ADDENDA

ANSI/ASHRAE/IES Addendum av 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).

The latest edition of an ASHRAE Standard may be purchased on the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 180 Technology Parkway, Peachtree Corners, GA 30092. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

 ISSN 1041-2336

Approved American National Standard
www.ansi.org

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.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

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.

DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

(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

Work on Addendum av was initiated following the publication of ASHRAE Research Project (RP) 1365 "Thermal Performance of Building Envelope Details for Mid- and High-Rise Buildings." The RP found that unaccounted heat flow through the cumulative impact of thermal bridges can increase the annual energy consumption associated with the building envelope when compared to a building without thermal bridges.

Addendum av incorporates numerous comments from multiple public review periods. Exceptions are added for overhangs, additional compliance options are added for mass walls, allowances are increased for unmitigated thermal bridges, and clarifying language is added to Section 11 and Normative Appendix G.

The options shown were considered cost effective based on the methodology agreed to by SSPC 90.1, except for the large elements, in which case an allowance is provided. The current standard assumes a near-perfect building with no large elements passing through the thermal envelope. Addendum av therefore offers the user two options: construct a near-perfect wall or take advantage of the allowances.

Addendum cr to Standard 90.1-2019, which was published during the development of this addendum, provides requirements that limit building envelope tradeoffs in the performance paths in Section 11 and Normative Appendix G (aka building envelope backstops). Projects can comply with the proposed building envelope tradeoff limits either by meeting the prescriptive envelope requirements in Section 5.5 or using Section 5.6 "Building Envelope Trade-Off Option" to demonstrate that the energy cost penalty from the proposed envelope does not exceed the set margins. The backstop margins are 15% for residential building area types and 7% for nonresidential building area types.

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 90.1-2019

Revise Section 3.2 as shown (I-P and SI).

chi-factor (χ or Chi): thermal transmittance of a *point thermal bridge* in units of Btu/(h·°F) [W/K]

[. . .]

clear-field thermal bridge: see *thermal bridge.*

[. . .]

linear thermal bridge: see *thermal bridge.*

[. . .]

point thermal bridge: see *thermal bridge.*

[. . .]

psi-factor (ψ or Psi): thermal transmittance per unit length of a *linear thermal bridge* in units of Btu/(h·ft·°F) [W/(m·K)]

[. . .]

thermal bridge: an element that has higher thermal conductivity than the surrounding materials, which creates a path of least resistance for heat transfer. For the purposes of determining *building envelope* requirements, the classifications for *thermal bridges* are defined as follows:

> ***clear-field thermal bridge:*** elements of a *building envelope* assembly that are distributed over the area of the assembly and addressed in determining the thermal performance of the assembly in accordance with Normative Appendix A. Examples of *clear-field thermal bridges* include studs, webs and face shells of masonry units, ties, tracks, plates, girts and purlins for metal building envelopes, and fasteners. Fasteners used to construct assemblies in accordance

with Normative Appendix A are not considered nor separately defined as *point thermal bridges*.

linear thermal bridge: a length-based element associated with horizontal, vertical, or diagonal elements that penetrates the insulation in the *building envelope* and with length measured along the exterior surface of the *building envelope*. Examples of *linear thermal bridges* include edges of *floors*, balconies, columns and beams in the plane of an assembly, parapets, *roof-wall-floor* intersections, *fenestration* interfaces, shelf angles, and similar conditions not otherwise defined as a *clear field thermal bridge* or *point thermal bridge*.

point thermal bridge: a discrete element that penetrates the insulation in the *building envelope*. Examples of *point thermal bridges* include a beam penetrating a *wall,* a column penetrating a *roof* or *floor*, and an anchor or connection used to attach an element to the *building* and not otherwise defined as a *clear field thermal bridge* or *linear thermal bridge*. The cross-sectional area of the *point thermal bridge* is measured at the outer surface of the outermost layer of insulation that is penetrated by the element.

Revise Section 3.3 as shown (I-P and SI).

χ *chi-factor*, thermal transmittance of a *point thermal bridge*

[. . .]

L length of a *linear thermal bridge*

[. . .]

min. minimum

[. . .]

n number of occurrences a *point thermal bridge*

[. . .]

Ψ *psi-factor*, thermal transmittance per unit length of a *linear thermal bridge*

Revise Section 5.5.3.2 as shown (I-P and SI).

5.5.3.2 Above-Grade Wall Insulation. Above-grade walls shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8. For the purposes of this provision, wall top plates, tracks, headers, or bond beams are considered part of the base wall assembly.

