third-party certifiers shall be accredited to ISO/IEC 17065 and have the relevant certification program in the scope of accreditation.

Modify Section 11 as follows.

ASTM International **100 Barr Harbor Dr.** **West Conshohocken, PA 19428-2959, United States** **1-610-832-9585; www.astm.org**		
ASTM D5197-09e1	Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)	8.4.2, 10.3.1.4
[. . .]		
California Department of Public Health (CDPH) **Indoor Air Quality Section** **850 Marina Bay Parkway** **Richmond, CA 94804, United States** **1-510-620-2802; www.cdph.ca.gov/programs/IAQ and www.cal-iaq.org**		
CDPH/EHLB/Standard Method v1.1(2010)	Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers—Version 1.1	8.4.28.4.2.1.1, 8.4.2.2.1, 8.4.2.3, 8.4.2.4, 8.4.2.6, 8.5.2, Table 10.3.1.4, Appendix F
[. . .]		
International Organization for Standardization (ISO) **ISO Central Secretariat, 1 rue de Varembee, Case postale 56** **CH-1211 Geneva 20, Switzerland** **+41-22-749-01-11; www.iso.org**		
ISO/IEC-17025-2005 (Reviewed 2010)	General requirements for the competence of testing and calibration laboratories	8.4.2
ISO/IEC 17065-2012	Conformity assessment—Requirements for bodies certifying products, processes and services	8.4.2
[. . .]		
United States Environmental Protection Agency (EPA) **Ariel Rios Building** **1200 Pennsylvania Avenue, NW** **Washington, DC 20460, United States** **1-919-541-0800; www.epa.gov** **ENERGY STAR ® 1-888-782-7937** **WaterSense 1-866-987-7367 and 1-202-564-2660**		
USEPA Method TO-17 (1999)	Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes	8.4.2

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FOREWORD

Addendum bt updates requirements for building envelope airtightness testing in ASHRAE/USGBC/IES Standard 189.1 based on changes in ASHRAE/IES Standard 90.1-2016. Note that Standard 90.1 now includes a new Section 5.9.2.2 on inspection and verification, which essentially meets the same intent of the options in Standard 189.1-2014, Sections 10 3.1.2.5 (a) and (b). This addendum resolves any differences between Standards 189.1 and 90.1.

The addendum allows additional whole-building pressurization (air leakage) test methods in addition to those that are allowed in Standard 90.1-2016. The addendum does not allow testing on portions of buildings as in Standard 90.1-2016, Section 5.4.3.1.3(a), Exception 1, because of the difficulty in isolating portions of buildings during such tests; this methodology has not been verified and is not part of any standard method of test. Section 5.4.3.1.3(a), Exception 2, is allowed but with lower air leakage rates. The addendum also requires that, when using the verification program option of Standard 90.1, the design review must be performed by a third party, as already required in Standard 189.1-2014.

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 bt to Standard 189.1-2014

Modify Section 7.3.1.1 as follows.

7.3.1.1 ***Continuous Air Barrier***. The exceptions to the requirement for a continuous air barrier in Section 5.4.3.1 of ANSI/ASHRAE/IES Standard 90.1 for specific climate zones and constructions shall not apply. The testing criteria of Section 10.3.1.2.5(a) shall supersede ANSI/ASHRAE/IES Standard 90.1, Section 5.4.3.1.3(a).

Modify Section 10.3.1.2.5 as follows.

10.3.1.2.5 ***Building Envelope*** **Airtightness.** *Building envelope* airtightness shall comply with ANSI/ASHRAE/IES Standard 90.1 ~~one of~~ with the following modifications and additions. Air leakage verification shall be determined in accordance with ANSI/ASHRAE/IES Standard 90.1, Section 5.9.2.2.

a. When implementing the testing option in ANSI/ASHRAE/IES Standard 90.1, Sections 5.9.2.2(b) and 5.4.3.1.3(a), ~~W~~whole-building pressurization testing shall ~~be~~ meet the following requirements:
   1. It shall be conducted in accordance with ASTM E779, ASTM E1827, CAN/CGSB-149.10-~~M86~~, CAN/CGSB-149.15-~~96,~~ ISO 9972, or equivalent by an independent third party.
   2. The measured air leakage rate of the *building envelope* shall not exceed 0.25 cfm/ft^2 (1.25 L/s·m^2) under a pressure differential of 0.3 in. of water~~wc~~ (75 Pa), with this air leakage rate normalized by the sum of the above- and below-grade *building envelope* areas of the *conditioned* and *semiheated space.*
   3. Section 5.4.3.1.3(a), Exception (1), is not allowed.
   4. Section 5.4.3.1.3(a), Exception (2), is allowed where the measured air leakage rate exceeds 0.25 cfm/ft^2 (1.25 L/s·m^2) but does not exceed 0.40 cfm/ft^2 (2.0 L/s·m^2).

b. When implementing the verification program option in ANSI/ASHRAE IES Standard 90.1, Section 5.9.2.2(a), the air barrier design review shall be performed by an independent third party. ~~An air-barrier commissioning program consistent with *generally accepted engineering standards* that consists of the following elements shall be implemented:~~
   1. ~~A third-party design review shall be conducted and documented to assess the design documentation describing the air-barrier systems and materials, the manner in which continuity will be maintained across joints between air-barrier components and at all envelope penetrations, and the constructability of the air-barrier systems.~~
   2. ~~Incremental field inspection and testing of air-barrier components shall be conducted and documented during construction to ensure proper construction of key components while they are still accessible for inspection and repair.~~

Modify Section 11 as follows.

Reference	Title	Section
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM E1827-11	Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door	10.3.1.2.5
[. . .]		
International Organization for Standardization (ISO) ISO Central Secretariat, 1 rue de Varembee, Case postale 56 CH-1211 Geneva 20, Switzerland +41-22-749-01-11; www.iso.org		
ISO 9972-2015	Thermal performance of buildings—Determination of air permeability of buildings—Fan pressurization method	10.3.1.2.5

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FOREWORD

Addendum bu revises the efficiency requirements in ASHRAE/USGBC/IES Standard 189.1, Table B-2, Electrically Operated Unitary and Applied Heat Pumps Minimum Efficiency Requirements (I-P), to adjust the efficiency metrics for industry improvements for these products. The strategy was to use industry-established efficiency metrics rather than new metrics that would result in requirements to develop new products.

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 bu to Standard 189.1-2014

Delete current Table B-2 (I-P and SI) and replace with the new table as shown.

Table B-2 (Supersedes Table 6.8.1-2 in ANSI/ASHRAE/IES Standard 90.1)
Electrically-Operated Unitary and Applied Heat Pumps Minimum Efficiency Requirements (I-P)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, air cooled (cooling mode)	<65,000 Btu/h (one phase)	All	Split systems	15.0 SEER 12.5 EER	AHRI 210/240
			Single packaged	15.0 SEER 12.0 EER	
	<65,000 Btu/h (three phase)	All	Split systems	15.0 SEER 12.5 EER	
			Single packaged	15.0 SEER 12.0 EER	
Through-the-wall, air cooled (cooling mode)	<30,000 Btu/h	All	Split systems	12.0 SEER	
			Single packaged	12.0 SEER	
Small duct high velocity, air cooled (cooling mode)	<65,000 Btu/h (one phase)	All	Split systems	12.0 SEER	
	<65,000 Btu/h (three phase)	All	Split systems	12.0 SEER	
Air conditioners, air cooled (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split systems and single package	11.3 EER 12.3 IEER	AHRI 340/360
		All other	Split systems and single package	11.1 EER 12.1 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split systems and single package	10.9 EER 11.9 IEER	
		All other	Split systems and single package	10.7 EER 11.7 IEER	
	≥240,000 Btu/h	Electric resistance (or none)	Split systems and single package	10.3 EER 10.9 IEER	
		All other	Split systems and single package	10.1 EER 10.7 IEER	
Water-to-air water loop (cooling mode)	<17,000 Btu/h	All	86°F entering water	14.0 EER	ISO-13256-1
	≥17,000 Btu/h and <65,000 Btu/h	All	86°F entering water	14.0 EER	
	>65,000 Btu/h and <135,000 Btu/h	All	86°F entering water	14.0 EER	
Water-to-air ground water (cooling mode)	<135,000 Btu/h	All	59°F entering water	18.0 EER	
Water-to-air ground loop (cooling mode)	<135,000 Btu/h	All	77°F entering water	14.1 EER	
Water-to-water water loop (cooling mode)	<135,000 Btu/h	All	86°F entering water	10.6 EER	ISO-13256-2
Water-to-water groundwater (cooling mode)	<135,000 Btu/h	All	59°F entering water	16.3 EER	
Brine-to-water ground loop (cooing mode)	<135,000 Btu/h	All	77°F entering water	12.1 EER	
Air conditioners, air cooled (heating mode)	<65,000 Btu/h (cooling capacity) (one phase)	All	Split systems	9.00 HSPF	AHRI 210/240
			Single packaged	8.50 HSPF	
	<65,000 Btu/h (cooling capacity) (three phase)	All	Split systems	9.00 HSPF	
			Single packaged	8.50 HSPF	

a. Section 11 contains details on the referenced test procedures, including year and version of the test procedure.

Table B-2 (Supersedes Table 6.8.1-2 in ANSI/ASHRAE/IES Standard 90.1)
Electrically-Operated Unitary and Applied Heat Pumps Minimum Efficiency Requirements (I-P) *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Through-the-wall, air cooled (heating mode)	<30,000 Btu/h (cooling capacity)	All	Split systems	7.40 HSPF	AHRI 210/240
			Single packaged	7.40 HSPF	
Small-duct high velocity, air cooled (heating mode)	<65,000 Btu/h (cooling capacity) (one phase)	All	Split systems	7.20 HSPF	
	<65,000 Btu/h (cooling capacity) (three phase)	All	Split systems	7.20 HSPF	
Air cooled (heating mode)	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)		47°F db/43°F wb *outdoor air*	3.40 COP_H	AHRI 340/360
			17°F db/15°F wb *outdoor air*	2.40 COP_H	
	≥135,000 Btu/h (cooling capacity)		47°F db/43°F wb *outdoor air*	3.20 COP_H	
			17°F db/15°F wb *outdoor air*	2.10 COP_H	
Water-to-air water loop (heating mode)	<135,000 Btu/h (cooling capacity)		68°F entering water	4.60 COP_H	ISO-13256-1
Water-to-air groundwater (heating mode)	<135,000 Btu/h (cooling capacity)		50°F entering water	3.70 COP_H	
Brine-to-air ground loop (heating mode)	<135,000 Btu/h (cooling capacity)		32°F entering fluid	3.20 COP_H	
Water-to-water water loop (heating mode)	<135,000 Btu/h (cooling capacity)		68°F entering water	3.70 COP_H	ISO-13256-2
Water-to-water groundwater (heating mode)	<135,000 Btu/h (cooling capacity)		50°F entering water	3.10 COP_H	
Brine-to-water ground loop (heating mode)	<135,000 Btu/h (cooling capacity)		32°F entering fluid	2.50 COP_H	

a. Section 11 contains details on the referenced test procedures, including year and version of the test procedure.

Table B-2 (Supersedes Table 6.8.1-2 in ANSI/ASHRAE/IES Standard 90.1)
Electrically-Operated Unitary and Applied Heat Pumps Minimum Efficiency Requirements (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, air cooled (cooling mode)	<19 kW (one phase)	All	Split systems	4.40 $SCOP_C$ 3.66 COP_C	AHRI 210/240
			Single packaged	4.40 $SCOP_C$ 3.52 COP_C	
	<19 kW (three phase)	All	Split systems	4.40 $SCOP_C$ 3.66 COP_C	
			Single packaged	4.40 $SCOP_C$ 3.52 COP_C	
Through-the-wall, air cooled (cooling mode)	<9 kW	All	Split systems	3.52 $SCOP_C$	
			Single packaged	3.52 $SCOP_C$	
Small duct high velocity, air cooled (cooling mode)	<19 kW (one phase)	All	Split systems	3.52 $SCOP_C$	
	<19 kW (three phase)	All	Split systems	3.52 $SCOP_C$	
Air conditioners, air cooled (cooling mode)	≥19 kW and <40 kW	Electric resistance (or none)	Split systems and single package	3.31 COP_C 3.60 $ICOP_C$	AHRI 340/360
		All other	Split systems and single package	3.25 COP_C 3.55 $ICOP_C$	
	≥40 kW and <70 kW	Electric resistance (or none)	Split systems and single package	3.19 COP_C 3.40 $ICOP_C$	
		All other	Split systems and single package	3.14 COP_C 3.34 $ICOP_C$	
	≥70 kW	Electric resistance (or none)	Split systems and single package	3.02 COP_C 3.11 $ICOP_C$	
		All other	Split systems and single package	2.96 COP_C 3.05 $ICOP_C$	
Water-to-air water loop (cooling mode)	<5 kW	All	30°C entering water	4.10 COP_C	ISO-13256-1
	≥5 kW and <19kW	All	30°C entering water	4.10 COP_C	
	>19kW and <40 kW	All	30°C entering water	4.10 COP_C	
Water-to-air ground water (cooling mode)	<40 kW	All	15°C entering water	5.28 COP_C	
Water-to-air ground loop (cooling mode)	<40 kW	All	25°C entering water	4.13 COP_C	
Water-to-water water loop (cooling mode)	<40 kW	All	30°C entering water	3.11 COP_C	ISO-13256-2
Water-to-water groundwater (cooling mode)	<40 kW	All	15°C entering water	4.78 COP_C	
Brine-to-water ground loop (cooing mode)	<40 kW	All	30° C entering water	3.55 COP_C	
Air conditioners, air cooled (heating mode)	<19kW (cooling capacity) (one phase)	All	Split systems	2.49 COP_H	AHRI 210/240
			Single packaged	2.40 COP_H	
	<19kW (cooling capacity) (three phase)	All	Split systems	2.49 COP_H	
			Single packaged	2.40 COP_H	

a. Section 11 contains details on the referenced test procedures, including year and version of the test procedure.

Table B-2 (Supersedes Table 6.8.1-2 in ANSI/ASHRAE/IES Standard 90.1)
Electrically-Operated Unitary and Applied Heat Pumps Minimum Efficiency Requirements (SI) *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Through-the-wall, air cooled (heating mode)	<9 kW (cooling capacity)	All	Split systems	2.17 COP_H	AHRI 210/240
			Single packaged	2.17 COP_H	
Small-duct high velocity, air cooled (heating mode)	<19kW (cooling capacity) (one phase)	All	Split systems	2.11 COP_H	
	<19kW (cooling capacity) (three phase)	All	Split systems	2.11 COP_H	
Air cooled (heating mode)	≥19kW and <40 kW (cooling capacity)		8.3°C db/6.1°C wb *outdoor air*	3.40 COP_H	AHRI 340/360
			–8.3°C db/9.4°C wb *outdoor air*	2.40 COP_H	
	≥40 kW (cooling capacity)		8.3°C db/6.1°C wb *outdoor air*	3.20 COP_H	
			–8.3°C db/9.4°C wb *outdoor air*	2.10 COP_H	
Water-to-air water loop (heating mode)	<40 kW (cooling capacity)		20°C entering water	4.60COP_H	ISO-1356-1
Water-to-air groundwater (heating mode)	<40 kW (cooling capacity)		10°C entering water	3.70 COP_H	
Brine-to-air ground loop (heating mode)	<40 kW (cooling capacity)		0°C entering fluid	3.20 COP_H	
Water-to-water water loop (heating mode)	<40 kW (cooling capacity)		20°C entering water	3.70 COP_H	ISO-13256-2
Water-to-water groundwater (heating mode)	<40 kW (cooling capacity)		10°C entering water	3.10 COP_H	
Brine-to-water ground loop (heating mode)	<40 kW (cooling capacity)		0°C entering fluid	2.50 COP_H	

a. Section 11 contains details on the referenced test procedures, including year and version of the test procedure.

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FOREWORD

Addendum bv updates the centrifugal chiller requirement for K_{adj}, which currently exists as a footnote to Table B-3, to reflect changes to AHRI Standards 550/590 and 551/591. The revised requirement is in alignment with ASHRAE/IES Standard 90.1.

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 bv to Standard 189.1-2014

Modify Section 7.4.3.1.1 as shown.

7.4.3.1.1 Water-Cooled Centrifugal Chiller Packages Efficiency Adjustment

a. **For Water-Cooled Centrifugal Units Rated per AHRI Standard 550/590 (I-P).** Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44.00°F leaving and 54.00°F entering chilled-fluid temperatures, and with 85.00°F entering and 94.30°F leaving condenser-fluid temperatures, shall have maximum full-load (FL) kW/ton and part-load rating requirements adjusted using the following equations:

$$FL_{adj} = FL/K_{adj}$$

$$PLV_{adj} = IPLV/K_{adj}$$

$$K_{adj} = A \times B$$

where

FL = full-load kW/ton value from Table 6.8.1-3

FL_{adj} = maximum full-load kW/ton rating, adjusted for nonstandard conditions

IPLV = IPLV value from Table 6.8.1-3

PLV_{adj} = maximum NPLV rating, adjusted for nonstandard conditions

A = $0.000000145920 \times (LIFT)^4 - 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.93073$

B = $0.0015 \times LvgEvap + 0.934$

LIFT = LvgCond – LvgEvap

LvgCond = full-load condenser leaving fluid temperature, °F

LvgEvap = full-load evaporator leaving temperature, °F

The FL_{adj} and PLV_{adj} values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

- 36.00°F ≤ LvgEvap ≤ 60.00°F
- LvgCond ≤ 115.00°F
- 20.00°F ≤ LIFT ≤ 80.00°F

Centrifugal chillers designed to operate outside of these ranges are not covered by this standard.

b. **For Water-Cooled Centrifugal Units Rated per AHRI Standard 551/591 (SI)**. Equipment not designed for operation at AHRI Standard 551/591 test conditions of 7.00°C leaving and 12.00°C entering chilled-fluid temperatures, and with 30.00°C entering and 35.00°C leaving condenser-fluid temperatures, shall have maximum full-load (FL) COP and part-load rating requirements adjusted using the following equations:

$$FL_{adj} = FL \times K_{adj}$$

$$PLV_{adj} = IPLV \times K_{adj}$$

$$K_{adj} = A \times B$$

where

FL = full-load COP value from Table 6.8.1-3

FL_{adj} = minimum full-load COP rating, adjusted for nonstandard conditions

IPLV = IPLV value from Table 6.8.1-3

PLV_{adj} = minimum NPLV rating, adjusted for nonstandard conditions

A = $0.00000153181 \times (LIFT)^4 - 0.000202076 \times (LIFT)^3 + 0.0101800 \times (LIFT)^2 - 0.264958 \times LIFT + 3.93073$

B = $0.0027 \times LvgEvap + 0.982$

LIFT = LvgCond – LvgEvap

LvgCond = full-load condenser leaving fluid temperature, °C

LvgEvap = full-load evaporator leaving temperature, °C

The FL_{adj} and PLV_{adj} values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

- 2.20°C ≤ LvgEvap ≤ 15.60°C
- LvgCond ≤ 46.00°C
- 11.00°C ≤ LIFT ≤ 44.00°C

Centrifugal chillers designed to operate outside of these ranges are not covered by this standard.

