SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as “substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution.” Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

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
d. permission to reprint portions of the Standard.

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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 alteration 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.)
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:

\[
\text{PCI}\_t = \left[ \text{BBUEC} + \left( \text{PF} \times \text{BBREC} \right) - \text{PRE} \right] / \text{BBP}
\]

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 \((\text{PBP}\_\text{pre} - \text{PBP}) / \text{BBP} > 0.05\), new buildings, additions to existing buildings, and/or alterations to existing buildings shall comply with the following:

\[
\text{PCI} + \left[ \left( \text{PBP}_\text{pre} - \text{PBP} \right) / \text{BBP} \right] - 0.05 < \text{PCI}\_t
\]

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:

or
b. Section 11, “Energy Cost Budget Method,”
or

**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.
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 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 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

G3.2.1 Baseline HVAC System Type and Description

[ . . . ]

G3.2.2 General Baseline HVAC System Requirements

[ . . . ]
G3.3.3 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 (I₇₅Pₐ) shall be equal to 0.35 cfm/ft² (1.8 L/s·m²) 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 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 COP₉₅cooling and COP₉₅heating 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 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).
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.
About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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