Exception to 5.5.3.2: ~~Alternatively, f~~For mass walls, where the requirement in Tables 5.5-0 through 5.5-8 is for a maximum assembly U-0.151 (U-0.857) followed by footnote "b," concrete masonry unit (CMU) walls complying with ASTM C90 ~~concrete block *walls*~~ that are ungrouted or partially grouted at 32 in. (800 mm) or greater~~less~~ on center vertically and 48 in. (1200 mm) or greater~~less~~ on center horizontally shall have their ungrouted openings (e.g., cores, cells) filled with insulating material having a maximum thermal conductivity of 0.44 Btu·in/ h·ft^2·°F (0.063 W/(m·K)). ~~Other *mass walls* with integral insulation shall meet the criteria when their *U-factors* are equal to or less than those for the appropriate thickness and density in the "Partly Grouted, Cells Insulated" column of Table A3.1.3.~~

Add new Section 5.5.5 as shown (I-P and SI).

5.5.5 Linear Thermal Bridges and Point Thermal Bridges. Where *linear thermal bridges* and *point thermal bridges* occur as described in Sections 5.5.5.1 through 5.5.5.5, they shall

a. comply with the applicable requirements of Sections 5.5.5.1 through 5.5.5.5 or
b. not exceed the mitigated *psi-factors* and *chi-factors* in Table A10.1, where the *psi-factors* and *chi-factors* for the *thermal bridges* are determined in accordance with Appendix A, Section A10.

For the purposes of Section 5.5.5, linear elements that are connected to the building structure by a series of point connections shall be permitted to be characterized as *linear thermal bridges* or as individual *point thermal bridges*.

Exceptions to 5.5.5:

1. *Buildings* located in Climate Zones 0 through 3.
2. *Semiheated spaces* in *buildings* located in Climate Zones 0 through 6.
3. *Clear-field thermal bridges*.
4. *Thermal bridges* in uninsulated assemblies.

5. *Linear and point thermal bridges* that have a material thermal conductivity less than 3.0 Btu·in/ h·ft^2·°F (0.433 W/[m·K]).
6. *Alterations* to *existing buildings* other than *additions.*
7. *Roofs* that project over *exterior walls.*

Informative Note: For *linear thermal bridges* and *point thermal bridges* that fall under the provisions of Section 2.4 and cannot comply prescriptively with the provisions of Sections 5.5.5.1 through 5.5.5.4, projects can use Section 5.5.5.5, Section 11, Normative Appendix C, or Normative Appendix G.

5.5.5.1 Roof and Wall Intersections. Where a *roof with insulation entirely above deck* intersects an exterior *wall,* the intersection shall comply with Sections 5.5.5.1.1, 5.5.5.1.2, 5.5.5.1.3, and 5.5.5.1.4, as applicable. Blocking, nailers, and similar elements shall be permitted to interrupt insulation for securement of the *roof covering*, coping, flashing materials, or similar elements.

5.5.5.1.1 Roof Edges. At *roof* edges without parapets or overhangs, the *roof* insulation and the *wall* insulation shall comply with the following, as applicable to the location of the insulation:

a. Where a *wall* has exterior *continuous insulation*, the *roof* insulation shall extend to the exterior of the *wall* insulation and the *wall* insulation shall extend to the *roof* insulation.
b. Where a *wall* has cavity or integral insulation that represents more than 50% of the total wall insulation *R-value*, the roof-to-wall insulation shall comply with one of the following:
   1. The cavity or integral insulation shall extend to the underside of the roof insulation.
   2. The cavity or integral insulation shall extend to the underside of the roof deck, and the *roof* insulation shall extend to the exterior face of the *wall*. The *wall* insulation shall be permitted to be interrupted by roof framing members.
   3. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall extend inward on the underside of the roof deck for not less than 2 ft (0.6 m) and be permitted to be interrupted by roof framing members.
   4. Insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall be placed at the exterior of the *roof* edge and be located between the bottom plane of the roof insulation and the plane of the bottom of the roof deck.
   5. The *wall* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.1.
   6. The *roof* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.2.
c. Where a *mass wall* has interior insulation that represents more than 50% of the total wall insulation *R-value*, the interior insulation shall extend to the underside of the roof deck, shall be permitted to be interrupted by framing members, and shall comply with one of the following:
   1. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall extend inward on the underside of the roof deck for not less than 2 ft (0.6 m) and be permitted to be interrupted by roof framing members.
   2. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall be placed at the exterior of the *roof* edge and be located between the bottom plane of the roof insulation and the plane of the bottom of the roof assembly in contact with the exterior *wall*.
   3. The *wall* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.1.
   4. The *roof* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.2.

(***Informative Note:*** See Informative Appendix J, Figures J-1.)