Delete footnote (f) in Table B-3 for I-P units as shown. No other changes are made to the table.

Table B-3 (Supersedes Table 6.8.1-3 in ANSI/ASHRAE/IES Standard 90.1-2013)
Water Chilling Packages – Efficiency Requirements (I-P) [a,b,e]

Equipment Type	Size Category	Units	Path A	Path B	Test Procedure
[. . .]					

a. The requirements for centrifugal chiller shall be adjusted for non-standard rating conditions per 6.4.1.2.1 and are only applicable for the range of conditions listed in AHRI 550/590. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.

b. Both the full load and IPLV requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 11 contains details for the referenced test procedure, including the referenced year version of the test procedure.

d. "NA" means the requirements are not applicable for Path B and only Path A can be used for compliance.

e. "FL" is the full-load performance requirements and "IPLV" is for the part-load performance requirements

f. ~~Centrifugal chillers that are not designed for operation at AHRI Standard 550/590 test conditions of 44°F leaving chilled-fluid temperature and 2.4 gpm/ton evaporator fluid flow and 85°F entering condenser-fluid temperature with 3.0 gpm/ton condenser-fluid flow (and, thus, cannot be tested to meet the requirements of Table C-3) shall have maximum full-load kW/ton (FL) and NPLV part load ratings requirements adjusted using the following equations:~~

$$FL_{adj} = FL/K_{adj}$$

$$PLV_{adj} = IPLV/K_{adj}$$

$$K_{adj} = A \times B$$

~~where~~

~~FL = full-load kW/Ton value from Table 6.8.1C~~
~~FL_{adj} = maximum full-load kW/Ton rating, adjusted for non-standard conditions~~
~~IPLV = IPLV value from Table C-3~~
~~PLV_{adj} = maximum *NPLV* rating, adjusted for non-standard conditions~~
~~A = $0.00000014592 \times (LIFT)^4 - 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.9302$~~
~~B = $0.0015 \times LvgEvap + 0.934$~~
~~LIFT = LvgCond – LvgEvap~~
~~LvgCond = full-load condenser leaving fluid temperature, °F~~
~~LvgEvap = full-load evaporator leaving temperature, °F~~

~~The FL_{adj} and $NPLV_{adj}$ values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:~~

- ~~Minimum Evaporator Leaving Temperature: 36°F~~
- ~~Maximum Condenser Leaving Temperature: 115°F~~
- ~~20°F ≤ LIFT ≤ 80°F~~

Delete current Table B-3 and replace it with the table shown.

Table B-3 (Supersedes Table 6.8.1-3 in ANSI/ASHRAE/IES Standard 90.1)
Water Chilling Packages—Efficiency Requirements (SI) [a,b,e]

Equipment Type	Size Category	Units	Path A	Path B	Test Procedure[c]
Air-cooled chillers	<528 kW	COP_R (W/W)	≥2.985FL	≥2.866 FL	AHRI 551/591
			≥4.048 IPLV.SI	≥4.669 IPLV.SI	
	≥528 kW		≥2.985 FL	≥2.866 FL	
			≥4.137 IPLV.SI	≥4.758 IPLV.SI	
Air cooled without condenser, electrically operated	All Capacities	COP_R (W/W)	Condenserless units shall comply with air cooled chiller requirements with a matched condenser		
Water cooled, electrically operated positive displacement	<264 kW	COP_R (W/W)	≥4.694 FL	≥4.513 FL	
			≥5.867 IPLV.SI	≥7.041 IPLV.SI	
	≥264 kW and <528 kW		≥4.889 FL	≥4.694 FL	
			≥6.286 IPLV.SI	≥7.184 IPLV.SI	
	≥528 kW and <1055 kW		≥5.334 FL	≥5.177 FL	
			≥6.519 IPLV.SI	≥8.001 IPLV.SI	
	≥1055kW and <2110 kW		≥5.771 FL	≥5.633 FL	
			≥6.770 IPLV.SI	≥8.586 IPLV.SI	
	≥2110 kW		≥6.286 FL	≥6.018 FL	
			≥7.041 IPLV.SI	≥9.264 IPLV.SI	
Water cooled, electrically operated centrifugal	<528 kW	COP_R (W/W)	≥5.771 FL	≥5.065 FL	
			≥6.401 IPLV.SI	≥8.001 IPLV.SI	
	≥528 kW and <1055 kW		≥5.771 FL	≥5.544 FL	
			≥6.401 IPLV.SI	≥8.801 IPLV.SI	
	≥1055 kW and <1407kW		≥6.286 FL	≥5.917 FL	
			≥6.770 IPLV.SI	≥9.027 IPLV.SI	
	≥1407 kW and <2110 kW		≥6.286 FL	≥6.018 FL	
			≥7.041 IPLV.SI	≥9.264 IPLV.SI	
	≥2110 kW		≥6.286 FL	≥6.018 FL	
			≥7.041 IPLV.SI	≥9.264 IPLV.SI	
Air-cooled absorption, single effect	All capacities	COP_R (W/W)	≥0.600 FL	NA[d]	AHRI 560
Water-cooled absorption, single effect	All capacities	COP_R (W/W)	≥0.700 FL	NA[d]	
Absorption double effect, indirect fired	All capacities	COP_R (W/W)	≥1.000 FL	NA[d]	
Absorption double effect, direct fired	All capacities	COP_R (W/W)	≥1.050 IPLV	NA[d]	
			≥1.000 FL ≥1.000 IPLV		

a. The requirements for centrifugal chillers shall be adjusted for nonstandard rating conditions per Section 7.4.3.1.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.
b. Both the full-load and IPLV.SI requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.
c. Section 11 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
d. "NA" means the requirements are not applicable for Path B, and only Path A can be used for compliance.
e. "FL" is the full-load performance requirements, and "IPLV.SI" is for the part-load performance requirements and are only applicable for ratings per AHRI 551/591 and AHRI 560.

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FOREWORD

Addendum bw updates the requirements in Table B-4 for electrically operated packaged-terminal air conditioners and packaged-terminal heat pumps. The table is being updated because ASHRAE Standard 90.1-2016 Table 6.8.1-4 has been revised for increased efficiencies for PTAC air conditioners.

There are no industry-defined, higher-tier requirements for PTAC units, but a review of the AHRI directory indicates that there are a significant number of models that have higher efficiencies than are reflected in the current Standard 90.1-2016 numbers, so a slight improvement of 0.4 has been made to the Standard 90.1-2016 new-construction requirements, but replacement was not changed due to the replacement market space constraints. A study of the AHRI directory indicated that a significant number of product models can comply with this requirement.

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 bw to Standard 189.1-2014

Delete the current Table B4 (I-P and SI) and replace with new tables as shown.

Table B-4 (Supersedes Table 6.8.1-4 in ANSI/ASHRAE/IES Standard 90.1)
Electrically Operated Single-Packaged Vertical Air Conditioners and Single-Packaged Vertical Heat Pumps Air-Conditioner Heat Pumps—Minimum Efficiency Requirements (I-P)

Equipment Type	Size Category Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
PTAC (cooling mode) standard size	All capacities	95°F db outdoor air	14.4 – (0.300 × Cap/1000)[c] EER	AHRI 310/380
PTAC (cooling mode) non standard size[b]	All capacities	95°F db outdoor air	10.9 – (0.213 × Cap/1000)[c] EER	AHRI 310/380
PTHP (cooling mode) standard size	All capacities	95°F db outdoor air	14.4 – (0.300 × Cap/1000)[c] EER	ARI 310/380
PTHP (cooling mode) non standard size[b]	<7000 Btu/h	95°F db outdoor air	10.8 – (0.213 × Cap/1000)[c] EER	ARI 310/380
PTHP (heating mode) new constructions	All capacities	47°F db/43°F wb outdoor air	3.7 – (0.052 × Cap/1000)[c] COP_H	ARI 310/380
PTHP (heating mode) non standard size[b]	All capacities	47°F db/43°F wb outdoor air	2.9 – (0.026 × Cap/1000)[c] COP_H	ARI 310/380

a. Section 11 contains a complete specification of the referenced test procedures, including year version of the test procedure.
b. Replacement units shall be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 in. high and 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.

Table B-4 (Supersedes Table 6.8.1-4 in ANSI/ASHRAE/IES Standard 90.1)
Electrically Operated Single-Packaged Vertical Air Conditioners and Single-Packaged Vertical Heat Pumps Air-Conditioner Heat Pumps—Minimum Efficiency Requirements (SI)

Equipment Type	Size Category Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
PTAC (cooling mode) standard size	All capacities	35°C db outdoor air	4.22 – (0.300 × Cap/1000)[c] COP_C	AHRI 310/380
PTAC (cooling mode) non standard size[b]	All capacities	35°C db outdoor air	3.19 – (0.213 × Cap/1000)[c] COP_C	AHRI 310/380
PTHP (cooling mode) standard size	All capacities	35°C db outdoor air	4.22 – (0.300 × Cap/1000)[c] COP_C	ARI 310/380
PTHP (cooling mode) non standard size[b]	<7000 Btu/h	35°C db outdoor air	3.16 – (0.213 × Cap/1000)[c] COP_C	ARI 310/380
PTHP (heating mode) new constructions	All capacities	8.3°C db/6.1°C wb outdoor air	3.7 – (0.052 × Cap/1000)[c] COP_H	ARI 310/380
PTHP (heating mode) non standard size[b]	All capacities	8.3°C db/6.1°C wb outdoor air	2.9 – (0.026 × Cap/1000)[c] COP_H	ARI 310/380

a. Section 11 contains a complete specification of the referenced test procedures, including year version of the test procedure.
b. Replacement units shall be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 0.45 m. high and less than 1.0 m. wide and having a cross-sectional area less than 0.43 m^2.
c. "Cap" means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 2.1 kW, use 2.1 kW in the calculation. If the unit's capacity is greater than 4.4 kW, use 4.4 kW in the calculation.

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FOREWORD

Addendum bx makes changes to Table B-8, "Performance Requirements for Heat-Rejection Equipment," to update some of the efficiency requirements to align with changes in the industry.

In ASHRAE Standard 90.1-2013, Table 6.8.1-7, the efficiency requirements for propeller or axial-fan closed-circuit cooling towers is set at ≥16.1 gpm/hp, while ASHRAE Standard 189.1-2014, Table B-8, lists the efficiency as ≥15.0 gpm/hp, so Table B-8 needs to be updated to the higher-efficiency requirement.

In Title 24 2016, for propeller or axial-fan open-circuit cooling towers, the efficiency level has been increased to 42.1 gpm/hp vs. the efficiency level shown in Table B-8 at 40.2 gpm/hp, so the addendum increases the Standard 189.1, Table B-8, efficiency level to better align with the new Title 24 efficiency level for this product class.

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 189.1-2014

Modify Table B-8 (I-P and SI) as shown.

Table B-8 (Supersedes Table 6.8.1-7 in ANSI/ASHRAE/IES Standard 90.1)
Performance Requirements for Heat-Rejection Equipment (I-P)

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Conditions[g]	Performance Required [a,b,c,d,e,f,i]	Test Procedure[h]
Propeller or axial fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥~~40.2~~42.1 gpm/hp	CTI ATC-105 and CTI STD-201RS
Centrifugal fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥22.0 gpm/hp	CTI ATC-105and CTI STD-201RS
Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥~~15.0~~16.1 gpm/hp	CTI ATC-105S and CTI STD-201RS
Centrifugal fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥8.0 gpm/hp	CTI ATC-105S and CTI STD-201RS
Propeller or axial fan evaporative condensers	All	Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥134,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥110,000 Btu/h·hp	CTI ATC-106
Propeller or axial fan evaporative condensers	All	R-507A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥157,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-507A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥135,000 Btu/h·hp	CTI ATC-106
Air-cooled condensers	All	190°F entering gas temperature 125°F condensing temperature 15°F subcooling 95°F entering wb	≥176,000 Btu/h·hp	AHRI 460

a. For purposes of this table, *open-circuit cooling tower performance* is defined as the water flow rating of the tower at the thermal rating condition listed in Table B-8 divided by the fan motor nameplate power.

b. For purposes of this table, *closed-circuit cooling tower performance* is defined as the process water flow rating of the tower at the thermal rating condition listed in Table B-8 divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.

c. For purposes of this table, *evaporative condenser performance* is defined as the heat rejected at the specified rating condition in the table divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power.

d. For purposes of this table, *air-cooled condenser performance* is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power.

e. The efficiencies and test procedures for both *open-* and *closed-circuit cooling towers* are not applicable to hybrid cooling towers that contain a combination of separate wet and dry heat exchange sections. The certification requirements do not apply to field erected cooling towers.

f. All cooling towers, closed-circuit coolers, evaporative condensers, and air-cooled condensers shall comply with the minimum efficiency listed in the table for that specific type of equipment with the capacity effect of any project specific accessories and/or options included with the equipment.

g. Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A must meet the minimum efficiency requirements listed for R-507A as the test fluid.

h. Informative Appendix G contains information on the referenced test procedures.

i. Not applicable for air-cooled condensers applied to condenserless chillers. The air-cooled condenser and condenserless chiller shall comply with the requirements for air-cooled chillers as defined in Table B-3.

Table B-8 (Supersedes Table 6.8.1-7 in ANSI/ASHRAE/IES Standard 90.1)
Performance Requirements for Heat-Rejection Equipment (SI)

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition[g]	Performance Required [a,b,c,d,e,f,i]	Test Procedure[h]
Propeller or axial fan open-circuit cooling towers	All	35.0°C entering water 29.4°C leaving water 23.9°C entering wb	~~≥3.40~~3.56 L/s kW	CTI ATC-105 and CTI STD-201RS
Centrifugal fan open-circuit cooling towers	All	35.0°C entering water 29.4°C leaving water 23.9°C entering wb	≥1.86 L/s kW	CTI ATC-105 and CTI STD-201RS
Propeller or axial fan closed-circuit cooling towers	All	38.9°C entering water 32.2°C leaving water 23.9°C entering wb	~~≥1.27~~1.36 L/s kW	CTI ATC-105S and CTI STD-201RS
Centrifugal fan closed-circuit cooling towers	All	38.9°C entering water 32.2°C leaving water 23.9°C entering wb	≥0.68 L/s kW	CTI ATC-105S and CTI STD-201RS
Propeller or axial fan evaporative condensers	All	Ammonia test fluid 60.0°C entering gas temperature 35.7°C condensing temperature 23.9°C entering wb	≥52.6 COP	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia test fluid 60.0°C entering gas temperature 35.7°C condensing temperature 23.9°C entering wb	≥43.2 COP	CTI ATC-106
Propeller or axial fan evaporative condensers	All	R-507A test fluid 73.9°C entering gas temperature 40.6°C condensing temperature 23.9°C entering wb	≥61.7 COP	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-507A test fluid 73.9°C entering gas temperature 40.6°C condensing temperature 23.9°C entering wb	≥53.1 COP	CTI ATC-106
Air-cooled condensers	All	88°C entering gas temperature 52°C condensing temperature 8°C subcooling 35°C entering wb	≥69 COP	AHRI 460

a. For purposes of this table, *open-circuit cooling tower performance* is defined as the water flow rating of the tower at the thermal rating condition listed in Table B-8 divided by the fan motor nameplate power.

b. For purposes of this table, *closed-circuit cooling tower performance* is defined as the process water flow rating of the tower at the thermal rating condition listed in Table B-8 divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.

c. For purposes of this table, *evaporative condenser performance* is defined as the heat rejected at the specified rating condition in the table divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power.

d. For purposes of this table, *air-cooled condenser performance* is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power.

e. The efficiencies and test procedures for both *open-* and *closed-circuit cooling towers* are not applicable to hybrid cooling towers that contain a combination of separate wet and dry heat exchange sections. The certification requirements do not apply to field erected cooling towers.

f. All cooling towers, closed-circuit coolers, evaporative condensers and air-cooled condensers shall comply with the minimum efficiency listed in the table for that specific type of equipment with the capacity effect of any project specific accessories and/or options included with the equipment.

g. Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A must meet the minimum efficiency requirements listed for R-507A as the test fluid.

h. Informative Appendix G contains information on the referenced test procedures.

i. Not applicable for air-cooled condensers applied to condenserless chillers. The air-cooled condenser and condenserless chiller shall comply with the requirements for air-cooled chillers as defined in Table B-3.

(This foreword 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.)

FOREWORD

This addendum provides a higher level of indoor moisture control (primarily to reduce the likelihood of microbial growth on interior surfaces and within the building envelope) than is currently required by Standard 189.1's reference to Standard 62.1. These pressurization requirements address air infiltration under design cooling conditions, superseding Section 5.9.2 of Standard 62.1. Standard 62.1 only requires more outdoor air intake flow than exhaust airflow on a whole-building level at design conditions during mechanical cooling operation, which in some cases will not result in positive building pressure over the entire building facade. Due to indoor and outdoor temperature and local exhaust airflow rate fluctuations, and due to wind effects, this addendum includes building pressure control requirements during mechanical cooling operation.

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 by to Standard 189.1-2014

Add new Section 8.3.1.4 and subsections as indicated, and renumber existing sections accordingly.

8.3.1.4 Building Pressure. The requirements in Section 8.3.1.4 supersede the requirements in Section 5.9.2 of ANSI/ASHRAE Standard 62.1. *Building projects* shall be designed in accordance with the following subsections.

8.3.1.4.1 Mechanical Exhaust. Mechanical systems shall include controls capable of disabling exhaust fans and closing exhaust dampers whenever mechanical intake airflow is discontinued.

8.3.1.4.2 Exfiltration. Mechanical air-conditioning systems with dehumidification capability shall include system controls capable of maintaining static pressure inside the building, at the top floor, equal to or greater than the static pressure outside of the building during mechanical cooling operation.

Exceptions:

1. Where excess exhaust is required by process considerations, such as certain industrial or healthcare facilities
2. Warehouse facilities
3. Buildings in Climate Zones 1b, 2b, 3b, 3c, 4b, 4c, 5, 6, 7 and 8

(This foreword 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.)

FOREWORD

Addendum bz updates Normative Appendix B by deleting several tables per the following approach. Where tables exist that are neither exactly the same as similar product tables in ASHRAE Standard 90.1-2016 nor less efficient than tables that have been updated in Standard 90.1-2016, and where no higher-tier CEE, EnergyStar, or other industry tables exist for higher efficiencies, this addendum deletes the tables from Standard 189.1 and cross references those in Standard 90.1-2016.

Where Standard 90.1-2016 adds new efficiency requirements for products not listed in tables in Appendix B of Standard 189.1-2014, Addendum bz specifically references these tables as well as the equivalent tables that are being deleted.

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 bz to Standard 189.1-2014

Delete the following I-P and SI tables.

~~**Table B-3 Water-Chilling Packages**~~
~~**Table B-10 Commercial Refrigerator and Freezers**~~
~~**Table B-14 Commercial Refrigeration Minimum Efficiency Requirements**~~
~~**Table B-15 Low-Voltage Dry-Type Distribution Transformers**~~

Revise Section 7.4.3.1 as follows.

