ADDENDA

ANSI/ASHRAE/IES Addendum co to
ANSI/ASHRAE/IES Standard 90.1-2019

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on June 25, 2022; by the ASHRAE Board of Directors on June 29, 2022; by the Illuminating Engineering Society on June 17, 2022; and by the American National Standards Institute on July 29, 2022.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (https://www.ashrae.org/continuous-maintenance).

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

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The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
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(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

Sections 5 through 10 include subsections with requirements that apply to building alterations, such as Section 5.1.3 for envelope alterations, Section 6.1.1.3 for HVAC&R alterations, Section 7.1.1.3 for service water heating alterations, etc. Requirements in these sections typically apply only to the systems that are being altered and are often less stringent than requirements for new construction projects. For example, Section 5.1.3 Exception 3 allows alterations to roof, wall, or floor to comply with the standard by having existing cavities insulated to full depth, with insulation having a minimum nominal value of R-3.0/in as an alternative to meeting insulation levels in Tables 5.5-0 to 5.5-8.

In contrast, Appendix G modeling rules are the same for new construction and alteration projects, and there are also no differences in the methodology used to establish compliance based on the simulation results for the baseline and proposed design models. As a result, retrofits are held to the same standard as new construction projects and are penalized for existing systems that are less efficient than the current requirements for new construction projects.

Addendum co includes the following changes to address this issue:

a. *Modifies Section 4.2.1.3 to increase the BPF for substantial alternation projects by 5% relative to the values for new construction projects included in Table 4.2.1.1. The BPF increase is a relaxation in stringency that was selected based on committee judgement and experience of several beyond-code programs and jurisdictions.*
b. *Adds a new Section G3.3 to Appendix G with the modeling rules for limited alterations that do not qualify as substantial alterations.*
    1. *The proposed design is modeled following existing requirements in Table G3.1—new and retrofitted systems and equipment are modeled based on the design documents, while systems and equipment excluded from the scope of retrofit are modeled based on the existing conditions.*
    2. *The baseline design is modeled the same as the proposed design, except system and equipment included in the scope of retrofit are modeled at the efficiency levels minimally compliant with the mandatory and prescriptive requirements in Sections 5 through 10 applicable to retrofit projects.*
c. *Modifies Section 4.2.1.3 to prescribe BPF = 1 to the limited retrofits modeled following Section G3.1.2. BPF reflects the change in stringency between the edition of Standard 90.1 used as the basis of the baseline model and the current edition. Because the modeling rules in Section G3.1.2 prescribe modeling baseline for the limited retrofits as minimally compliant with the current edition of Standard 90.1, BPF = 1 is appropriate.*
d. *Modifies Section 4.2.1.1 to indicate that for projects involving an existing building and an addition, the BPF must be calculated as an area-weighted average of the existing-building BPF from Section 4.2.1.3 and the addition BPF from Table 4.2.1.1*

This addendum impacts an optional performance path in the standard designed to provide increased flexibility and therefore was not subjected to cost effectiveness analysis.

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 co to Standard 90.1-2019

Modify Section 4 as shown (I-P and SI). (Note: This text was previously modified by Addendum cp to Standard 90.1-2019, which can be downloaded from the ASHRAE website at https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-addenda/addenda-to-standard-90-1-2019.)

4.2 Compliance

4.2.1 Compliance Paths

4.2.1.1 New Buildings. New *buildings* shall comply with Sections 4.2.2 through 4.2.5 and either the provisions of

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "*Energy Cost Budget* Method," or
c. Normative Appendix G, "*Performance Rating Method*."

When using Normative Appendix G, the Performance Cost Index (PCI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Cost Index Target (PCI_t) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (PF \times BBREC) - PRE]/BBP$$

where

PCI = Performance Cost Index calculated in accordance with Section G1.2

BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*

BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use*

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use "All others." Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types based on their *gross floor area*. Where a project includes an *existing building* and an *addition*, the required BPF shall be equal to the area-weighted average of the *existing building* BPF determined as described in Section 4.2.1.3 and the *addition* BPF from Table 4.2.1.1.