5.5.5.1.2 Parapets. At *roof* edges with parapets, the *exterior wall* insulation shall comply with one or more of the following as applicable to the location of the insulation and *wall* assembly:

a. Where a *wall* has exterior *continuous insulation*, such *insulation* shall be applied to both vertical sides of the parapet.
   (***Informative Note:*** See Informative Appendix J, Figure J-2[a].)
b. Where a *wall* has cavity or integral insulation that represents more than 50% of the total wall insulation *R-value*, the *roof* to *wall* intersections at parapets shall comply with one of the following:

Table 5.5.5.1.2.1 Additional Wall Insulation Required for *Mass Walls* with Insulation on the Interior or Integral at Intersections with Roof Edges and Parapets

Climate Zone	*R-Value* Increase	*U-factor* % Decrease
4	R-1.0 (R-0.18)	8%
5	R-1.0 (R-0.18)	8%
6	R-1.5 (R-0.26)	10%
7	R-1.5(R-0.26)	10%
8	R-2.5 (R-0.44)	14%

Table 5.5.5.1.2.2 Additional *Roof* Insulation Required for *Mass Walls* with Insulation on the Interior or Integral at Intersections with Roof Edges and Parapets

Climate Zone	*R-Value* Increase	*U-factor* % Decrease
4	R-7.0 (R-1.23)	24%
5	R-7.0 (R-1.23)	24%
6	R-7.0 (R-1.23)	26%
7	R-9.0(R-1.58)	26%
8	R-9.0 (R-1.58)	26%

1. The *wall* insulation shall extend within the cavity of the parapet not less than the height of the top of the *roof* insulation. The *wall* insulation shall be permitted to be interrupted by roof framing members.
2. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall extend inward on the underside of the roof deck for not less than 2 ft (0.6 m) and be permitted to be interrupted by roof framing members.
3. Insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall be placed at the exterior of the *roof* edge and be located between the bottom plane of the roof insulation and the plane of the bottom of the roof deck.
4. The *wall* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.1
5. The *roof* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.2.

(***Informative Note:*** See Informative Appendix J, Figure J-2[b].)

c. Where a *mass wall* has interior insulation that represents more than 50% of the total wall insulation *R-value*, the interior insulation shall extend to the underside of the roof deck, shall be permitted to be interrupted by framing members, and shall comply with one of the following:
   1. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall extend inward on the underside of the roof deck for not less than 2 ft (0.6 m) and be permitted to be interrupted by *roof* framing members.
   2. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall be placed at the exterior of the *roof* edge and be located between the bottom plane of the roof insulation and the plane of the bottom of the roof assembly in contact with the exterior *wall*.
   3. The *wall* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.1.
   4. The *roof* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.1.2.2.

   (***Informative Note:*** See Informative Appendix J, Figure J-2[c] and J-2[d].)

5.5.5.1.3 Parapets within the Field of a *Roof*. Exterior *continuous insulation* having a minimum *rated R-value of insulation* not less than R-5 (R-0.9) shall be applied to both vertical sides of the parapet and extend from the coping at the top of the parapet to not less than the top of the roof insulation below.

Informative Notes:

1. See Informative Appendix J, Figure J-3.
2. Parapets that are an integral part of a fire-resistance-rated wall, and the exterior continuous insulation applied to the parapet, shall comply with the fire resistance ratings of the building code.

5.5.5.2 Walls and Intermediate Floor Intersections. At floor and *exterior wall* intersections, the *exterior wall* insulation shall comply with Sections 5.5.5.2.1, 5.5.5.2.2, and 5.5.5.2.3 as applicable to the type of floor intersection, *exterior wall* assembly and location of the *exterior wall* insulation.

5.5.5.2.1 Intermediate floor edges that do not serve as balconies or floor overhangs shall comply with the following as applicable:

a. Where a *wall* has *exterior continuous* insulation, such insulation shall extend continuously past the floor edge.
b. Where a *wall* has cavity insulation that represents more than 50% of the total wall insulation *R-value*, the cavity insulation shall extend to the underside of the floor deck and shall be permitted to be interrupted by floor framing members and *wall* top and bottom plates or tracks.
(***Informative Note:*** See Informative Appendix J, Figure J-4[a] and J-4[b].)
c. Where a *mass wall* has integral insulation that represents more than 50% of the total wall insulation *R-value*, the intermediate floor intersection shall comply with one of the following:
   1. The full thickness of integral insulation shall extend past the floor edge.
   2. Where the intermediate floor deck extends through the integral insulation, insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall be maintained to the full depth of the floor edge on the exterior side of the floor edge.