7.4.3.1 Minimum Equipment Efficiencies for the Alternate Renewables Approach. All building projects complying with the Alternate Renewables Approach in Section 7.4.1.1.2 shall comply with the applicable equipment efficiency requirements in Normative Appendix B and the applicable ENERGY STAR requirements in Section 7.4.7.3.2. Where equipment efficiency is not defined/listed in Normative Appendix B or in Section 7.4.7.3.2, the equipment shall meet the minimum efficiency requirements defined/listed in ASHRAE/ANSI/IES Standard 90.1. Specifically, this applies to the following products in these tables in ASHRAE/ANSI/IES Standard 90.1:

a. Table 6.8.1.3, "Water-Chilling Packages—Minimum Efficiency Requirements"
b. Table 6.8.1-11, "Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements"
c. Table 6.8.1-12, "Commercial Refrigerator and Freezers—Minimum Efficiency Requirements—Minimum Efficiency Requirements"
d. Table 6.8.1-13, "Commercial Refrigeration—Minimum Efficiency Requirements—Minimum Efficiency Requirements"
e. Table 6.8.1-14, "Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements"
f. Table 6.8.1-15, "Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements"
g. Table 6.8.1-16, "Electrically Operated DX-DOAS Units, Single Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements"
h. Table 10.8-1, "Minimum Nominal Full-Load Efficiency for NEMA Design A, NEMA Design B, and IEC Design N Motors (Excluding Fire Pump Electric Motors)"
i. Table 10.8-2, "Minimum Nominal Full-Load Efficiency for NEMA Design C and IEC Design H Motors"
j. Table 10.8-3, "Minimum Average Full-Load Efficiency for Polyphase Small Electric Motors"
k. Table 10.8-4, "Minimum Average Full-Load Efficiency for Capacitor-Start Capacitor-Run and Capacitor-Start Induction-Run Small Electric Motors"
l. Table 10.8-5, "Minimum Nominal Full-Load Efficiency for Fire Pump Electric Motors"

(This foreword 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.)

FOREWORD

Addendum cd revises the daylight requirements in Section 8.4, "Prescriptive Compliance Path," and Section 8.5, "Performance Option." These revisions incorporate the latest information on daylighting performance metrics and create a more comprehensive approach to daylighting in the standard. Daylighting in commercial buildings has been compromised in many instances because of visual discomfort from glare or high contrast ratios, or due to poor distribution and control of the daylight.

Daylight is an essential element of a healthy and productive indoor environment. Numerous research studies and occupant evaluations of commercial buildings have found that providing daylight to meet the illumination requirements of building occupants improves their well being, satisfaction, health, performance, and productivity.

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 cd to Standard 189.1-2014

Modify Section 3.2 as shown.

annual sunlight exposure (ASE): the percent of an analysis area that exceeds a specified direct sunlight illuminance level for more than a specified number of hours per year (Source: IES LM 83). *Annual sunlight exposure* is a metric that quantifies the potential for excessive sunlight in interior work environments.

spatial daylight autonomy (sDA): the percent of an analysis area that meets a minimum daylight illuminance level for a specified fraction of the hours per year (Source: IES LM 83). *Spatial daylight autonomy* is a metric quantifying annual sufficiency of ambient daylight levels in interior spaces.

Modify Section 8.4.1 as shown.

8.4.1 Daylighting

8.4.1.1 Daylighting in Large Spaces Directly under a Roof and Having High Ceilings. Enclosed spaces, including conditioned and unconditioned spaces, meeting all of the following criteria, shall comply with Sections 8.4.1.1.1, 8.4.1.1.2 and 8.4.1.1.3:

a. The space is in a building with three stories or fewer above grade.
b. The space area is greater than 2500 ft^2 (232 m^2).
c. The space is located directly under a *roof* and average ceiling heights are greater than 15 ft (4.6 m).

Exceptions to Section 8.4.1.1:

1. *Spaces* in buildings located in *Climate Zones* 7 or 8.
2. Auditoria, motion picture theaters, performing arts theaters, museums, places of worship, and refrigerated warehouses.
3. *Enclosed spaces* where documentation shows that existing structures or natural objects block direct sunlight on at least 50% of the *roof* over the *enclosed space* at all three of the following times on the date of the spring equinox: three hours before solar noon (peak solar altitude), at solar noon, and three hours after solar noon.

8.4.1.1.1 Minimum Daylight Area. Not less than ~~A minimum of~~ 50% of the floor area shall be in the *daylight area* as defined in Section 3. For the purposes of Section 8.4.1.1.1, the definition of *daylight area* shall be modified such that partitions and other obstructions that are less than the ceiling height are disregarded. *Daylight areas* shall be under *skylights*, under *roof monitors*, or in the primary or secondary sidelighted areas and shall meet not less than ~~at least~~ one of the following requirements:

a. The combined area of the *skylights* within the space shall be not ~~no~~ less than 3% of the calculated *daylight area* under *skylights*.
b. The *space* shall have a *skylight effective aperture* of not less than ~~at least~~ 1%.
c. The combined area within the space of any *vertical fenestration* in *roof monitors* shall be not ~~no~~ less than 20% of the *calculated daylight area under roof monitors*.
d. *Primary sidelighted* areas shall have a *sidelighting effective aperture* of not ~~no~~ less than 0.15.
e. *Secondary sidelighted areas* shall have a *sidelighting effective aperture* of not ~~no~~ less than 0.30.

8.4.1.1.2 Visible Transmittance (VT) of *Skylights* and *Roof Monitors*. The visible transmittance of *skylights* and *roof monitors* for *daylight areas* used to comply with Section 8.4.1.1.1 shall be not ~~no~~ less than 0.40. For *dynamic glazing*, the highest labeled VT shall be used for compliance with this section.

Exception: *Enclosed spaces* that have a *skylight effective aperture* of not less than ~~at least~~ 1%.

8.4.1.1.3 Skylight Optical Diffusion Characteristics. Skylights used to comply with Section 8.4.1.1.1 shall have a glazing material or diffuser that has a measured haze value greater than 90%, when tested in accordance with ASTM D1003 or other test method approved by the AHJ.

Exceptions:

1. *Skylights* with a measured haze value less than or equal to 90% ~~whose~~ and having a combined area ~~does~~ not ~~exceed~~ in excess of 5% of the total *skylight* area.
2. *Tubular daylighting devices* having a diffuser.
3. *Skylights* designed to prevent direct sunlight from entering the occupied *space* below during occupied hours.

4. *Skylights* in transportation terminals and concourses, sports arenas, convention centers, atria, and shopping malls.

8.4.1.2 Minimum *Sidelighting Effective Aperture* ~~for Office Spaces and Classrooms~~. The spaces listed in Table 8.4.1.2A shall comply with items a, b and c. ~~Office spaces and classrooms shall comply with the following criteria:~~

a. ~~All~~The north-, south-, and east-facing façades shall have a minimum *sidelighting effective aperture* as prescribed in Table 8.4.1.2B.
b. For all façades, the combined width of the *primary sidelighted areas* shall be not less than ~~at least~~ 75% of the length of the façade *wall*.
c. ~~All~~ Opaque interior surfaces in *daylight areas* shall have average visible light reflectances greater than or equal to 80% for ceilings, 40% for partitions higher than 60 in. (1.5 m), and 60% for *walls*.

Exceptions:

1. Spaces not adjacent to an exterior wall.
~~1.~~2. A *space* that would have tasks or activities requiring routine dark conditions for more than 4 daytime hours per day. ~~*Spaces* with tasks that requires dark conditions~~
~~2.~~3. *Spaces* covered by and in compliance with Section 8.4.1.1 without the use of any exception.
~~3.~~4. *Daylight areas* where the height of existing adjacent structures above the window is not less than ~~at least~~ twice the distance between the window and the adjacent structures, measured from the top of the glazing.
5. Existing buildings undergoing alteration, repair, relocation or a change in occupancy.

8.4.1.3 ~~Office Space~~ Shading for Offices. For office spaces 250 ft^2 (23 m^2) and larger, each ~~Each west-, south-, and east-facing~~ façade~~,~~ shall be designed with a shading *projection factor* (*PF*). The *PF* shall be not less than 0.5. Shading is allowed to be external or internal using the *interior PF*. ~~The building is allowed to be rotated up to 45 degrees for purposes of calculations and showing compliance~~. ~~The following shading devices are allowed to be used.~~ Shading devices shall be limited to the following:

a. Louvers, sun shades, light shelves, and any other permanent device. Any *vertical fenestration* that employs a combination of interior and external shading is allowed to be separated into multiple segments for compliance purposes, each segment shall comply with the requirements for either external or *interior projection factor*.
b. Building self-shading through *roof* overhangs or recessed windows.

Exceptions to 8.1.4.3:

1. Facades facing within 45 degrees of true north in the northern hemisphere or facades facing 45 degrees from true south in the southern hemisphere.
~~1.~~2. Translucent panels and glazing systems with a measured haze value greater than 90%, when tested according to ASTM D1003 (~~notwithstanding its scope~~) or other test method approved by the AHJ, and that are entirely 8 ft (2.5 m) above the floor, do not require external shading devices.
~~2.~~3. *Vertical fenestration* that receives direct solar radiation for less than 250 hours per year because of shading by permanent external buildings, existing permanent infrastructure, or topography.
~~3.~~4. *Vertical fenestration* with automatically controlled shading devices in compliance with Exception (2) of Section 7.4.2.5.
~~4.~~5. *Vertical fenestration* with automatically controlled dynamic glazing in compliance with Exception (3) of Section 7.4.2.5.
6. Existing buildings undergoing alteration, repair, relocation or a change in occupancy.

Table 8.4.1.2A Daylit Spaces

Classroom/training room
Conference /meeting/multipurpose room except in convention centers
Lounge/breakroom
Enclosed office and open plan office
Library reading area
Patient rooms and physical therapy rooms within a healthcare facility

Table 8.4.1.2B Minimum *Sidelighting* Effective Aperture

Climate Zone	Minimum *Sidelighting* Effective Aperture
0, 1, 2, 3A, 3B	0.10
3C, 4, 5, 6, 7, 8	0.15

Modify Section 8.5.1 as shown.

8.5.1 Daylight~~ing~~ Simulation. For the *spaces* listed in Table 8.4.1.2A and any spaces required to have daylighting in accordance with section 8.4.1.1, the total floor area shall be calculated and computer modeling shall be used to determine that the requirements specified in Sections 8.5.1.1 and 8.5.1.2 are met. Computer models shall use an hourly simulation and shall adhere to the modeling protocols described in IES LM 83 for *spatial daylight autonomy* (*sDA*) calculations in Section 8.5.1.1 and *annual sunlight exposure* (*ASE*) calculations in Section 8.5.1.2.

~~**8.5.1.1 Usable Daylight Illuminance in Large Spaces**. In buildings three stories and fewer above grade, enclosed spaces, including conditioned and unconditioned spaces, with floor area greater than 5000 ft² (465 m²) directly under a roof with average ceiling heights greater than 15 ft (4.6 m) and with a lighting power allowance for general lighting equal to or greater than 0.5 W/ft² (5.4 W/m²), a physical or computer model for the building project shall be used to demonstrate a calculated illuminance from daylight of no less than 25 fc (250 lux) at 9:00 a.m. and 3:00 p.m. on the date of the spring equinox for at least half of the space. Daylight illuminances resulting from a physical model or computer daylighting~~

~~model are to be calculated for a plane 2.5 ft (0.8 m) above the floor and need not include storage racks or internal obstructions other than walls and permanent partitions. The simulation shall include daylight illuminance calculations with no more than 5 ft (1.5 m) between calculation points.~~

~~a. Computer models shall be built using daylight simulation software based on the ray-tracing or radiosity methodology.~~
~~b. Simulation and normalized physical model results shall be based on external daylight illuminance using either the CIE Overcast Sky Model or the CIE Clear Sky Model for the location of the project.~~
~~c. For office spaces, the same model (including shading) used to show compliance with Section 8.5.1.3 shall be used in the calculation of illuminances.~~

~~Exceptions to 8.5.1.1:~~

~~1. Buildings in Climate Zones 7 or 8.~~
~~2. Auditoria, motion picture theaters, performing arts theaters, museums, places of worship, and refrigerated warehouses.~~
~~3. Enclosed spaces where it is documented that existing structures or natural objects block direct beam sunlight on at least 50% of the roof over the enclosed space at all three of the following times on the date of the spring equinox: three hours before solar noon (peak solar altitude), at solar noon, and three hours after solar noon.~~

~~8.5.1.2 Usable Daylight Illuminance in Office Spaces and Classrooms~~~~. The physical or computer model for the building project shall demonstrate that at least 75% of the area within one ceiling height of the perimeter walls has a calculated daylight illuminance of at least 25 fc (250 lux) at 9:00 a.m. and 3:00 p.m. on the date of the spring equinox. The physical or computer daylighting model shall calculate daylight illuminance on a plane 2.5 ft (0.8 m) above the floor with no more than 5 ft (1.5 m) between calculation points. The simulation need not include storage racks or internal obstructions other than walls and permanent partitions.~~

~~a. Computer models shall use daylight simulation software based on the ray-tracing or radiosity methodology. b. Simulation and normalized physical model results shall be based on external daylight illuminance using either the CIE Overcast Sky Model or the CIE Clear Sky Model for the location of the project.~~
~~b. Simulation and normalized physical model results shall be based on external daylight illuminance using either the CIE Overcast Sky Model or the CIE Clear Sky Model for the location of the project.~~
~~c. For office spaces, the same model (including shading) used to show compliance with Section 8.5.1.3 shall be used in the calculation of illuminances.~~

~~Exceptions to 8.5.1.2:~~

~~1. Spaces with tasks that require dark conditions (e.g., photographic processing).~~
~~2. Spaces that are covered by and compliant with the requirements of Section 8.5.1.1 without using exceptions.~~
~~3. Daylight areas where the height of existing adjacent structures above the window is at least twice the distance between the window and the adjacent structures, measured from the top of the glazing.~~

~~8.5.1.3 Direct Sun Limitation on Worksurfaces in Offices.~~ ~~It shall be demonstrated that direct sun does not strike anywhere on a work surface in any daylighted space for more than 20% of the occupied hours during an equinox day in regularly occupied office spaces. If the work surface height is not defined, a height of 2.5 ft (0.75 m) above the floor shall be used.~~

8.5.1.1 Minimum Daylight. The computed area-weighted *sDA* shall be not less than 40%.

The *sDA* within each space shall be calculated in accordance with the methodology of IES LM 83. Calculations shall be made on the basis of 28 fc (300 lux) for all *spaces*, with the exception of the following *space* types, which shall be calculated on the basis of 14 fc (150 lux): health-care patient rooms, post-office sorting areas, gymnasia, big box retail, transportation facility terminal ticket counters, airport concourses, and nonrefrigerated warehouses.

Exceptions to 8.5.1.1:

1. A *space* used for tasks or activities requiring routine dark conditions for more than 4 daytime hours per day.
2. A *space* where the height of existing facing structures above the *vertical fenestration* is not less than twice the distance between the *vertical fenestration* and facing structures, measured from the top of the glazing.

8.5.1.2 Excessive Sunlight. The *ASE*, calculated with a threshold of 93 fc (1000 lux) and 250 hours, shall not exceed 20% of the floor area.

Exceptions to 8.5.1.2:

1. Spaces less than 250 ft^2 (23 m^2)
2. *Vertical fenestration* with automatically controlled shading devices in compliance with Section 7.4.2.5, Exception (2).
3. *Vertical fenestration* with automatically controlled dynamic glazing in compliance with Section 7.4.2.5, Exception (3).

Modify Section 11 as shown.

Reference	Title	Section
[. . .]		
Illuminating Engineering Society 120 Wall Street, Floor 17 New York, NY 10005-4001, United States 1-212-248-5017, www.ies.org		
TM-15-2011 including addendum "a"	Luminaire Classification System for Outdoor Luminaires	5.3.3.2
LM 83	Approved Method: IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE)	8.5.1
[. . .]		

(This foreword 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.)

FOREWORD

This addendum contains modifications to the mandatory and prescriptive requirements for peak load reduction in Section 7. The existing prescriptive requirement in Section 7.4.5.1 is deleted, and a mandatory requirement is added in Section 7.3.4. The new mandatory language is similar to the previous prescriptive requirement, with one change: the exception for buildings that comply with the high-efficiency path of the minimum equipment efficiency requirement has been removed. All projects must now meet the mandatory requirement, regardless of the chosen equipment efficiency path.

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 ce to Standard 189.1-2014

Modify Section 7 as follows.

7.3.4 Peak Load Reduction. *Building projects* shall contain automatic systems, such as demand limiting or load shifting, that are capable of reducing electric peak demand of the building by not less than 10% of the projected peak demand. Standby power generation shall not be used to achieve the reduction in peak demand.

[. . .]

~~**7.4.5 Power.** The power shall comply with Section 8 of ANSI/ASHRAE/IES Standard 90.1 with the following modifications and additions.~~

~~**7.4.5.1 Peak Load Reduction.** *Building projects* shall contain automatic systems, such as demand limiting or load shifting, that are capable of reducing electric peak demand of the building by not less than 10% of the projected peak demand. Standby power generation shall not be used to achieve the reduction in peak demand.~~

~~Building projects complying with the Alternate Renewables Approach in Section 7.4.1.1.2 and containing automatic systems, such as demand limiting or load shifting, that are capable of reducing electric peak demand by not less than 5% of the projected peak demand.~~

(This foreword 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.)

FOREWORD

Addendum cf updates Informative Appendix E to make it consistent with changes contained in previously approved addendum k, which modified the building envelope requirements in Section 7.4.2.1. It also adds tables for Climate Zone 0, consistent with addendum q.

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 cf to Standard 189.1-2014

Revised the text of Appendix E as shown.

(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.)

INFORMATIVE APPENDIX E *BUILDING ENVELOPE* TABLES

The first nine ~~eight~~ tables are in I-P units, followed by nine ~~eight~~ tables in SI units. U-factors, C-factors, F-factors, and *SHGC* in these tables meet the requirements of Section 7.4.2.1, although the R-values in most cases provide more insulation than is required in Section 7.4.2.1. These R-values represent common assemblies in building construction. Assemblies with lower R-values are allowed to be used to meet the criteria of Section 7.4.2.1 when they meet the appropriate U-factor, C- factor, or F-factor criteria.

Add new Table E-0 (I-P and SI), and delete Tables E-1 through E-8 (I-P and SI) in their entirety and replace with the tables shown.