BBP = baseline building performance

PBP = *proposed building performance*, including the reduced, annual purchased energy cost associated with all *on-site renewable energy* generation systems

PBP_{nre} = *proposed building performance* without any credit for reduced annual energy costs from on-site renewable energy generation systems

PBP_{pre} = *proposed building performance,* excluding any renewable energy system in the *proposed design* and including an *on-site renewable energy* system that meets but not exceeds the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 11.5.1

PRE = $PBP_{nre} - PBP_{pre}$

When $(PBP_{pre} - PBP)/BBP > 0.05$, new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Regulated *energy* cost shall be calculated by multiplying the total *energy* cost by the ratio of *regulated energy use* to total *energy* use for each *fuel* type. Unregulated *energy* cost shall be calculated by subtracting regulated *energy* cost from total *energy* cost.

Informative Notes:

1. PBP_{nre} = *proposed building performance*, no renewable energy
2. PBP_{pre} = *proposed building performance*, prescriptive renewable energy
3. PRE = prescriptive renewable energy

4.2.1.2 Additions to Existing Buildings. *Additions* to *existing buildings* shall comply with the provisions of Sections 4.2.2 through 4.2.5 and one of the following:

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "Energy Cost Budget Method," or
c. Normative Appendix G, "Performance Rating Method," in accordance with Section 4.2.1.1.

4.2.1.2.1 When an *addition* to an *existing building* cannot comply by itself, trade-offs will be allowed by modification to one or more of the existing components of the *existing building*. Model-

ing of the modified components of the *existing building* and *addition* shall employ the procedures of Section 11 or Normative Appendix G; the *addition* shall not increase the *energy* consumption of the *existing building* plus the *addition* beyond the *energy* that would be consumed by the *existing building* plus the *addition* if the *addition* alone did comply.

4.2.1.3 Alterations of Existing Building Assemblies, Systems, and Equipment. *Alterations* of *existing building* assemblies, systems, and equipment shall comply with the provisions of Sections 4.2.2 through 4.2.5 and one of the following:

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Condition- ing"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "Energy Cost Budget Method," or
c. Normative Appendix G, "Performance Rating Method," in accordance with Section 4.2.1.1 with the following modifications:

1. *Alterations* that meet the criteria in G3.1.4(a) shall use the BPF from Table 4.2.1.1 multiplied by 1.05.
2. All other *alterations* modeled following Section G3.3 shall use BPF = 1.

Exception to 4.2.1.3: A *building* that has been specifically designated as historically significant by the *adopting authority* or is listed in The National Register of *Historic* Places or has been determined to be eligible for listing by the U.S. Secretary of the Interior need not comply with these requirements.

[. . .]

Modify Section G3.1 as shown (I-P and SI) and renumber subsections accordingly.

G3.1 Building Performance Calculations

G3.1.1 Scope. The simulation model for calculating the ~~proposed~~*proposed building performance* and *baseline building performance* shall be developed in accordance with Section G3.1.2, 3.1.3, or 3.1.4 as applicable.

G3.1.2 New Buildings. The simulation model for calculating the ~~proposed~~*proposed building performance* and *baseline building performance* for new *buildings* shall be developed in accordance with the requirements in ~~Table G3.1~~ Section G3.2.

G3.1.3 Additions. The simulation model for calculating the ~~proposed~~*proposed building performance* and *baseline building performance* for *additions* shall be developed in accordance with the requirements in Section G3.2.

G3.1.4 Alterations. The simulation model for calculating the ~~proposed~~*proposed building performance* and *baseline building performance* for *alterations*, excluding *additions*, shall be developed in accordance with the applicable subparagraph (a) or (b).

a. In accordance with Section G3.2 for *alterations* that include replacement of two or more of the following:
   1. *HVAC systems* that account for more than 50% of the capacity serving either the heating or cooling loads of the *alteration* area. This includes HVAC unitary *systems*, HVAC *terminal* units, or components of HVAC central heating or cooling *equipment*. HVAC *terminal* units, for the purposes of this section, can include VAV boxes, fan-coil units, VRF room units, or water-loop heat pumps;
   2. 50% or more of the *luminaires* in the *alteration* area;
   3. 25% or more of the *building envelope* area of the *alteration* portion of the building, including new exterior cladding, *fenestration*, or insulation.
b. In accordance with Section G3.3 for all other *alterations*.

G3.2 Performance Calculations for New Buildings, Additions and Substantial Alterations

~~G3.1.1~~G3.2.1 Baseline HVAC System Type and Description

[. . .]

~~G3.1.2~~G3.2.2 General Baseline HVAC System Requirements

[. . .]

~~G3.1.3~~G3.2.3 System-Specific Baseline HVAC System Requirements

[. . .]