Table E-0 (Supersedes Table 5.5-0 in ANSI/ASHRAE/IES Standard 90.1)
Building Envelope Requirements For Climate Zone 0 (A,B)* (I-P)

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.039	R-25 c.i.	U-0.032	R-30 c.i.	U-0.218	R-3.8 c.i.
Metal building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
Attic and other	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
Walls, above grade						
Mass[b]	U-0.580	NR	U-0.151	R-5.7 c.i.	U-0.580	NR
Metal building	U-0.094	R-0 + R-9.8 ci	U-0.094	R-0 + R-9.8 ci	U-0.352	NR
Steel framed	U-0.124	R-13	U-0.124	R-13	U-0.352	NR
Wood framed and other	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
Wall, below grade						
Below-grade *wall*	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.322	NR	U-0.322	NR	U-0.322	NR
Steel joist	U-0.350	NR	U-0.350	NR	U-0.350	NR
Wood framed and other	U-0.282	NR	U-0.282	NR	U-0.282	NR
Slab-on-grade floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque doors						
Swinging	U-0.370		U-0.370		U-0.700	
Nonswinging	U-0.310		U-0.310		U-1.450	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max.U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of wall		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing (all)	U-0.30	E&W-0.21, N&S-0.22	1.10	U-0.30	E&W-0.21, N&S-0.22	1.10	U-0.88	NR	NR
Metal framing, fixed	U-0.48			U-0.48			U-1.14		
Metal framing, operable	U-0.62			U-0.62			U-1.14		
Metal framing, entrance door	U-0.79			U-0.79			U-1.05		
Skylight, 0% to 3% of roof									
All types	U-0.71	0.33	NR	U-0.71	0.33	NR	U-1.71	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

b. Exception applies for mass *walls* above grade where the requirement is for a maximum assembly U-0.151 (see ANSI/ASHRAE/IES Standard 90.1, Section 5.5.3.2).

Table E-1 (Supersedes Table 5.5-1 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 1 (A,B)* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.048	R-20 c.i.	U-0.039	R-25 c.i.	U-0.218	R-3.8 c.i.
Metal building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
Attic and other	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
Walls, above grade						
Mass[b]	U-0.580	NR	U-0.151	R-5.7 c.i.	U-0.580	NR
Metal building	U-0.094	R-0 + R-9.8 c.i.	U-0.094	R-0 + R-9.8 c.i.	U-0.352	NR
Steel framed	U-0.124	R-13	U-0.124	R-13	U-0.352	NR
Wood framed and other	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
Wall, below grade						
Below-grade *wall*	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.322	NR	U-0.322	NR	U-0.322	NR
Steel joist	U-0.350	NR	U-0.350	NR	U-0.350	NR
Wood framed and other	U-0.282	NR	U-0.282	NR	U-0.282	NR
Slab-on-grade floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque doors						
Swinging	U-0.370		U-0.370		U-0.700	
Nonswinging	U-0.310		U-0.310		U-1.450	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.48	E&W-0.24, S-0.25, N-0.35,	1.10	U-0.48	E&W-0.24, S-0.25, N-0.35,	1.10	U-0.88	NR	NR
Metal framing, fixed	U-0.54			U-0.54			U-1.14		
Metal framing, operable	U-0.62			U-0.62			U-1.14		
Metal framing, entrance door	U-1.05			U-1.05			U-1.05		
Skylight, 0% to 3% of *roof*									
All types	U-0.71	0.33	NR	U-0.71	0.33	NR	U-1.71	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

b. Exception applies for mass *walls* above grade where the requirement is for a maximum assembly U-0.151 (see ANSI/ASHRAE/IES Standard 90.1, Section 5.5.3.2).

Table E-2 (Supersedes Table 5.5-2 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 2 (A,B)* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.039	R-25 c.i.	U-0.039	R-25 c.i.	U-0.173	R-5 c.i.
Metal building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.096	R-16
Attic and other	U-0.027	R-38	U-0.027	R-38	U-0.053	R-19
Walls, above grade						
Mass[b]	U-0.151	R-5.7 c.i.	U-0.123	R-7.6 c.i.	U-0.580	NR
Metal building	U-0.094	R-0 + R-9.8 c.i.	U-0.094	R-0 + R-9.8. c.i.	U-0.162	R-13
Steel framed	U-0.084	R-13 + R-3.8 c.i.	U-0.064	R-13 + R-7.5 c.i.	U-0.124	R-13
Wood framed and other	U-0.089	R-13	U-0.089	R-13	U-0.089	R-13
Wall, below grade						
Below-grade *wall*	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.107	R-6.3 c.i.	U-0.087	R-8.3 c.i.	U-0.322	NR
Steel joist	U-0.038	R-30	U-0.038	R-30	U-0.069	R-13
Wood framed and other	U-0.033	R-30	U-0.033	R-30	U-0.066	R-13
Slab-on-grade floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-0.900	R-10 for 24 in.	F-0.860	R-15 for 24 in.	F-1.020	R-7.5 for 12 in.
Opaque doors						
Swinging	U-0.370		U-0.370		U-0.700	
Nonswinging	U-0.310		U-0.310		U-1.450	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.35	E&W-0.24, S-0.25, N-0.35	1.10	U-0.35	E&W-0.24, S-0.25, N-0.35	1.10	U-0.88	NR	NR
Metal framing, fixed	U-0.51			U-0.51			U-1.14		
Metal framing, operable	U-0.62			U-0.62			U-1.14		
Metal framing, entrance door	U-0.79			U-0.73			U-0.79		
Skylight, 0% to 3% of *roof*									
All types	U-0.62	0.33	NR	U-0.62	0.33	NR	U-1.71	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

b. Exception applies for mass *walls* above grade where the requirement is for a maximum assembly U-0.151 (see ANSI/ASHRAE/IES Standard 90.1, Section 5.5.3.2).

Table E-3 (Supersedes Table 5.5-3 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 3 (A,B,C)* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.039	R-25 c.i.	U-0.039	R-25 c.i.	U-0.119	R-7.6 c.i.
Metal building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.096	R-16
Attic and other	U-0.027	R-38	U-0.027	R-38	U-0.053	R-19
Walls, above grade						
Mass	U-0.123	R-7.6 c.i.	U-0.104	R-9.5 c.i.	U-0.580	NR
Metal building	U-0.094	R-0 + R-9.8 c.i.	U-0.072	R-0 + R-13 c.i.	U-0.162	R-13
Steel framed	U-0.077	R-13 + R-5 c.i.	U-0.064	R-13 + R-7.5 c.i.	U-0.124	R-13
Wood framed and other	U-0.089	R-13	U-0.064	R-13 + R-3.8 c.i.	U-0.089	R-13
Wall, below grade						
Below-grade *wall*	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.074	R-10 c.i.	U-0.074	R-10 c.i.	U-0.137	R-4.2 c.i.
Steel joist	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
Wood framed and other	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
Slab-on-grade floors						
Unheated	F-0.730	NR	F-0.540	R-10 for 24 in.	F-0.730	NR
Heated	F-0.860	R-15 for 24 in.	F-0.860	R-15 for 24 in.	F-1.020	R-7.5 for 12 in.
Opaque doors						
Swinging	U-0.370		U-0.370		U-0.370	
Nonswinging	U-0.310		U-0.310		U-0.360	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.31	E&W-0.24, S-0.25, N-0.35	1.10	U-0.33	E&W-0.24, S-0.25, N-0.35	1.10	U-0.83	NR	NR
Metal framing, fixed	U-0.43			U-0.47			U-1.14		
Metal framing, operable	U-0.57			U-0.57			U-1.14		
Metal framing, entrance door	U-0.73			U-0.65			U-0.73		
Skylight, 0% to 3% of *roof*									
All types	U-0.52	0.33	NR	U-0.52	0.33	NR	U-1.62	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-4 (Supersedes Table 5.5-4 in ANSI/ASHRAE/IES Standard 90.1)
Building Envelope Requirements for *Climate Zone* 4 (A,B,C)* (I-P)

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.030	R-35 c.i.	U-0.030	R-35 c.i.	U-0.088	R-11 c.i.
Metal building[a]	U-0.035	R-11 + R-19 c.i.	U-0.035	R-11 + R-19 c.i.	U-0.078	R-19 + R-6.5 c.i.
Attic and other	U-0.020	R-60	U-0.020	R-60	U-0.032	R-38
Walls, above grade						
Mass	U-0.099	R-11.4 c.i.	U-0.086	R-13.3 c.i.	U-0.580	NR
Metal building	U-0.057	R-11 + R-13 c.i.	U-0.048	R-11 + R-15.8 c.i.	U-0.154	R-19
Steel framed	U-0.061	R-13 + R-12.5 c.i.	U-0.061	R-13 + R-12.5 c.i.	U-0.118	R-13 + R-3.8 c.i.
Wood framed and other	U-0.061	R-13 + R-7.5 c.i.	U-0.061	R-13 + R-7.5 c.i.	U-0.085	R-13 + R-3.8 c.i.
Wall, below grade						
Below-grade *wall*	C-0.113	R-10.0 c.i.	C-0.087	R-12.5 c.i.	C-1.140	NR
Floors						
Mass	U-0.054	R-16.7 c.i.	U-0.048	R-18.7 c.i.	U-0.102	R-8.3 c.i.
Steel joist	U-0.036	R-38	U-0.036	R-38	U-0.049	R-30
Wood framed and other	U-0.031	R-38	U-0.031	R-38	U-0.048	R-30
Slab-on-grade floors						
Unheated	F-0.494	R-20 for 48 in.	F-0.494	R-20 for 48 in.	F-0.730	NR
Heated	F-0.801	R-20 for 48 in.	F-0.654	R-20 full slab	F-0.855	R-20 for 24 in.
Opaque doors						
Swinging	U-0.352		U-0.352		U-0.352	
Nonswinging	U-0.295		U-0.295		U-0.342	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.29	E&W-0.34, S-0.36, N-0.46	1.10	U-0.29	E&W-0.34, S-0.36, N-0.46	1.10	U-0.48	NR	NR
Metal framing, fixed	U-0.36			U-0.36			U-0.69		
Metal framing, operable	U-0.44			U-0.44			U-0.77		
Metal framing, entrance door	U-0.65			U-0.65			U-0.73		
Skylight, 0% to 3% of *roof*									
All types	U-0.48	0.38	NR	U-0.48	0.38	NR	U-1.09	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-5 (Supersedes Table 5.5-5 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 5 (A,B,C)* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.030	R-35 c.i.	U-0.030	R-35 c.i.	U-0.060	R-17 c.i.
Metal building[a]	U-0.035	R-11 + R-19 c.i.	U-0.035	R-11 + R-19 c.i.	U-0.078	R-19 + R-6.5 c.i.
Attic and other	U-0.020	R-60	U-0.020	R-60	U-0.032	R-38
Walls, above grade						
Mass	U-0.086	R-13.3 c.i.	U-0.076	R-15.0 c.i.	U-0.143	R-7.5 c.i.
Metal building	U-0.048	R-11 + R-15.8 c.i.	U-0.048	R-11 + R-15.8 c.i.	U-0.089	R-11 + R-6.5 c.i.
Steel framed	U-0.052	R-13 + R-12.5 c.i.	U-0.052	R-13 + R-12.5 c.i.	U-0.080	R-13 + R-5.0 c.i.
Wood framed and other	U-0.048	R-13 + R-12.5 c.i.	U-0.048	R-13 + R-12.5 c.i.	U-0.085	R-13 + R-3.8 c.i.
Wall, below grade						
Below-grade *wall*	C-0.113	R-10.0 c.i.	C-0.087	R-12.5 c.i.	C-1.140	NR
Floors						
Mass	U-0.054	R-16.7 c.i.	U-0.048	R-18.7 c.i.	U-0.102	R-8.3 c.i.
Steel joist	U-0.036	R-38	U-0.036	R-38	U-0.049	R-30
Wood framed and other	U-0.031	R-38	U-0.031	R-38	U-0.048	R-30
Slab-on-grade floors						
Unheated	F-0.494	R-20 for 48 in.	F-0.485	R-20 for 48 in.	F-0.730	NR
Heated	F-0.654	R-20 full slab	F-0.654	R-20 full slab	F-0.855	R-20 for 24 in.
Opaque doors						
Swinging	U-0.352		U-0.352		U-0.352	
Nonswinging	U-0.295		U-0.295		U-0.342	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/ *SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.29	E&W-0.36, S-0.38, N-0.48	1.10	U-0.29	E&W-0.36, S-0.38, N-0.48	1.10	U-0.43	NR	NR
Metal framing, fixed	U-0.36			U-0.36			U-0.59		
Metal framing, operable	U-0.44			U-0.44			U-0.67		
Metal framing, entrance door	U-0.65			U-0.65			U-0.73		
Skylight, 0% to 3% of *roof*									
All types	U-0.48	0.38	NR	U-0.48	0.38	NR	U-0.93	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-6 (Supersedes Table 5.5-6 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 6 (A,B)* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.030	R-35 c.i.	U-0.030	R-35 c.i.	U-0.060	R-17 c.i.
Metal building[a]	U-0.029	R-30 + R-11 *Ls*	U-0.028	R-10 + R-19 + R-13 c.i.	U-0.057	R-10 + R-10 + R-6.5 c.i.
Attic and other	U-0.020	R-60	U-0.020	R-60	U-0.032	R-38
Walls, above grade						
Mass	U-0.076	R-15.0 c.i.	U-0.067	R-17.5 c.i.	U-0.143	R-7.5 c.i.
Metal building	U-0.048	R-11 + R-15.8 c.i.	U-0.048	R-11 + R-15.8 c.i.	U-0.089	R-11 + R-6.5 c.i.
Steel framed	U-0.047	R-13 + R-15.6 c.i.	U-0.047	R-13 + R-15.6 c.i.	U-0.080	R-13 + R-5 c.i.
Wood framed and other	U-0.048	R-13 + R-12.5 c.i.	U-0.048	R-13 + R-12.5 c.i.	U-0.085	R-13 + R-3.8 c.i.
Wall, below grade						
Below-grade *wall*	C-0.087	R-12.5 c.i.	C-0.060	R-17.5 c.i.	C-0.113	R-10.0 c.i.
Floors						
Mass	U-0.048	R-18.7 c.i.	U-0.048	R-18.7 c.i.	U-0.083	R-10 c.i.
Steel joist	U-0.030	R-49.0	U-0.030	R-49	U-0.049	R-30
Wood framed and other	U-0.026	R-38+ R-7.5 c.i.	U-0.026	R-38 + R-7.5 c.i.	U-0.048	R-30
Slab-on-grade floors						
Unheated	F-0.485	R-20 for 48 in.	F-0.412	R-15 full slab	F-0.730	NR
Heated	F-0.654	R-20 full slab	F-0.637	R-20 full slab	F-0.817	R-20 for 48 in.
Opaque doors						
Swinging	U-0.352		U-0.352		U-0.352	
Nonswinging	U-0.295		U-0.295		U-0.342	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.29	E&W-0.38, S-0.40, N-0.50	1.10	U-0.29	E&W-0.38, S-0.40, N-0.50	1.10	U-0.43	NR	NR
Metal framing, fixed	U-0.34			U-0.34			U-0.48		
Metal framing, operable	U-0.43			U-0.43			U-0.56		
Metal framing, entrance door	U-0.65			U-0.65			U-0.73		
Skylight, 0% to 3% of *roof*									
All types	U-0.48	0.38	NR	U-0.48	0.38	NR	U-0.81	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; *Ls* = *liner system* (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.4).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-7 (Supersedes Table 5.5-7 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 7* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.027	R-40 c.i.	U-0.027	R-40 c.i.	U-0.037	R-26 c.i.
Metal building [a]	U-0.028	R-10 + R19 + R-13 c.i.	U-0.028	R-10 + R19 + R-13 c.i.	U-0.035	R-11 + R-19 c.i.
Attic and other	U-0.016	R-71	U-0.016	R-71	U-0.026	R-49
Walls, above grade						
Mass	U-0.067	R-17.5 c.i.	U-0.067	R-17.5 c.i.	U-0.117	R-9.5 c.i.
Metal building	U-0.042	R-11 + R-19 c.i.	U-0.042	R-11 + R-19 c.i.	U-0.068	R-11 + R-9.8 c.i.
Steel framed	U-0.047	R-13 + R-15.6 c.i.	U-0.040	R-13 + R-18.8 c.i.	U-0.061	R-13 + R-12.5 c.i.
Wood framed and other	U-0.048	R-13 + R-12.5 c.i.	U-0.048	R-13 + R-12.5 c.i.	U-0.061	R-13 + R-7.5 c.i.
Wall, below grade						
Below-grade *wall*	C-0.060	R-17.5 c.i.	C-0.060	R-17.5 c.i.	C-0.113	R-10.0 c.i.
Floors						
Mass	U-0.040	R-23 c.i.	U-0.040	R-23 c.i.	U-0.070	R-12.5 c.i.
Steel joist	U-0.030	R-49	U-0.030	R-49	U-0.049	R-30
Wood framed and other	U-0.026	R-38+ R-7.5 c.i.	U-0.026	R-38 + R-7.5 c.i.	U-0.048	R-30
Slab-on-grade floors						
Unheated	F-0.485	R-20 for 48 in.	F-0.412	R-15 full slab	F-0.730	NR
Heated	F-0.637	R-20 full slab	F-0.637	R-20 full slab	F-0.817	R-20 for 48 in.
Opaque doors						
Swinging	U-0.352		U-0.352		U-0.352	
Nonswinging	U-0.295		U-0.295		U-0.295	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.27	E&W-0.43, S-0.45, N-0.55	1.10	U-0.27	E&W-0.43, S-0.45, N-0.55	1.10	U-0.30	NR	NR
Metal framing, fixed	U-0.31			U-0.31			U-0.36		
Metal framing, operable	U-0.38			U-0.38			U-0.42		
Metal framing, entrance door	U-0.65			U-0.65			U-0.73		
Skylight, 0% to 3% of *roof*									
All types	U-0.48	NR	NR	U-0.48	NR	NR	U-0.81	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-8 (Supersedes Table 5.5-8 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 8* (I-P)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.027	R-40 c.i.	U-0.027	R-40 c.i.	U-0.037	R-26 c.i.
Metal building [a]	U-0.025	R-19 + R-19 + R-25 c.i.	U-0.025	R-19 + R-19 + R-25 c.i.	U-0.035	R-11 + R-19 c.i.
Attic and other	U-0.016	R-71	U-0.016	R-71	U-0.026	R-49
Walls, above grade						
Mass	U-0.046	R-21.0 c.i.	U-0.046	R-21.0 c.i.	U-0.099	R-11.4 c.i.
Metal building	U-0.037	R-11 + R-22.1 c.i.	U-0.037	R-11 + R-22.1 c.i.	U-0.057	R-11 + R-13 c.i.
Steel framed	U-0.035	R-13 + R-21.9 c.i.	U-0.035	R-13 + R-21.9 c.i.	U-0.061	R-13 + R-12.5 c.i.
Wood framed and other	U-0.030	R-13 + R-21.9 c.i.	U-0.030	R-13 + R-21.9 c.i.	U-0.048	R-13 + R-12.5 c.i.
Wall, below grade						
Below-grade *wall*	C-0.060	R-17.5 c.i.	C-0.060	R-17.5 c.i.	C-0.113	R-10.0 c.i.
Floors						
Mass	U-0.036	R-25.1 c.i.	U-0.036	R-25.1 c.i.	U-0.061	R-14.6 c.i.
Steel joist	U-0.030	R-49	U-0.030	R-49	U-0.049	R-30
Wood framed and other	U-0.026	R-38+ R-7.5 c.i.	U-0.026	R-38 + R-7.5 c.i.	U-0.031	R-38
Slab-on-grade floors						
Unheated	F-0.412	R-15 full slab	F-0.403	R-15 full slab	F-0.513	R-20 for 24 in.
Heated	F-0.637	R-20 full slab	F-0.354	R-25 full slab	F-0.817	R-20 for 48 in.
Opaque doors						
Swinging	U-0.352		U-0.352		U-0.352	
Nonswinging	U-0.295		U-0.295		U-0.295	

		Nonresidential			*Residential*			Semiheated	
Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.24	E&W-0.43, S-0.45, N-0.55	1.10	U-0.24	E&W-0.43, S-0.45, N-0.55	1.10	U-0.30	NR	NR
Metal framing, fixed	U-0.28			U-0.28			U-0.36		
Metal framing, operable	U-0.33			U-0.33			U-0.42		
Metal framing, entrance door	U-0.65			U-0.65			U-0.73		
Skylight, 0% to 3% of *roof*									
All types	U-0.39	NR	NR	U-0.39	NR	NR	U-0.81	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-0 (Supersedes Table 5.5-0 in ANSI/ASHRAE/IES Standard 90.1)
Building Envelope Requirements For Climate Zone 0 (A,B)* (SI)

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.222	R-4.4 c.i.	U-0.184	R-5.3 c.i.	U-1.240	R-0.7 c.i.
Metal building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.653	R-1.8
Attic and other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
Walls, above grade						
Mass[b]	U-3.293	NR	U-0.857	R-1.0 c.i.	U-3.293	NR
Metal building	U-0.533	R-0 + R-1.7 ci	U-0.533	R-0 + R-1.7 ci	U-1.998	NR
Steel framed	U-0.705	R-2.3	U-0.705	R-2.3	U-1.998	NR
Wood framed and other	U-0.504	R-2.3	U-0.504	R-2.3	U-1.660	NR
Wall, below grade						
Below-grade *wall*	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors						
Mass	U-1.825	NR	U-1.825	NR	U-1.825	NR
Steel joist	U-1.986	NR	U-1.986	NR	U-1.986	NR
Wood framed and other	U-1.599	NR	U-1.599	NR	U-1.599	NR
Slab-on-grade floors						
Unheated	F-1.264	NR	F-1.264	NR	F-1.264	NR
Heated	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm
Opaque doors						
Swinging	U-2.101		U-2.101		U-3.975	
Nonswinging	U-1.760		U-1.760		U-8.233	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max.U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of wall		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing (all)	U-1.73	E&W-0.21, N&S-0.22	1.10	U-1.73	E&W-0.21, N&S-0.22	1.10	U-5.02	NR	NR
Metal framing, fixed	U-2.70			U-2.70			U-6.48		
Metal framing, operable	U-3.51			U-3.51			U-6.48		
Metal framing, entrance door	U-4.48			U-4.48			U-5.94		
Skylight, 0% to 3% of roof									
All types	U-4.05	0.33	NR	U-4.05	0.33	NR	U-9.71	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

b. Exception applies for mass *walls* above grade where the requirement is for a maximum assembly U-0.151 (see ANSI/ASHRAE/IES Standard 90.1, Section 5.5.3.2).

Table E-1 (Supersedes Table 5.5-1 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 1 (A,B)* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.273	R-3.5 c.i.	U-0.220	R-4.4 c.i.	U-1.240	R-0.7 c.i.
Metal building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.653	R-1.8
Attic and other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
Walls, above grade						
Mass[b]	U-3.293	NR	U-0.857	R-1.0 c.i.	U-3.293	NR
Metal building	U-0.533	R-0 + R-1.7 c.i.	U-0.533	R-0 + R-1.7 c.i.	U-1.998	NR
Steel framed	U-0.705	R-2.3	U-0.705	R-2.3	U-1.998	NR
Wood framed and other	U-0.504	R-2.3	U-0.504	R-2.3	U-1.660	NR
Wall, below grade						
Below-grade *wall*	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors						
Mass	U-1.825	NR	U-1.825	NR	U-1.825	NR
Steel joist	U-1.986	NR	U-1.986	NR	U-1.986	NR
Wood framed and other	U-1.599	NR	U-1.599	NR	U-1.599	NR
Slab-on-grade floors						
Unheated	F-1.264	NR	F-1.264	NR	F-1.264	NR
Heated	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm
Opaque doors						
Swinging	U-2.101		U-2.101		U-3.975	
Nonswinging	U-1.760		U-1.760		U-8.233	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-2.70	E&W-0.24, S-0.25, N-0.35	1.10	U-2.70	E&W-0.24, S-0.25, N-0.35	1.10	U-5.02	NR	NR
Metal framing, fixed	U-3.08			U-3.08			U-6.48		
Metal framing, operable	U-3.51			U-3.51			U-6.48		
Metal framing, entrance door	U-5.94			U-5.94			U-5.94		
Skylight, 0% to 3% of *roof*									
All types	U-4.05	0.33	NR	U-4.05	0.33	NR	U-9.71	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

b. Exception applies for mass *walls* above grade where the requirement is for a maximum assembly U-0.151 (see ANSI/ASHRAE/IES Standard 90.1, Section 5.5.3.2).

Table E-2 (Supersedes Table 5.5-2 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 2 (A,B)* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.220	R-4.4 c.i.	U-0.220	R-4.4 c.i.	U-0.982	R-0.9 c.i.
Metal building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.545	R-2.8
Attic and other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.300	R-3.3
Walls, above grade						
Mass[b]	U-0.857	R-1.0 c.i.	U-0.701	R-1.3 c.i.	U-3.293	NR
Metal building	U-0.533	R-0 + R-1.7 c.i.	U-0.533	R-0 + R-1.7 c.i.	U-0.920	R-2.3
Steel framed	U-0.479	R-2.3 + R-0.7 c.i.	U-0.365	R-2.3 + R-1.3 c.i.	U-0.705	R-2.3
Wood framed and other	U-0.504	R-2.3	U-0.504	R-2.3	U-0.504	R-2.3
Wall, below grade						
Below-grade *wall*	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors						
Mass	U-0.606	R-1.1	U-0.496	R-1.5	U-1.825	NR
Steel joist	U-0.214	R-5.3	U-0.214	R-5.3	U-0.390	R-2.3
Wood framed and other	U-0.188	R-5.3	U-0.188	R-5.3	U-0.376	R-2.3
Slab-on-grade floors						
Unheated	F-1.264	NR	F-1.264	NR	F-1.264	NR
Heated	F-1.558	R-1.8 for 600 mm	F-1.489	R-2.6 for 600 mm	F-1.766	R-1.3 for 300 mm
Opaque doors						
Swinging	U-2.101		U-2.101		U-3.975	
Nonswinging	U-1.760		U-1.760		U-8.233	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-2.00	E&W-0.24, S-0.25, N-0.35	1.10	U-2.00	E&W-0.24, S-0.25, N-0.35	1.10	U-5.02	NR	NR
Metal framing, fixed	U-2.91			U-2.91			U-6.48		
Metal framing, operable	U-3.51			U-3.51			U-6.48		
Metal framing, entrance door	U-4.48			U-4.15			U-4.48		
Skylight, 0% to 3% of *roof*									
All types	U-3.51	0.35	NR	U-3.51	0.33	NR	U-9.71	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

b. Exception applies for mass *walls* above grade where the requirement is for a maximum assembly U-0.151 (see ANSI/ASHRAE/IES Standard 90.1, Section 5.5.3.2).

Table E-3 (Supersedes Table 5.5-3 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 3 (A,B,C)* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.220	R-4.4 c.i.	U-0.220	R-4.4 c.i.	U-0.677	R-1.3 c.i.
Metal building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.545	R-2.8
Attic and other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.300	R-3.3
Walls, above grade						
Mass	U-0.701	R-1.3 c.i.	U-0.592	R-1.7 c.i.	U-3.293	NR
Metal building	U-0.533	R-0 + R-1.7 c.i.	U-0.409	R-0 + R-2.3 c.i.	U-0.920	R-2.3
Steel framed	U-0.435	R-2.3 + R-0.9 c.i.	U-0.365	R-2.3 + R-1.3 c.i.	U-0.705	R-2.3
Wood framed and other	U-0.504	R-2.3	U-0.365	R-2.3 + R-0.7 c.i.	U-0.504	R-2.3
Wall, below grade						
Below-grade *wall*	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors						
Mass	U-0.420	R-1.8 c.i.	U-0.420	R-1.8 c.i.	U-0.780	R-0.7 c.i.
Steel joist	U-0.214	R-5.3	U-0.214	R-5.3	U-0.296	R-3.3
Wood framed and other	U-0.188	R-5.3	U-0.188	R-5.3	U-0.288	R-3.3
Slab-on-grade floors						
Unheated	F-1.264	NR	F-0.935	R-1.8 for 600 mm	F-1.264	NR
Heated	F-1.489	R-2.6 for 600 mm	F-1.489	R-2.6 for 600 mm	F-1.766	R-1.3 for 300 mm
Opaque doors						
Swinging	U-2.101		U-2.101		U-2.101	
Nonswinging	U-1.760		U-1.760		U-2.044	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-1.78	E&W-0.24, S-0.25, N-0.35	1.10	U-1.89	E&W-0.24, S-0.25, N-0.35	1.10	U-4.69	NR	NR
Metal framing, fixed	U-2.43			U-2.64			U-6.48		
Metal framing, operable	U-3.24			U-3.24			U-6.48		
Metal framing, entrance door	U-4.15			U-3.67			U-4.15		
Skylight, 0% to 3% of *roof*									
All types	U-2.97	0.33	NR	U-2.97	0.33	NR	U-9.17	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement; FC = filled cavity (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.5).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-4 (Supersedes Table 5.5-4 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 4 (A,B,C)* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.173	R-6.2 c.i.	U-0.173	R-6.2 c.i.	U-0.502	R-1.9 c.i.
Metal building [a]	U-0.200	R-1.9 + R-3.3 c.i.	U-0.200	R-1.9 + R-3.3 c.i.	U-0.442	R-3.3 + R-1.1 c.i.
Attic and other	U-0.113	R-10.6	U-0.113	R-10.6	U-0.183	R-6.7
Walls, above grade						
Mass	U-0.561	R-2.0 c.i.	U-0.486	R-2.3 c.i.	U-3.294	NR
Metal building	U-0.324	R-1.9 + R-2.3 c.i.	U-0.270	R-1.9 + R-2.8 c.i.	U-0.874	R-3.3
Steel framed	U-0.345	R-2.3 + R-2.2 c.i.	U-0.345	R-2.3 + R-2.2 c.i.	U-0.669	R-2.3+ R-0.7 c.i.
Wood framed and other	U-0.345	R-2.3 + R-1.3 c.i.	U-0.345	R-2.3 + R-1.3 c.i.	U-0.480	R-2.3+ R-0.7 c.i.
Wall, below grade						
Below-grade *wall*	C-0.642	R-1.8 c.i.	C-0.496	R-2.2 c.i.	C-6.475	NR
Floors						
Mass	U-0.308	R-2.9 c.i.	U-0.275	R-3.3 c.i.	U-0.577	R-1.5 c.i.
Steel joist	U-0.205	R-6.7	U-0.205	R-6.7	U-0.281	R-5.3
Wood framed and other	U-0.178	R-6.7	U-0.178	R-6.7	U-0.275	R-5.3
Slab-on-grade floors						
Unheated	F-0.855	R-3.5 for 1200 mm	F-0.855	R-3.5 for 1200 mm	F-1.264	NR
Heated	F-1.386	R-3.5 for 1200 mm	F-1.131	R-3.5 full slab	F-1.480	R-3.5 for 600 mm
Opaque doors						
Swinging	U-1.997		U-1.997		U-1.997	
Nonswinging	U-1.673		U-1.673		U-1.943	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-1.67	E&W-0.34, S-0.36, N-0.46	1.10	U-1.67	E&W-0.34, S-0.36, N-0.46	1.10	U-2.75	NR	NR
Metal framing, fixed	U-2.05			U-2.05			U-3.94		
Metal framing, operable	U-2.48			U-2.48			U-4.37		
Metal framing, entrance door	U-3.67			U-3.67			U-4.15		
Skylight, 0% to 3% of *roof*									
All types	U-2.70	0.38	NR	U-2.70	0.38	NR	U-6.21	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-5 (Supersedes Table 5.5-5 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 5 (A, B, C)* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.173	R-6.2 c.i.	U-0.173	R-6.2 c.i.	U-0.340	R-3.0 c.i.
Metal building [a]	U-0.200	R-1.9 + R-3.3 c.i.	U-0.200	R-1.9 + R-3.3 c.i.	U-0.442	R-3.3 + R-1.1 c.i.
Attic and other	U-0.113	R-10.6	U-0.113	R-10.6	U-0.183	R-6.7
Walls, above grade						
Mass	U-0.486	R-2.3 c.i.	U-0.432	R-2.6 c.i.	U-0.815	R-1.3 c.i.
Metal building	U-0.270	R-1.9 + R-2.8 c.i.	U-0.270	R-1.9 + R-2.8 c.i.	U-0.507	R-1.9 + R-1.1 c.i.
Steel framed	U-0.297	R-2.3 + R-2.2 c.i.	U-0.297	R-2.3 + R-2.2 c.i.	U-0.453	R-2.3+ R-0.9 c.i.
Wood framed and other	U-0.275	R-2.3 + R-2.2 c.i.	U-0.275	R-2.3 + R-2.2 c.i.	U-0.480	R-2.3+ R-0.7 c.i.
Wall, below grade						
Below-grade *wall*	C-0.642	R-1.8 c.i.	C-0.496	R-2.2 c.i.	C-6.475	NR
Floors						
Mass	U-0.308	R-2.9 c.i.	U-0.275	R-3.3 c.i.	U-0.577	R-1.5 c.i.
Steel joist	U-0.205	R-6.7	U-0.205	R-6.7	U-0.281	R-5.3
Wood framed and other	U-0.178	R-6.7	U-0.178	R-6.7	U-0.275	R-5.3
Slab-on-grade floors						
Unheated	F-0.855	R-3.5 for 1200 mm	F-0.839	R-3.5 for 1200 mm	F-1.264	NR
Heated	F-1.131	R-3.5 full slab	F-1.131	R-3.5 full slab	F-1.480	R-3.5 for 600 mm
Opaque doors						
Swinging	U-1.997		U-1.997		U-1.997	
Nonswinging	U-1.673		U-1.673		U-1.943	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-1.67	E&W-0.36, S-0.38, N-0.48	1.10	U-1.67	E&W-0.36, S-0.38, N-0.48	1.10	U-2.43	NR	NR
Metal framing, fixed	U-2.05			U-2.05			U-3.35		
Metal framing, operable	U-2.48			U-2.48			U-3.78		
Metal framing, entrance door	U-3.67			U-3.67			U-4.15		
Skylight, 0% to 3% of *roof*									
All types	U-2.70	0.38	NR	U-2.70	0.38	NR	U-5.29	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-6 (Supersedes Table 5.5-6 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 6 (A,B)* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.173	R-6.2 c.i.	U-0.173	R-6.2 c.i.	U-0.340	R-3.0 c.i.
Metal building[a]	U-0.167	R-5.3 + R-1.9 *Ls*	U-0.156	R-1.8 + R-3.3 + R-2.3 c.i.	U-0.324	R-1.8 + R-1.8 + R-1.1 c.i.
Attic and other	U-0.113	R-10.6	U-0.113	R-10.6	U-0.183	R-6.7
Walls, above grade						
Mass	U-0.432	R-2.6 c.i.	U-0.383	R-3.1 c.i.	U-0.815	R-1.3 c.i.
Metal building	U-0.270	R-1.9 + R-2.8 c.i.	U-0.270	R-1.9 + R-2.8 c.i.	U-0.507	R-1.9 + R-1.1 c.i.
Steel framed	U-0.264	R-2.3 + R-2.7 c.i.	U-0.264	R-2.3 + R-2.7 c.i.	U-0.453	R-2.3+ R-0.9 c.i.
Wood framed and other	U-0.275	R-2.3 + R-2.2 c.i.	U-0.275	R-2.3 + R-2.2 c.i.	U-0.480	R-2.3+ R-0.7 c.i.
Wall, below grade						
Below-grade *wall*	C-0.496	R-2.2 c.i.	C-0.340	R-3.1 c.i.	C-0.642	R-1.8 c.i.
Floors						
Mass	U-0.275	R-3.3 c.i.	U-0.275	R-3.3 c.i.	U-0.469	R-1.8 c.i.
Steel joist	U-0.173	R-8.6	U-0.173	R-8.6	U-0.281	R-5.3
Wood framed and other	U-0.146	R-6.7+ R-1.3 c.i.	U-0.146	R-6.7 + R-1.3 c.i.	U-0.275	R-5.3
Slab-on-grade floors						
Unheated	F-0.839	R-3.5 for 1200 mm	F-0.714	R-2.6 full slab	F-1.264	NR
Heated	F-1.131	R-3.5 full slab	F-1.103	R-3.5 full slab	F-1.414	R-3.5 for 1200 mm
Opaque doors						
Swinging	U-1.997		U-1.997		U-1.997	
Nonswinging	U-1.673		U-1.673		U-1.943	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-1.62	E&W-0.38; S-0.40; N-0.50	1.10	U-1.62	E&W-0.38; S-0.40; N-0.50	1.10	U-2.43	NR	NR
Metal framing, fixed	U-1.94			U-1.94			U-2.75		
Metal framing, operable	U-2.43			U-2.43			U-3.18		
Metal framing, entrance door	U-3.67			U-3.67			U-4.15		
Skylight, 0% to 3% of *roof*									
All types	U-2.70	0.38	NR	U-2.70	0.38	NR	U-4.59	NR	NR

* The following definitions apply: c.i. = continuous insulation (ANSI/ASHRAE/IES Standard 90.1, see Section 3.2); NR = no (insulation) requirement; *Ls* = *liner system* (see ANSI/ASHRAE/IES Standard 90.1, Section A2.3.2.4).