G3.3 Performance Calculations for Other Alterations

G3.3.1 Proposed Building Performance. The simulation model for calculating the *proposed building performance* shall be developed in accordance with the requirements in Table G3.1, Proposed Building Performance column and the following additional requirements:

a. New and retrofitted *systems* and *equipment* shall be consistent with design documents.
b. Systems and *equipment* excluded from the scope of retrofit shall reflect the existing conditions.

G3.3.2 Baseline Building Performance

G3.3.2.1 General Approach. *System* and *equipment* included in the scope of retrofit shall be modeled at *efficiency* levels meeting the mandatory and prescriptive requirements in Sections 5 through 10 and as described in this section. All other baseline *systems* and *equipment* shall be modeled the same as in the *proposed design.*

G3.3.2.2 Schedules. Schedules modeled in the *baseline design* are allowed to differ from the *proposed design* following Table G3.1(4), Baseline Building Performance column, Exceptions 1 through 3.

G3.3.2.3 Opaque Assemblies. *Opaque* assemblies shall be modeled with U-factors meeting the requirements in Section 5.1.3.

G3.3.2.4 Fenestration. *Fenestration U-factor*, *SHGC*, and *VT* shall be modeled as meeting the requirements in Section 5.1.3.

The *fenestration area* for an *existing building* shall equal the existing *fenestration area* prior to the proposed work and shall be distributed on each face of the *building* in the same proportions as the *existing building.*

G3.3.2.5 Air Leakage. When Section 5.4.3.1.3 applies, the *air leakage* rate of the *building envelope* (I_{75Pa}) shall be equal to 0.35 cfm/ft^2 (1.8 L/s·m^2) of *building envelope* area at a pressure differential of 75 Pa (0.30 of water) (75 Pa). The *air leakage* rate shall be converted to appropriate units for the simulation software using the same method as the *proposed design*.

G3.3.2.6 Interior Lighting. Interior *lighting power density* shall be modeled as meeting Section 9.1.2 using allowances in Section 9.6.1, "Space-by-Space Method of Calculating Interior Lighting Power Allowance." Lighting *controls* shall be modeled as meeting Section 9.1.2.

G3.3.2.7 Exterior Lighting. Tradeable exterior lighting shall be modeled as meeting Section 9.1.2.

G3.3.2.8 HVAC Systems

a. Baseline *HVAC system* types shall be the same as the *proposed design*.
   Exception to to G3.3.2.8(a): If the *proposed design* includes variable-refrigerant heat pumps or *single-zone systems* with *electric resistance* heat, then air-source heat pumps shall be used in the *baseline design*.
b. *Baseline systems* shall meet the requirements in Section 6.1.1.3. Chillers shall meet the *efficiency* requirements in Table 6.8.1-3 using Path A or Path B, the same as the *proposed design*. If the *proposed design* meets both Path A and Path B requirements, Path A shall be used.
c. Where the *efficiency* rating includes supply fan energy, calculate the minimum $COP_{nfcooling}$ and $COP_{nfheating}$ following Section 11.5.2(c).
d. Fan *system efficiency* (bhp per cfm [input *kW* per L/s] of supply air, including the effect of belt losses but excluding motor and motor drive losses) shall be the same as the *proposed design* or up to the limit prescribed in Section 6.5.3.1, whichever is smaller. If this limit is reached, each fan shall be proportionally reduced in brake horsepower (input *kilowatts*) until the limit is met. Fan electrical power shall then be determined by adjusting the calculated fan hp (*kW*) by the minimum motor efficiency prescribed by Section 10.4.1 for the appropriate motor size for each fan.
   Exception to to G3.3.2.8(d): When a *proposed design* includes energy recovery but it is not required in the *baseline building design* per Section 6.5.6, the fan power of the baseline *system* shall be equal to either the *proposed design system* or the fan power limit in Section 6.5.3.1 calculated without fan power credit for energy recovery, whichever is less.
e. The equipment capacities for the *baseline design* shall be sized proportionally to the capacities in the *proposed design* based on sizing runs—i.e., the ratio between the capacities used in the

annual simulations and the capacities determined by the sizing runs shall be the same for both the *proposed design* and budget building design.

G3.3.2.9 *Service Water Heating Systems.* *Service water heating systems* shall be modeled as meeting Section 7.1.1.3. *Service water heating energy* use can be documented to be reduced as allowed in Table G3.1(11) *Baseline Building Performance* column exceptions to (g).

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.

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