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-7 (Supersedes Table 5.5-7 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 7* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.151	R-7.0 c.i.	U-0.151	R-7.0 c.i.	U-0.210	R-4.6 c.i.
Metal building[a]	U-0.156	R-1.8 + R-3.3 +R-2.3 c.i.	U-0.156	R-1.8 + R-3.3 + R-2.3 c.i.	U-0.200	R-1.9 + R-3.3 c.i.
Attic and other	U-0.092	R-12.5	U-0.092	R-12.5	U-0.146	R-8.6
Walls, above grade						
Mass	U-0.383	R-3.1 c.i	U-0.383	R-3.1 c.i.	U-0.664	R-1.7 c.i.
Metal building	U-0.237	R-1.9 + R-3.3 c.i.	U-0.237	R-1.9 + R-3.3 c.i.	U-0.389	R-1.9 + R-1.7 c.i.
Steel framed	U-0.264	R-2.3 + R-2.7 c.i.	U-0.227	R-2.3 + R-3.3 c.i.	U-0.345	R-2.3+ R-2.2 c.i.
Wood framed and other	U-0.275	R-2.3 + R-2.2 c.i.	U-0.275	R-2.3 + R-2.2 c.i.	U-0.345	R-2.3+ R-1.3 c.i.
Wall, below grade						
Below-grade *wall*	C-0.340	R-3.1 c.i.	C-0.340	R-3.1 c.i.	C-0.642	R-1.8 c.i.
Floors						
Mass	U-0.227	R-4.1 c.i.	U-0.227	R-4.1 c.i.	U-0.399	R-2.2 c.i.
Steel joist	U-0.173	R-8.6	U-0.173	R-8.6	U-0.281	R-5.3
Wood framed and other	U-0.146	R-6.7+ R-1.3 c.i.	U-0.146	R-6.7 + R-1.3 c.i.	U-0.275	R-5.3
Slab-on-grade floors						
Unheated	F-0.839	R-3.5 for 1200 mm	F-0.714	R-2.6 full slab	F-1.264	NR
Heated	F-1.103	R-3.5 full slab	F-1.103	R-3.5 full slab	F-1.414	R-3.5 for 1200 mm
Opaque doors						
Swinging	U-1.997		U-1.997		U-1.997	
Nonswinging	U-1.673		U-1.673		U-1.673	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-1.51	E&W-0.43, S-0.45, N-0.55	1.10	U-1.51	E&W-0.43, S-0.45, N-0.55	1.10	U-1.73	NR	NR
Metal framing, fixed	U-1.78			U-1.78			U-2.05		
Metal framing, operable	U-2.16			U-2.16			U-2.37		
Metal framing, entrance door	U-3.67			U-3.67			U-4.15		
Skylight, 0% to 3% of *roof*									
All types	U-2.70	NR	NR	U-2.70	NR	NR	U-4.59	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

Table E-8 (Supersedes Table 5.5-8 in ANSI/ASHRAE/IES Standard 90.1)
***Building Envelope* Requirements for *Climate Zone* 8* (SI)**

	Nonresidential		*Residential*		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****	**Assembly Maximum**	**Insulation Min. R-Value****
Roofs						
Insulation entirely above deck	U-0.151	R-7.0 c.i.	U-0.151	R-7.0 c.i.	U-0.210	R-4.6 c.i.
Metal building[a]	U-0.140	R-3.3 + R-3.3 + R-4.4 c.i.	U-0.140	R-3.3 + R-3.3 + R-4.4 c.i.	U-0.200	R-1.9 + R-3.3 c.i.
Attic and other	U-0.092	R-12.5	U-0.092	R-12.5	U-0.146	R-8.6
Walls, above grade						
Mass	U-0.259	R-3.7 c.i.	U-0.259	R-3.7 c.i.	U-0.561	R-2.0
Metal building	U-0.210	R-1.9 + R-3.9 c.i.	U-0.210	R-1.9 + R-3.9 c.i.	U-0.324	R-1.9 + R-2.3 c.i.
Steel framed	U-0.200	R-2.3 + R-3.9 c.i.	U-0.200	R-2.3 + R-3.9 c.i.	U-0.345	R-2.3+ R-2.2 c.i.
Wood framed and other	U-0.173	R-2.3 + R-3.9 c.i.	U-0.173	R-2.3 + R-3.9 c.i.	U-0.275	R-2.3+ R-2.2 c.i.
Wall, below grade						
Below-grade *wall*	C-0.340	R-3.1 c.i.	C-0.340	R-3.1 c.i.	C-0.642	R-1.8 c.i.
Floors						
Mass	U-0.205	R-4.4 c.i.	U-0.205	R-4.4 c.i.	U-0.345	R-2.6 c.i.
Steel joist	U-0.173	R-8.6	U-0.173	R-8.6	U-0.281	R-5.3
Wood framed and other	U-0.146	R-6.7 + R-1.3 c.i.	U-0.146	R-6.7 + R-1.3 c.i.	U-0.178	R-6.7
Slab-on-grade floors						
Unheated	F-0.714	R-2.6 full slab	F-0.697	R-2.6 full slab	F-0.888	R-3.5 for 600 mm
Heated	F-1.103	R-3.5 full slab	F-0.613	R-4.4 full slab	F-1.414	R-3.5 for 1200 mm
Opaque doors						
Swinging	U-1.997		U-1.997		U-1.997	
Nonswinging	U-1.673		U-1.673		U-1.673	

Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. VT/*SHGC***
Vertical glazing, 0% to 40% of *wall*		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-1.35	E&W-0.43, S-0.45, N-0.55	1.10	U-1.35	E&W-0.43, S-0.45, N-0.55	1.10	U-1.73	NR	NR
Metal framing, fixed	U-1.56			U-1.56			U-2.05		
Metal framing, operable	U-1.89			U-1.89			U-2.37		
Metal framing, entrance door	U-3.67			U-3.67			U-4.15		
Skylight, 0% to 3% of *roof*									
All types	U-2.21	NR	NR	U-2.21	NR	NR	U-4.59	NR	NR

* The following definitions apply: c.i. = continuous insulation (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2); NR = no (insulation) requirement.

** The insulation minimum R-value criteria in this table meet the criteria in Section 7.4.2.1 but it is possible that some assemblies with slightly less insulation minimum R-value will also meet the criteria of Section 7.4.2.1.

a. When using the R-value compliance method for metal building *roofs*, a thermal spacer block is required (see ANSI/ASHRAE/IES Standard 90.1, Section 3.2).

(This foreword 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.)

FOREWORD

Addendum cg adds a new informative appendix to aid in understanding and adoption of the functional performance testing (FPT) and commissioning (Cx) processes of Section 10.

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 cg to Standard 189.1-2014

Add new Appendix I as shown.

(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.)

INFORMATIVE APPENDIX I ADDITIONAL GUIDANCE FOR FUNCTIONAL PERFORMANCE TESTING (FPT) AND THE COMMISSIONING (Cx) PROCESS

This appendix provides guidance on best practices for *functional performance testing* (*FPT*) and *commissioning* (*Cx*) *processes* that relate to Section 10.3.1.1.

I1. PROVIDER QUALIFICATIONS

I1.1 Recommended Minimum Qualifications and Independence of a *Commissioning (Cx) Provider* and a *Functional Performance Testing (FPT) Provider*. A *Cx provider* or an *FPT provider* should have the following qualities to ensure the needed qualifications and independence for building project testing or commissioning:

a. **Equipment.** A *Cx provider* or *FPT provider* should use equipment necessary to carry out the *Cx process* and *FPT*. Equipment should be calibrated in accordance with the manufacturer's specifications.

b. **Personnel Experience.** The *Cx provider* or *FPT provider* should provide personnel experienced in conducting, supervising, or evaluating *functional and performance testing*, inspections, and, where applicable, performing Cx activities prior to and subsequent to the tests. Where possible, the *Cx provider* should have completed the *Cx process* on not fewer than two projects of equal or greater scope and complexity, or should be able to demonstrate adequate experience and training in the fundamentals and application of the *Cx process*.

c. **Independence.** The *Cx provider* and the *FPT provider* should be independent of the building system design and construction functions of the systems being commissioned. The *Cx provider* and *FPT* provider should disclose possible conflicts of interest to ensure objectivity.

d. **Registration, Licensure, or Certification of a *Cx Provider*.** Where available, a *Cx provider* should be registered or licensed in a relevant discipline or certified according to the provisions of ISO 17024 or an equivalent certification process.

I1.2 Overview of the *Cx Process*. Table I1.2-1 provides an overview of activities, documentation, and responsibilities that should be included in the *Cx process*.

I2. CX DOCUMENTATION

The *Cx process* should result in the following deliverables.

I2.1 Typical Elements Included in *Owner's Project Requirements (OPR)*. The *OPR* is a document developed by the *owner* with assistance from the design and Cx teams that details the requirements of a project and the expectations for how it will be used and operated. The *OPR* should include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. The term "project intent" or "design intent" is used by some owners for their *Cx process OPR*.

The *OPR* document should address the following for the commissioned systems:

a. Facility objectives, size, location, user requirements, and *owner* directives, including space use and occupancy/operations schedules and special project requirements.

b. Applicable codes and standards, in addition to local building codes, and environmental, sustainability, and efficiency goals and benchmarks.

c. Indoor environment requirements, including temperature, humidity, and ventilation.

d. Cx process scope and requirements; listing of equipment; systems and assemblies requiring commissioning, including installation, evaluation, and testing requirements; and *Cx plan* and report formats and distribution requirements. Sampling procedures, if permitted, for all reviews, evaluations, and testing should be detailed.

e. Equipment, systems, and assemblies requirements, expectations, and warranty provisions.

f. Maintainability, access, and operational performance requirements.

g. Project documentation requirements, including formats and delivery schedules for *Basis of Design* (*BoD*), Cx specifications, *Cx plan* and reports, equipment submittals, and the systems manual. Documentation reviews, approvals, and distribution during design and construction phases.

h. Training requirements for owner's operation and maintenance personnel and occupants.

I2.2 *Basis of Design (BoD)*. The *BoD* is a document developed by the design team that records the concepts, calculations, decisions, and product selections used to meet the *OPR*

Table1.2-1 Typical Commissioning Process Activities, Deliverables, and Responsibilities

Item	Activity	Deliverable	Normally Provided by
1	*Owner's project requirements*	*OPR* document	Owner with assistance from design and Cx teams
2	*Basis of Design*	*BoD* document	Design team
3	*Cx plan*	*Cx plan* document	*Cx provider* with input from owner, design team, and contractor
4	Contractor Cx requirements	Cx specifications	Design team and *Cx provider*
5	Design review	Cx design review report	*Cx provider*
6	Submittal review	Submittal review report	*Cx provider*
7	Commissioning designated systems inspections, *FPT*	Installation, inspection, functional test reports, performance test reports	Contractors, manufacturers, *Cx provider* and team
8	Issue and resolution log	Issue and resolution logs	*Cx provider* and team
9	Systems manual	Systems manual	Contractors with review by *Cx provider*
10	Training	Training plan and reports	Contactor and manufacturers with review by *Cx provider*
11	Preliminary Cx report	Preliminary Cx report	*Cx provider*
12	Cx activities during occupancy	Additional information and updates to reports	*Cx provider* and building operations
13	Final Cx report	Final Cx report	*Cx provider*

and to satisfy applicable regulatory requirements, standards, and guidelines. The document should include both narrative descriptions and lists of individual items that support the design process, including the following:

a. A detailed description of the design team's technical approach to, and assumptions about, the *OPR*.
b. A platform for the review of the design and for changes as the project progresses.
c. A detailed description addressing coordination of applicable technical and code requirements.

I2.3 *Cx Plan.* A *Cx plan* is a document developed by a *Cx provider* that should include the following:

a. An overview of the *Cx process* developed specifically for the project.
b. The roles and responsibilities of the *Cx provider* and the Cx team through final commissioning activities.
c. Documentation of communication channels and processes, including distribution of the *Cx plan*, logs, testing documents, and reports during the design and construction processes.
d. A detailed description and schedule of *Cx process* activities and the list of operations, systems, and assemblies that will be commissioned, and a description of performance criteria where not shown on the *construction documents*.
e. The project design documentation and submittal review procedures and reports.
f. Inspection checklists and testing forms, issues and resolution log, and Cx progress reports to be used during the project to communicate and track commissioning and inspection process information, including format, approvals, and distribution.
g. The procedures to follow for resolution where the Cx evaluation does not meet the *OPR*.

I2.4 Cx Specifications. For construction or renovation projects requiring contract documents, the *owner* should require by agreement that the design/construction team include Cx specifications in the project contract documents. The Cx specification should require compliance with the *OPR* and with the *Cx process* contained in the project's *Cx plan* as detailed in this standard.

I2.5 Cx Design Review Report. The *Cx provider* should provide a design review (Commissioning Design Review Report) to the *owner* and design teams to report compliance with the *OPR* and *BoD*. This Cx design review is not intended to replace a design peer review or a code or regulatory review.

I2.6 Record Documents. Record documents should be provided to the *owner* upon project completion. The record documents should be accessible to the building operations and maintenance personnel, be included in the systems manual, and include all of the following:

a. Approved construction documents, including record plans and specifications.
b. Approved submittals and coordination drawings. This documentation should show the actual locations of equip-

ment, systems, and assemblies, such as piping, ductwork, valves, controls, access panels, electrical equipment, plumbing equipment, lighting, and other operating components and systems. The record documents should note equipment locations that are concealed or are installed in locations other than those indicated on the approved construction documents.

c. Copies of engineering and institutional control information for sites that have previously been a *brownfield* or that required environmental corrective action, remediation, or restoration at the federal, state, or local level.

I2.7 Systems Manual. A systems manual should be provided by an *owner* for use in building operations training. The systems manual should be made accessible to building operations and maintenance (O&M) personnel and should be updated and maintained by an *owner* for the life of the building.

A systems manual should include the following:

a. Facility design and construction documents, including the following:
   1. *OPR* and *BoD*
   2. Construction record documents, including drawings, specifications, and approved submittals
b. Facility systems and assemblies information, including the following:
   1. Manufacturer's operation and maintenance data for installed equipment systems and assemblies
   2. Warranties and certificate of occupancy
   3. Contractor and supplier listing and contact information
c. A facility operations guide, including an operating plan, building and equipment operating schedules, set points and ranges, verified sequences of operation, system and equipment limitations, and emergency procedures.
d. Where training is provided, training plans, materials, and records.
e. A final Cx report.

I2.8 Preliminary Cx Report. A preliminary Cx Report should be provided by the *Cx provider* and should include the following information:

a. Performance of commissioned equipment, systems, and assemblies.
b. Issue and resolution logs, including itemization of deficiencies found during testing and commissioning that have not been corrected at the time of report preparation.
c. Deferred tests that cannot be performed at the time of report preparation.
d. A plan for the completion of Cx activities and training, including climatic and other conditions required for performance of the deferred tests.

I2.9 Final Cx Report. A final Cx report should be provided by the *Cx provider* and should include the following information:

a. A copy of the final *Cx plan*, including *FPT* procedures used during the *Cx process*, including measurable criteria for test acceptance.
b. A copy of the final *OPR*, *BoD*, and design and submittal reviews as required by the *Cx plan* if not included in the submitted systems manual.
c. Results of all evaluations, start-up data, *FPT*, and reports by suppliers, contractors, observers, and *Cx providers*.
d. Issue logs and disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
e. Equipment, systems, and assemblies repaired or replaced and adjustments to calibration.
f. Documentation of equipment and systems sequences and settings, which are typically submitted in the final sequence of operation and in the systems manual.
g. A resolution plan identifying all of the issues unresolved and incomplete at the end of the project.

(This foreword 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.)

FOREWORD

Addendum ch to ASHRAE Standard 189.1 contains updates to references.

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 ch to Standard 189.1-2014

Revise Section 5 as shown.

5.3.5.4 ***Solar Reflectance Index (SRI).*** [. . .]

b. For roofing products, the *SRI* values shall be based on a minimum three-year-aged solar reflectance and thermal emittance, as measured in accordance with ~~the~~ CRRC S100 ~~1 standard~~, and shall be certified by the manufacturer.

Revise Section 11 as shown.

Reference	Title	Section
Air-Conditioning, Heating, and Refrigeration Institute (AHRI) 2111 Wilson Blvd, Suite 500 Arlington, VA 22201, United States 1-703-524-8800; www.ahrinet.org		
~~ANSI/AHRI 340/360-2007 (with Addenda 1 and 2)~~ 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	Appendix ~~C~~B
[. . .]		
ASHRAE 1791 Tulle Circle NE Atlanta, GA 30320, United States 1-404-636-8400; www.ashrae.org		
ANSI/ASHRAE Standard 52.2-2017	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size	8.3.1.3
ANSI/ASHRAE Standard 55-~~2010~~2017	Thermal ~~Comfort~~ EnvironmentalConditions for Human Occupancy	8.3.2, 10.3.1.2.1
ANSI/ASHRAE Standard 160-~~2009~~2016	Criteria for Moisture-Control Design Analysis in Buildings	8.3.6
[. . .]		
ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959, United States 1-610-832-9585; www.astm.org		
ASTM C1371-04a	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers	5.3.~~2~~5.4
ASTM C1549-09	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	5.3.~~2~~5.4
ASTM E408-71(2008)	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques	5.3.~~2~~5.4
ASTM E1918-06	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field	5.3.~~2~~5.4
ASTM E1980-11	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces	5.3.~~2~~5.4
ASTM E2843-2017	Standard Specification for Demonstrating that a Building is in Walkable Proximity to Neighborhood Assets	5.3.1.1

Reference	Title	Section
Cooling Roof Rating Council (CRRC) **449 15th Street, Suite ~~200~~400** **Oakland, CA 94612** **United States** **1-866-465-2523; www.coolroofs.org**		
ANSI/CRRC Standard ~~1-2012~~ S100-2016	~~ANSI/CRRC-1~~ Standard Test Methods for Determining Radiative Properties of Materials	5.3.2~~5~~.4
[. . .]		
International Code Council **500 New Jersey Ave NW # 300** **Washington, DC 20001, United States** **1-800-786-4452; www.iccsafe.org**		
2015 IFC	International Fire Code	5.3.5.5
[. . .]		
NSF International **789 Dixboro Road** **Ann Arbor, MI 48105, United States** **734-769-8010; www.nsf.org; info@nsf.org**		
NSF/ANSI 44-2016	Residential Cation Exchange Water Softeners	6.3.4
NSF/ANSI 58-2016	Reverse Osmosis Drinking Water Treatment Systems	6.3.5
NSF/ANSI 350-2017	On-site Residential and Commercial Water Reuse Systems	6.3.5
[. . .]		
United States Department of Energy (U.S. DOE) **Energy Information Administration** **Washington, DC 20585, United States** **1-202-586-5000; www.eia.doe.gov/emeu/cbecs/contents.html and http://tonto.eia.doe.gov**		
~~Title 10 – Energy~~ ~~Chapter II – Department of Energy – Part 430~~ 10 CFR Part 430, App N	~~Energy Conservation Program for Consumer Products~~ Uniform Test Method for Measuring the Energy Consumption of Furnaces	Appendix ~~C~~B
~~Title 10 – Energy~~ ~~Chapter II – Department of Energy – Part 431~~ 42 USC 6831, et seq., Public Law 102-486	~~Energy Efficiency Program for Certain Commercial and Industrial Equipment~~ Energy Policy Act of 1992, EPACT 2005, and EISA 2007	Appendix ~~C~~B
[. . .]		
United States Environmental Protection Agency (EPA) **Ariel Rios Building** **1200 Pennsylvania Avenue, NW** **Washington, DC 20460, United States** **1-919-541-0800; www.epa.gov** **ENERGY STAR ® 1-888-782-7937** **WaterSense 1-866-987-7367 and 1-202-564-2660**		
EPA-420-F-07-063, November 2007	Green Vehicle Guide: Consider a SmartWay Vehicle Program Requirements for Certified Passenger Vehicles~~, http://epa.gov/greenvehicles/Aboutratings.do#aboutsmartway~~	5.3.7

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FOREWORD

Addendum cj adds an informative appendix for use in correlating the prescriptive energy path provisions of this standard with those of the International Energy Conservation Code (IECC). It is intended that those jurisdictions, and projects within those jurisdictions, that adopt the IECC can use this appendix to connect base IECC prescriptive energy requirements to the International Green Construction Code (IgCC). The appendix will facilitate the adoption and use of this standard and the IgCC in jurisdictions that adopt the IECC (which references but does not require the use of ASHRAE/IES Standard 90.1).

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 cj to Standard 189.1-2014

Add new Appendix H as shown. Rename existing Appendix H as Appendix J.

(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.)

INFORMATIVE APPENDIX H
OPTION FOR ENERGY EFFICIENCY USING THE IECC PRESCRIPTIVE COMPLIANCE PATH

The purpose of this appendix is to provide users of the prescriptive energy path of the IECC a correlated version of ASHRAE/ICC/USGBC/IES Standard 189.1, Section 7, that facilitates the use of the prescriptive provisions of the IECC without directly relying on the energy provisions of ASHRAE/IES Standard 90.1. Section numbers in this appendix, unless otherwise specified, refer to Standard 189.1. Where ASHRAE standards are referenced in this appendix, ASHRAE provides free online access to read-only versions of the standards. See https://www.ashrae.org/standards-research--technology/standards--guidelines/other-ashrae-standards-referenced-in-code.

H1. DEFINITIONS APPLICABLE TO THIS APPENDIX

air, outdoor: see ANSI/ASHRAE Standard 62.1.

building envelope: see ANSI/ASHRAE/IES Standard 90.1.

dynamic glazing: see ANSI/ASHRAE/IES Standard 90.1.

enclosed space: see ANSI/ASHRAE/IES Standard 90.1.

fenestration: see ANSI/ASHRAE/IES Standard 90.1.

vertical fenestration: see ANSI/ASHRAE/IES Standard 90.1.

fenestration area: see ANSI/ASHRAE/IES Standard 90.1.

gross wall area: see ANSI/ASHRAE/IES Standard 90.1.

lighting power allowance: see ANSI/ASHRAE/IES Standard 90.1.

roof: see ANSI/ASHRAE/IES Standard 90.1.

service water heating: see ANSI/ASHRAE/IES Standard 90.1.

single-rafter roof: see ANSI/ASHRAE/IES Standard 90.1.

skylight: see ANSI/ASHRAE/IES Standard 90.1.

space: see ANSI/ASHRAE/IES Standard 90.1.

semiheated space: see ANSI/ASHRAE/IES Standard 90.1.

H2. GENERAL

H2.1 Scope. This section specifies prescriptive requirements for energy efficiency for buildings and appliances, for *on-site renewable energy systems*, and for energy measuring.

H3. COMPLIANCE

H3.1 Compliance. The energy systems shall comply with Sections 7.3.2 through 7.3.4 and with the International Energy Conservation Code (IECC), Sections C402 through C405. In addition, commercial buildings shall comply with the IECC, Section C406, and tenant spaces shall comply with the IECC, Section C406.1.1.

Where requirements are provided below, they shall supersede the requirements of the IECC. For all other criteria, the *building project* shall comply with the requirements of the IECC.

H4. PRESCRIPTIVE REQUIREMENTS

H4.1 *On-Site Renewable Energy Systems*. *Building projects* shall comply with either the standard renewables approach in Section 7.4.1.1.1 or the alternate renewables approach in Section 7.4.1.1.2.

H4.2 *Building Envelope*. The *building envelope* shall comply with the IECC, Sections C301 and C402, with the following modifications and additions.

H4.2.1 *Continuous Air Barrier*. The exceptions to the requirement for a *continuous air barrier* in the IECC, Section C402.5.1, for specific *climate zones* and constructions shall not apply.

H4.2.2 *Building Envelope* Requirements. The *building envelope* shall comply with the requirements in the IECC, Table C402.1.4, with the following modifications to values in the table.

For the opaque elements, each U-factor, C-factor, and F-factor in the table shall be reduced by 5%. For *vertical fenestration* and *skylights*, each U-factor in the IECC, Table C402.4, shall be reduced by 5%. For *skylights* and east-oriented and west-oriented *vertical fenestration*, each *solar heat*

gain coefficient (*SHGC*) in the IECC, Table C402.4, shall be reduced by 5%. These adjustments shall also be applicable where the intent is to comply with the component performance alternative of the IECC, Section C402.1.5.

Exceptions to H4.2.2:

1. The U-factor, C-factor, or F-factor shall not be modified where the corresponding R-value requirement is designated as "NR" (no requirement) in the IECC, Table C402.4.
2. The *SHGC* shall not be modified where the *SHGC* requirement is designated as "NR" (no requirement) in the IECC, Table C402.4.
3. *Spaces* that meet the requirements of Section 8.4.1, regardless of *space* area, are exempt from the *SHGC* criteria for *skylights*.

Notes:

1. U-factors, C-factors, and F-factors for many common assemblies are provided in ANSI/ASHRAE/IES Standard 90.1, Normative Appendix A.
2. Section 5.3.5.3 includes additional provisions related to *roofs*.

H4.2.3 *Single-Rafter Roof* Insulation. *Single-rafter roofs* shall comply with the requirements in Normative Appendix A, Table A-1. These requirements supersede the requirements in the IECC, Tables C402.1.3 and C402.1.4.

H4.2.4 Air Curtains. Where provided, air curtains shall comply with Section 7.4.2.4.

H4.2.5 *High-Speed Doors*. *High-speed doors* that are intended to operate, on average, at least 75 cycles per day shall not exceed a maximum U-factor of 1.20 Btu/h·ft^2·°F (6.81 W/m^2·K). Opening rate, closing rate, and average cycles per day shall be included in the construction drawings. IECC, Table C402.1.3, shall not apply for *high-speed doors* complying with all criteria in this section.

H4.2.6 *Vertical Fenestration Area*. *Vertical fenestration area* shall comply with the IECC, Sections C402.4.1 and C402.4.1.1.

H4.2.7 Permanent Projections. *Vertical fenestration* shall comply with Section 7.4.2.5.

H4.2.8 *SHGC* of *Vertical Fenestration*. *Vertical fenestration* shall comply with the IECC, Table C402.4.

H4.2.9 *Building Envelope* Trade-Off Option. The *building envelope* component performance alternative of the IECC, Section C402.1.5, shall not apply unless the modifications and additions of Section H4.2 are incorporated.

H4.2.10 Orientation. The *vertical fenestration* shall comply with either (a) or (b):

a. $A_W \le (A_N + A_S)/4$ and $A_E \le (A_N + A_S)/4$
b. $A_W \times SHGC_W \le (A_N \times SHGC_C + A_S \times SHGC_C)/6$ and $A_E \times SHGC_E \le (A_N \times SHGC_C + A_S \times SHGC_C)/6$

where

$SHGC_X$ = the *SHGC* for orientation *x* that complies with Section H4.2.7

$SHGC_C$ = the *SHGC* criteria for each *climate zone* from Section H4.2.2

A_X = *fenestration area* for orientation *x*

N = north (oriented less than 45 degrees of true north)

S = south (oriented less than 45 degrees of true south)

E = east (oriented less than or equal to 45 degrees of true east)

W = west (oriented less than or equal to 45 degrees of true west)

Exceptions to H4.2.10:

1. Buildings with shade on 75% of the west- and east-oriented *vertical fenestration areas* from permanent projections, existing buildings, existing permanent infrastructure, or topography at 9 a.m. and 3 p.m. on the summer solstice (June 21 in the northern hemisphere).
2. Alterations and additions with no increase in *vertical fenestration area*.
3. Buildings where the west- and east-oriented *vertical fenestration areas* do not exceed 20% of the *gross wall area* for each of those façades, and the *SHGC* on those façades is not greater than 90% of the criteria in Section H4.2.2.
4. Buildings in *Climate Zone* 8.

H4.3 Heating, Ventilating, and Air Conditioning. The heating, ventilating, and air conditioning shall comply with the IECC, Sections C301 and C403, with the following modifications and additions.

H4.3.1 Minimum Equipment Efficiencies for the Alternate Renewables Approach. *Building projects* complying with the alternate renewables approach in Section 7.4.1.1.2 shall comply with Section 7.4.3.1.

H4.3.2 Ventilation Controls for *Densely Occupied Spaces*. The requirements in this section supersede those in the IECC, Section C403.7.1. *Demand control ventilation* (*DCV*) shall be provided for *densely occupied spaces* served by systems with one or more of the following:

a. An air-side economizer
b. *Automatic* modulating control of the *outdoor air* dampers
c. A design *outdoor airflow* greater than 1000 cfm (500 L/s)

Exceptions to H4.3.2:

1. Systems with exhaust air energy recovery complying with Section H4.3.6.
2. Systems with a design *outdoor airflow* less than 750 cfm (350 L/s).
3. *Spaces* where more than 75% of the *space* design *outdoor airflow* is used as *makeup air* or *transfer air* to provide *makeup air* for other *spaces*.
4. *Spaces* with one of the following occupancy categories as defined in ANSI/ASHRAE Standard 62.1: cells in correctional facilities; daycare sickrooms; science laboratories; barbers; beauty and nail salons; and bowling alleys (*seating*).

The *DCV* system shall be designed to be in compliance with ANSI/ASHRAE Standard 62.1, Section 6.2.7. Occupancy assumptions shall be shown in the design documents

for *spaces* provided with *DCV*. All CO_2 sensors used as part of a *DCV* system or any other system that dynamically controls *outdoor air* shall meet the following requirements:

a. *Spaces* with CO_2 sensors or air-sampling probes leading to a central CO_2 monitoring station shall be provided with at least one sensor or probe for each 10,000 ft^2 (1000 m^2) of floor *space*. Sensors or probes shall be installed between 3 and 6 ft (1 and 2 m) above the floor.
b. CO^2 sensors shall have a rated accuracy of ±50 ppm at 1000 ppm.
c. *Outdoor air* CO_2 concentrations shall be determined by one of the following:
   1. *Outdoor air* CO_2 concentrations shall be dynamically measured using one or multiple CO_2 sensors. The CO_2 sensor locations shall be identified on the construction documents.
   2. When documented statistical data are available on the local ambient CO_2 concentrations, a fixed value typical of the location where the building is located shall be allowed in lieu of an outdoor sensor.
d. Occupant CO_2 generation rate assumptions shall be shown in the design documents.

H4.3.3 Duct Leakage Tests. Leakage tests shall be performed in compliance with the requirements in ANSI/ASHRAE/IES Standard 90.1, Section 6.4.4.2.2, with the following modification. Ductwork that is designed to operate at static pressures in excess of 2 in. of water (500 Pa), and all ductwork located outdoors, shall be leak-tested according to industry-accepted test procedures.

H4.3.4 Economizers. Where economizers are required by Section 7.4.3.3, economizers shall meet the requirements in the IECC, Section C403.5, except as modified by the following:

a. Rooftop units with a capacity of less than 54,000 Btu/h (16 kW) shall have two stages of capacity control, with the first stage controlling the economizer and the second stage controlling *mechanical cooling*. Units with a capacity equal to or greater than 54,000 Btu/h (16 kW) shall comply with the staging requirements defined in the IECC, Section C403.8.
b. For systems that control to a fixed leaving air temperature (i.e., *variable-air-volume* [*VAV*] systems), the system shall be capable of resetting the supply air temperature up at least 5°F (3°C) during economizer operation.

All of the exceptions in the IECC, Section C403.5, shall apply except as modified by the following.

a. Where the reduced renewable approach defined in Section 7.4.1.1 is used, the IECC, Section C403.5, Exception 7, shall be permitted to eliminate the economizer requirement, provided the requirements in the IECC, Table C403(5)(2), are applied to the efficiency requirements required by Section 7.4.1.2. If the standard renewable approach is chosen, as defined in Section 7.4.1.1, then the requirements in the IECC, Table C403(5)(2), shall be applied to the efficiency requirements in the IECC, Tables C403.3.2(1) through C403.3.2(10).
b. For water-cooled units with a capacity less than 54,000 Btu/h (16 kW) that are used in systems where heating and cooling loads are transferred within the building (i.e., water-source heat pump systems), the requirement for an air or water economizer can be eliminated if the condenser-water temperature controls are capable of being set to maintain full-load heat rejection capacity down to a 55°F (12°C) condenser-water supply temperature, and the HVAC equipment is capable of operating with a 55°F (12°C) condenser-water supply temperature

H4.3.5 Fan System Power and Efficiency

H4.3.5.1 Fan System Power Limitation. Systems shall have fan power limitations 10% below the limitations specified in the IECC, Table C403.8.1(1). This requirement supersedes the requirement in the IECC, Section C403.8, and the IECC, Table C403.8.1(2). All exceptions in the IECC, Section C403.8, shall apply.

H4.3.5.2 Fan Efficiency. The fan efficiency requirements defined in the IECC, Section C403.8.3, shall be used, except that the total efficiency of the fan at the design point of operation shall be within ten percentage points of the maximum total efficiency of the fan. All exceptions in the IECC, Section C403.8.3, shall apply.

H4.3.6 Exhaust Air Energy Recovery. The exhaust air energy recovery shall comply with the requirements defined in the IECC, Section C403.7.4, including the requirements in Tables C403.7.4(1) and C403.7.4(2). The energy recovery effectiveness shall be not less than 60%, and this shall supersede the requirement of the IECC.

H4.3.7 Kitchen Exhaust Systems. The requirements in the IECC, Section C403.7.5, shall apply, except as modified by Sections 7.4.3.7.1 and 7.4.3.7.2.

H4.3.8 Duct Insulation. Duct insulation shall comply with the minimum requirements in Normative Appendix A, Tables A-2 and A-3. These requirements supersede the requirements in the IECC, Section C403.11.1.

H4.3.9 Automatic Control of HVAC and Lights in Hotel/Motel Guest Rooms. Controls in hotel and motel guest rooms shall comply with Section 7.4.3.9.

H4.3.10 HVAC Equipment Performance Requirements. Equipment shall meet the minimum efficiency requirements of ANSI/ASHRAE/IES Standard 90.1, Section 6.4.1, or of the IECC, Section C403.3.2.

Note: Some 2018 IECC minimum efficiency requirements are below Federal minimum standards. Users may want to verify applicable requirements.

H4.4 *Service Water Heating*. The *service water heating* shall comply with the IECC, Section C404, with the following modifications and additions.

H4.4.1 Equipment Efficiency for the Alternate Renewables Approach. *Building projects* complying with the Alternate Renewables Approach in Section 7.4.1.1.2 shall comply with the applicable equipment efficiency requirements in Normative Appendix B, Table B-9, and the applicable ENERGY STAR requirements in Section 7.4.7.3. These requirements supersede the requirements in the IECC, Table C404.2.

H4.4.2 Insulation for Spa Pools. Insulation for spa pools shall comply with Section 7.4.4.2.

H4.5 Lighting. The lighting shall comply with the IECC, Sections C405.2 through C405.4, with the following modifications and additions.

H4.5.1 *Lighting Power Allowance*

H4.5.1.1 Interior Lighting Power Densities (LPDs). The interior *lighting power allowance* shall comply with Section 7.4.6.1.1.

H4.5.1.2 Exterior LPDs. The exterior *lighting power allowance* shall be determined using the IECC, Section C405.4.1, with the following modification. The LPDs from the IECC, Table C405.4.2(2), shall be multiplied by the appropriate LPD Factor from Table 7.4.6.1C.

H4.5.2 Occupancy Sensor Controls with Multilevel Switching or Dimming. Lighting in commercial and industrial storage stack areas shall comply with Section 7.4.6.2.

H4.5.3 *Automatic* Controls for Egress and Security Lighting. *Automatic* controls for egress and security lighting shall comply with Section 7.4.6.3.

H4.5.4 Controls for Exterior Sign Lighting. Controls for exterior sign lighting shall comply with Section 7.4.6.4.

H4.5.5 Parking and Outdoor Sales Lighting. This section supersedes the IECC, Section C.405.4.2, for lighting serving uncovered parking areas. Outdoor luminaires serving uncovered parking areas and open areas in outdoor sales lots shall be controlled by all of the following:

a. Luminaires shall be controlled by a device that automatically turns off the luminaire during *daylight hours*.
b. Luminaires shall be controlled by a timeclock or other control that automatically turns off the luminaire according to a timed schedule.
c. For luminaires having a rated input wattage of more than 50 W and where the bottom of the luminaire is mounted 24 ft (7.3 m) or less above the ground, the luminaires shall be controlled by one or more devices that automatically reduce lighting power of each luminaire by a minimum of 50% when there is no activity detected in the controlled zone for a period no longer than 15 minutes. No more than 1500 input watts of lighting power shall be controlled together.

Exceptions to H4.5.5(c):

1. Lighting serving street frontage for vehicle sales lots.
2. Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

H4.5.6 Other Equipment. The other equipment shall comply with the IECC, Sections C405.5 through C405.9, with the following additions.

H4.5.6.1 Equipment Efficiency for the Alternate Renewables Approach. *Building projects* complying with the Alternate Renewables Approach in Section 7.4.1.1.2 shall comply with the applicable equipment efficiency requirements in Normative Appendix B and the applicable ENERGY STAR requirements in Section 7.4.7.3.2.

H4.5.6.2 Supermarket Heat Recovery. Supermarkets shall comply with Section 7.4.7.2, as applicable.

H4.5.6.3 ENERGY STAR Equipment. All *building projects* shall comply with Section 7.4.7.3.

H4.5.6.4 Programmable Thermostats. Residential programmable thermostats shall comply with Section 7.4.7.4.

H4.5.6.5 Refrigerated Display Cases. Refrigerated display cases shall comply with Section 7.4.7.5.

Modify Informative Appendix G as follows.

Reference	Title	Section
International Code Council, Inc. (ICC) 500 New Jersey Ave., NW 6th Floor Washington, DC 20001		
IECC-2018	International Energy Conservation Code	Appendix H

(This foreword 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.)

FOREWORD

Addendum cl updates Table 7.5.2A to provide consistency with changes to ASHRAE Standard 90.1-2016, which is referenced by Standard 189.1, and to changes in the stringency of the prescriptive requirements in Standard 189.1, Section 7.

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 cl to Standard 189.1-2014

Modify Table 7.5.2A as shown.

Table 7.5.2A Performance Option A: Energy Cost and CO_2e ~~Reductions~~ Building Performance Factors (BPF)

Building Type	~~Percent Reduction~~ Building Performance Factor (BPF)
Multifamily	0.71
Healthcare/hospital	0.56
Hotel/motel	0.58
Office	0.54
Restaurant	0.59
Retail	0.50
School	0.37
Semiheated warehouse[a]	0.44
All others	0.54
~~Apartments~~	~~10%~~
~~Restaurants~~	~~5%~~
~~Lodging~~	~~12%~~
~~Semiheated warehouses~~[a]	~~45%~~
~~Other~~[b]	~~24%~~

a. Conditioned warehouses shall use the "All others" category.

b. ~~When the modeled energy use that is not regulated energy use exceeds 35% of the total proposed building energy use, the reduction shall be calculated using the following equation: Percent reduction = 0.55 – 0.99 × Percent Non-Regulated Energy. The reduction shall be no lower than 5%.~~

ADDENDA DESCRIPTION INFORMATION

The table below lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE, and ANSI approval dates for each addendum.

Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
a	Section 7.4.3.2	This addendum clarifies the location of a CO_2 sensor to determine the outdoor air concentration.	Jan. 23, 2016	Jan. 11, 2016 Dec. 31, 2015 Dec. 22, 2015	Jan. 27, 2016	Jan. 28, 2016
b	Section 7.3.4	This addendum replaces the mandatory requirement for peak load reduction in Section 7.3.4 that was introduced in addendum ce to the standard.	June 27, 2015	May 12, 2015 June 29, 2015 N/A	July 1, 2015	July 2, 2015
c	Sections 10.3.1.2 and 11	This addendum is intended to incorporate ANSI/ASHRAE/IES Standard 202, Commissioning Process for Buildings and Systems, into Standard 189.1, thereby basing commissioning on an industry standard.	Oct. 13, 2015	Sept. 30, 2015 Sept. 28, 2015 Oct. 8, 2015	Oct. 19, 2015	Nov. 2, 2015
d	Section 7.4.6.1.1	This addendum corrects and clarifies a potentially confusing sentence in the standard that could cause some designers to believe that the bonus lighting power control factors from ASHRAE Standard 90.1, Table 9.6.3, cannot be used in Standard 189.1.	Jan. 23, 2016	Jan. 11, 2016 Dec. 31, 2015 Dec. 22, 2015	Jan. 27, 2016	Jan. 28, 2016
e	Sections 3.2, 7.4.6.1.1, 10.3.1.1.3, and 10.3.1.2.4	This new Section 7.4.6.1.1(d) to Standard 189.1 provides control credits for institutional tuning that are in additions to the control factors that already exist in Standard 90.1-2013, Section 9.6.3.	Jan. 23, 2016	Jan. 11, 2016 Dec. 31, 2015 Dec. 22, 2015	Jan. 27, 2016	Jan. 28, 2016
f	Table 6.3.2.1	This addendum modifies Table 6.3.2.1 to make it consistent with the text of Section 6.3.2.1(b).	June 25, 2016	July 4, 2016 June 27, 2016 June 9, 2016	June 29, 2016	June 30, 2016
g	Sections 8.3.1.4 and 10.3.2.1.4.7	This addendum to Standard 189.1 provides a higher level of indoor moisture control than is currently required by reference to Standard 62.1.	Jan. 23, 2016	Jan. 11, 2016 Dec. 31, 2015 Dec. 22, 2015	Jan. 27, 2016	Jan. 28, 2016
i	Sections 5.3.5.3, 5.3.5.5, 10.3.2.1.1, and 11	This addendum reorganizes the roof heat island mitigation section and adds new provisions for vegetated terrace and roofing systems.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
j	Sections 5.3.1.2	This addendum clarifies the exceptions contained under Section 5.3.1.2, "Prohibited Development Activity," which includes provisions for fish/wildlife habitat conservation areas and wetlands.	Aug. 24, 2016	July 4, 2016 June 27, 2016 June 9, 2016	Aug. 29, 2016	Aug. 30, 2016
k	Section 7.4.2.1	This addendum is based in part on a comparison of 189.1 with the 2015 International Green Construction Code (IgCC). The change from 10% to 5% in the U-, C- and F- factors and in the SHGC is based on it being more practical to design and build, while having only a limited impact on energy use.	Feb. 1, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	March 2, 2017

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
l	Sections 9 and 9.1	This addendum revises the title and scope of Section 9 in order to improve clarity and more accurately describe the content of the section.	Feb. 1, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	March 2, 2017
m	Section 5.3.7.1.1	This addendum augments provisions for connection of on-site walkways and bicycle paths to street sidewalks and bicycle paths.	Aug. 24, 2016	July 4, 2016 June 27, 2016 June 9, 2016	Aug. 29, 2016	Aug. 30, 2016
n	Section 9.3.5	This addendum clarifies footnote b to Table 7.5.2A of Standard 189.1-2014. This footnote provides a method to adjust the percent reduction for buildings with unregulated energy cost exceeding 35% of the total energy cost.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
o	Sections 1 and 2	This addendum revises the existing purpose and scope of the standard to clarify the intended purposes of the standard and its application and to better reflect revisions to the standard that are being considered by the committee.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2017	May 20, 2017
p	Sections 3 and 6.3.2.1	This addendum adds requirements for water-bottle filling stations, which are intended to improve water efficiency and sanitation of public drinking water and reduce the environmental effects of plastic bottles.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
q	Sections 4.1.4, 5.3.5.3, 7.4.2.1, 7.4.2.5, 7.4.3.7.2, and 11; Tables 7.4.3.3 and 8.4.1.2; Appendix A	This addendum Standard 189.1 was developed in response to the update of ASHRAE Standard 169-2013, Climatic Data for Building Design Standards. Standard 189.1 now references ANSI/ASHRAE/IES Standard 90.1 and Standard 169 for climatic data and includes criteria for Climate Zone 0.	Aug. 24, 2016	July 4, 2016 June 27, 2016 June 9, 2016	Aug. 29, 2016	Aug. 30, 2016
r	Section 7.4.3.3	This addendum lowers the threshold for duct leakage testing to include 2 in. pressure class ducts, which are common upstream of VAV boxes.	June 28, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	Aug. 1, 2017
s	Section 6	This addendum removes the performance option for water use and moves the prescriptive option into the mandatory section.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 20, 2017
t	Sections 6.3.4 and 6.3.5	This addendum adds new requirements for reverse osmosis and on-site reclaim water systems in order reduce the likelihood of excessive water use due to poor design of water treatment and filter systems.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
u	Section 6.3.4	This addendum adds new requirements for water softeners to reduce water consumption, given the impact of their design and efficiency on water discharge water rates.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
v	Sections 3.2, 5.3.1.1, and 11	This addendum revises two paragraphs in Section 5.3.1.1, "Allowable Sites." The revisions reference ASTM standards that provide more precision than the requirements that currently exist in Standard 189.1.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
w	Section 7.5.2	This addendum updates Performance Option A of Section 7.5.2 to be consistent with recent changes to the Performance Rating Method as published in Standard 90.1-2016.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017
x	Section 7.5; Appendix C	This addendum deletes Performance Path B and sections of Appendix C, motivated in part by changes to the Performance Rating Method published in Standard 90.1-2016, which made significant structural changes to the performance compliance path on which the requirements in Standard 189.1 are heavily based.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
y	Sections 10.3.2.1, 10.3.2.1.4 and 10.3.2.1.5; Appendix G	This addendum adds a requirement for an Indoor Environmental Quality (IEQ) occupant satisfaction survey to be included in the postoccupancy plan for operation.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
z	Tables 7.4.6.1A and 7.4.6.1B	This addendum revises the lighting power density (LPD) requirements in Standard 189.1 to include parking structures.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
aa	Sections 3.2, 7.4.1.1, and 11	This addendum revises current requirements for renewable energy systems and related exceptions. It requires that renewable energy certificates (RECs) be retained and retired by the building owner for all compliance options.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug. 1, 2017	Aug. 23, 2017
ab	Section 7.4.3.7	This addendum adds SI values to the requirements for kitchen hood exhausts. The SI values were extracted from Standard 90.1-2016, Table 6.5.7.2.2, which has the same table content as Table 7.4.3.7.	Jan. 28, 2017	Feb. 11, 2017 Jan. 31, 2017 Jan. 12, 2017	Feb. 1, 2017	Feb. 13, 2017
ac	Section 7.3.4	This addendum deletes the existing Section 7.3.4 and replaces with new text that is based in part on concepts that are included in the 2015 International Green Construction Code.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
ad	Section 7.4.2.5 and 8.4.1.3	This addendum changes the requirements for permanent projections (such as balconies, overhangs, or shading devices). It deletes the prescriptive requirements for permanent projections in Climate Zones 4A and 5, retaining the requirements in Climate Zones 0 through 3, 4B, and 4C.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
ae	Section 5.3.8	This addendum adds a new Section 5.3.8, which addresses plans for the treatment of waste materials originating from the development of a building project site.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
ag	Section 7.4.2	This addendum makes creates a new definition for plants that are suitable for inclusion in this standard. It replaces “adapted plants” in Section 6 to better define the desired vegetation and to avoid conflicting with the term’s use in Section 5.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
ah	Table 7.5.3	This addendum revises the lighting power density (LPD) requirements in Standard 189.1 for exterior parking areas using the same methodology employed in Standard 90.1 but targeting a high level of performance.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
ai	Sections 7.4.2.4, 10.3.1.2.4, and 11	This addendum adds requirements for testing, installing, and commissioning air curtains in building entrances. These requirements are intended to ensure that air curtains function and operate as intended.	June 28, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	Aug. 1, 2017
aj	Sections 7.4.6.4 and 7.4.6.5	This addendum revises the bilevel motion control requirements to better align with the requirements of Standard 90.1-2016, which increased the lighting power reduction from 30% to 50% for signs and most exterior lighting (except façade and landscape lighting) after business hours.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017
ak	Sections 9.5 and 11	This addendum revises Section 9.5 to reflect advancements in the implementation of life-cycle assessment and to reference ASTM E2921, Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes and Rating Systems.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug 1, 2017	Aug. 23, 2017
al	Section 5.3.7.3	This addendum modifies the provisions for electric-vehicle charging infrastructure to include an additional option to provide electric conduit from electric service panels to parking lot spaces during new-building construction	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017
am	Section 5.3.5.3	This addendum modifies the roof heat island mitigation section that was previously changed via addendum i. The only change is to adjust the steep-slope roof SRI from 15 to 25, which matches the 2015 IgCC and is slightly less that the LEED V4 SRI of 32.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
ap	Section 11 and Appendix G	This addendum to Standard 189.1-2014 updates the normative references in Section 11 and the informative references in Appendix G.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017
aq	Sections 3 and 10	This addendum updates requirements in Standard 189.1 for functional performance testing and for building systems commissioning. These changes are intended to harmonize the standard with requirements and methods included in the 2015 International Green Construction Code and to update the standard with respect to trends and terminology in the evolving commissioning industry.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug 1, 2017	Aug. 23, 2017
as	Sections 3.2, 3.3, 8.3.3, 10, and 11	This addendum updates the acoustical requirements of Standard 189.1. Its development included comparison with the International Green Construction Code, Acoustical Society of America, Facilities Guideline Institute, and LEED, and benefited from the participation of ASHRAE TC 2.6, Sound and Vibration Control.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug 1, 2017	Sept. 12, 2017
au	Sections 3.2, 6, and 11	This addendum provides additional requirements for irrigation systems to improve water use efficiency, based in part on consideration of requirements included in the IgCC.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
av	Section 7.4.6.1.1; Tables 7.4.6.1A and 7.4.6.1B	This addendum simplifies the application of lighting power allowances in ASHRAE/USGBC/IES Standard 189.1 and increases their stringency, while maintaining the same provisions for illuminance.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
aw	Sections 3.2, 8.3.8 and 8.3.9; Table 8.4.1.2A	This addendum adds two new mandatory requirements to Section 8, "Indoor Environmental Quality," with regard to occupant control of operable methods of glare control and of automatic daylight-responsive controls.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug 1, 2017	Aug. 23, 2017
ax	Section 6.4.3	This addendum modifies the existing requirements on water features by focusing on those circumstances, malfunctioning automatic water refilling values, which are most likely to use excessive water.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017
ay	Sections 6.4.4	This addendum adds requirements for dual plumbing in new buildings so that nonpotable waters (when available) can be used to flush toilets and urinals.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug 1, 2017	Aug. 23, 2017
az	Section 5.3.3.2	This addendum adds exceptions to the calculation of the area of greenfields that must consist of biodiverse plantings other than turfgrass.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	Aug 1, 2017	Aug. 23, 2017
ba	Sections 8.3 and 11	This addendum updates the broad reference in Section 8.3.1 to a wide range of requirements in both Standard 62.1 and Standard 170 to more narrowly cite the specific sections of those standards that are relevant to Standard 189.1.	April 6, 2017	April 13, 2017 March 28, 2017 March 31, 2017	April 17, 2013	May 1, 2017
bb	Section 7.3.3.2	This addendum adds a new requirement to Section 7 to display energy use in support of existing requirements in Section 10.3.2.1.3.2, "Track and Assess Energy Consumption."	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bd	Table 7.5.2B	This addendum updates carbon dioxide equivalent values in Table 7.5.2B.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017
be	Sections 8.3.1 and 11	This addendum requires that the products of combustion from any equipment or system that is permanently installed indoors be vented to the outside.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	Aug. 3, 2017
bh	Appendix B; Table B-1	This addendum revises the requirements in ASHRAE/USGBC/ IES Standard 189.1, Table B-1, Electrical-Operated Unitary Air Conditioners and Condensing Units, to adjust the efficiency metrics for industry improvements for these products.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bi	Section 3; Appendix B; Table B-5	This addendum modifies Table B-5, which defines the requirements for single packaged vertical air conditioners, single packaged vertical heat pumps, room air conditioners, and room air-conditioner heat pumps.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bj	Appendix B; Table B-6	This addendum updates requirements in ASHRAE/USGBC/IES Standard 189.1, Table B-6, "Warm Air Furnace and Combination Warm Air Furnaces/Air-Conditioning Units, Warm Air Duct Furnaces, and Unit Heaters."	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
bk	Appendix B; Tables B-12 and B-13	This addendum modifies Tables B-12, Electrically Operated Variable-Refrigerant-Flow (VRF) Air Conditioners Minimum Efficiency, and table B-13, Electrically Operated Variable-Refrigerant-Flow (VRF) Heat-Pump Air Conditioners Minimum Efficiency.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bl	Appendix B; Table B-9	This addendum updates the efficiency requirements in Table B-9 to reflect changes in efficiency metrics.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bn	Section 8.3	This addendum updates the soil-gas control requirements in Section 8 to increase the protection of building occupants against radon exposure, specifying the key elements of effective soil-gas control.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017
bo	Sections 3 and 11	This addendum broadens and simplifies the existing definition of "sidelighting effective aperture" in ASHRAE/USGBC/IES Standard 189.1 in order to clarify its application in the prescriptive daylighting requirements in Section 8.4.1.2.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bp	Sections 8.4.2.1 and 11	This addendum updates existing requirements for the emissions or VOC content in adhesives and sealants by updating references, adding accreditation requirements for testing laboratories and clarifying language related to the VOC content requirements.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bq	Sections 8.4.4.2 and 11	This addendum updates the existing requirements for the emissions or VOC content for paints and coating materials by adding accreditation requirements for testing laboratories, clarifying the language related to the VOC contents requirements, and updating references.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
br	Sections 8.4.2.3 and 11	This addendum updates the existing requirements for the emissions for floor covering materials by adding accreditation requirements for testing laboratories, updating product categories to be consistent with CDPH/EHLB v1.1, adding a list of materials that are deemed to comply, and updating references.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bs	Sections 8.4.2.6 and 11	This addendum updates the existing requirements for the emissions for ceiling and wall assemblies by modifying the list of materials covered, adding a separate subsection on insulation, adding a list of materials that are deemed to comply, adding accreditation requirements for testing laboratories, and updating references.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bt	Sections 7.3.1.1, 10.3.1.2.5, and 11	This addendum updates requirements for building envelope airtightness testing in ASHRAE/USGBC/IES Standard 189.1 based on changes in ANSI/ASHRAE/IES Standard 90.1-2016.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bu	Appendix B; Table B-2	This addendum revises the efficiency requirements in ASHRAE/USGBC/IES Standard 189.1, Table B-2, Electrically Operated Unitary and Applied Heat Pumps Minimum Efficiency Requirements (I-P), to adjust the efficiency metrics for industry improvements for these products.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
bv	Appendix B; Table B-3	This addendum updates the centrifugal chiller requirement for K_{adj}, which currently exists as a footnote to Table B-3, to reflect changes to AHRI Standards 550/590 and 551/591. The revised requirement is in alignment with ANSI/ASHRAE/IES Standard 90.1.	June 28, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
bw	Appendix B; Table B-4	This addendum updates the requirements in Table B-4 for electrically operated packaged-terminal air conditioners and packaged-terminal heat pumps.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017
bx	Appendix B; Table B-8	This addendum makes changes to Table B-8, "Performance Requirements for Heat-Rejection Equipment," to update some of the efficiency requirements to align with changes in the industry.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017
by	Section 8.3.1.4	This addendum provides a higher level of indoor moisture control (primarily to reduce the likelihood of microbial growth on interior surfaces and within the building envelope) than is currently required by Standard 189.1's reference to Standard 62.1.	June 27, 2015	May 12, 2015 June 29, 2015 N/A	July 1, 2015	July 2, 2015
bz	Appendix B; Tables B-3, B-10, B-14 and B-15	This addendum updates tables for Water-Chilling Packages, Commercial Refrigerator and Freezers, Commercial Refrigeration Minimum Efficiency Requirements and low-Voltage Dry-Type Distribution Transformers in appendix B.	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
cd	Sections 3.2, 8.4.1, 8.5.1 and 11	This addendum revises the daylight requirements in Section 8.4, "Prescriptive Compliance Path," and Section 8.5, "Performance Option."	June 23, 2017	June 14, 2017 June 13, 2017 June 12, 2017	June 28, 2017	June 29, 2017
ce	Section 7	This addendum revises contains modifications to the mandatory and prescriptive requirements for peak load reduction in Section 7. The existing prescriptive requirement in Section 7.4.5.1 is deleted, and a mandatory requirement is added in Section 7.3.4.	June 27, 2015	May 12, 2015 June 29, 2015 N/A	July 1, 2015	July 2, 2015
cf	Appendix E	This addendum updates Informative Appendix E to make it consistent with changes approved by addendum k, which changed the building envelope requirements in Section 7.4.2.1. It also adds tables for Climate Zone 0, consistent with addendum q.	May 22, 2017	May 15, 2017 May 12, 2017 May 11, 2017	N/A	N/A
cg	Appendix I	This addendum adds a new informative appendix to aid in understanding and adoption of the functional performance testing (FPT) and commissioning (Cx) processes of Section 10.	May 22, 2017	May 15, 2017 May 12, 2017 May 11, 2017	N/A	N/A
ch	Sections 5 and 11	This addendum to ASHRAE Standard 189.1 contains updates to references.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017
cj	Appendix H	This addendum adds an informative appendix for use in correlating the prescriptive energy path provisions of this standard with those of the International Energy Conservation Code (IECC).	May 22, 2017	May 15, 2017 May 12, 2017 May 11, 2017	N/A	N/A

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Addenda to ANSI/ASHRAE/USGBC/IES Standard 189.1-2014 *(Continued)*

Addendum	Sections Affected	Description of Changes*	ASHRAE Standards Committee Approval	Cosponsor Approval (USGBC, IES, ICC)	ASHRAE BOD Approval	ANSI Approval
cl	Table 7.5.2A	This addendum updates Table 7.5.2A to provide consistency with changes to ASHRAE Standard 90.1-2016, which is referenced by Standard 189.1, and to changes in the stringency of the prescriptive requirements in Standard 189.1, Section 7.	July 24, 2017	July 24, 2017 July 26, 2017 July 24, 2017	July 26, 2017	July 27, 2017

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NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at http://www.ashrae.org/technology.

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.