   (***Informative Note:*** See Informative Appendix J, Figure J-4[c] and J-4[d].)
d. Where a *mass wall* has interior insulation that represents more than 50% of the total wall insulation *R-value*, the interior insulation shall extend to the underside of the floor deck, shall be permitted to be interrupted by framing members, and shall comply with one of the following:
   1. Additional interior insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall cover the full depth of the floor edge. Such insulation shall be permitted to be interrupted by floor framing members. Fire safing applied to the full depth of the floor edge meets this requirement.
   2. Additional insulation having a *rated R-value of insulation* not less than R-5 (R-0.9) shall cover the full depth of the floor edge on the exterior side of the wall.
   3. The *wall* insulation values in Tables 5.5-1 through 5.5-8 shall be adjusted in accordance with Table 5.5.5.2.1.

   (***Informative Note:*** See Informative Appendix J, Figure J-4[e] and J-4[f].)
e. Where *mass walls* have not less than 50 percent of the *rated R-value of insulation* on the exterior side of the *wall* and the remainder on the interior side, the insulation on the interior side of the *wall* shall be permitted to be interrupted by an intermediate floor.
(***Informative Note:*** See Informative Appendix J, Figure J-4[g].)

5.5.5.2.2 The total length of *mass* floor assembly projections serving as balconies or floor overhangs that penetrate the *building envelope* shall not exceed the percentages of the total *building* perimeter depicted in Table 5.5.5.2.2. For this calculation, total building perimeter is the sum of the perimeters of each above grade floor where it intersects the *exterior building envelope*.

Exceptions to 5.5.5.2.2:

1. *Mass floor* assembly projections located directly above and providing protection to a pedestrian walkway at street-level.
2. *Mass* floor assembly projections thermally broken with a continuous thermal spacer block not less than R-12 (R-2.1). The thermal spacer block shall be permitted to be interrupted by structural connections.

5.5.5.3 Exterior Cladding Support. Shelf angles that support masonry exterior cladding shall be offset from the floor edge or primary structural frame using point connections to accommodate the full depth of any exterior *continuous insulation* between the support and floor or structure, exclusive of the point connections. The cross-sectional area of point connections shall not exceed 1.5 $in.^2$ /lin ft (3200 mm^2/lin m) for carbon steel connections or 2.3 $in.^2$ /lin ft (4900 mm^2/lin m) for stainless steel. Other cladding supports that penetrate the exterior *continuous insulation* shall be subject to the provisions of Section 5.5.5.5 and be mounted away from the backup construction

Table 5.5.5.2.1 Additional *Wall* Insulation Required for *Mass Walls* With Insulation on the Interior Complying with Section 5.5.5.2(d)(3)

Climate Zone	*R-Value* Increase	*U-factor* % Decrease
4	R-1.5 (R-0.26)	13%
5	R-2.0 (R-0.35)	15%
6	R-2.5 (R-0.44)	16%
7	R-3.0 (R-0.53)	20%
8	R-4.0 (R-0.70)	25%

Table 5.5.5.2.2 *Mass Floor* Balcony or Floor Overhang Allowances

Climate Zone	Maximum Percent of *Building* Perimeter
4	35%
5	30%
6	20%
7	10%
8	0%

using point connections to accommodate the full depth of any exterior *continuous insulation* exclusive of the point connections.

Exception to 5.5.5.3: Girts in *metal building walls* as described in Normative Appendix A.

(***Informative Note:*** See Informative Appendix J, Figure J-5.)

5.5.5.4 Opaque Wall and Vertical Fenestration Intersection. *Vertical fenestration* shall be installed in accordance with one or more of the following:

a. For *vertical fenestration*, the outermost glazing layer shall be aligned within the thickness of or within 2 in. (50 mm) of either face of the *continuous insulation* layer.

(***Informative Note:*** See Informative Appendix J, Figure J-6[a] and J-6[b].)

b. For *vertical fenestration*, where *continuous insulation* is not present, the outermost glazing layer shall be aligned within the thickness of the *wall* insulation layer and not more than 2 in. (50 mm) from the exterior side of the outermost insulation layer.

(***Informative Note:*** See Informative Appendix J, Figure J-6[c].)

c. Intersections between *vertical fenestration* and *opaque walls* where the surfaces of the rough opening located between the edge of the frame of the *vertical fenestration* and the *opaque wall* insulation shall be

   1. covered with a material having an *R-value* not less than R-3 (R-0.5), or
   2. covered with wood framing not less than 1.5 in. (38 mm) thick, or
   3. covered with a material having a thermal conductivity of not more than 3.0 Btu·in/ h·ft^2·°F (0.433 W/[m·K]).

(***Informative Note:*** See Informative Appendix J, Figure J-6[d] and J-6[e].)

d. Intersections between *vertical fenestration* and *opaque* spandrel in a shared fenestration framing system shall have a thermal break with a thermal conductivity of 3.6 Btu·in/ h·ft^2·°F (0.519 W/(m·K)) or less.

Exception to 5.5.5.4: Intersections between *vertical fenestration* and uninsulated *opaque walls*.

5.5.5.5 Other Elements and Building Assembly Intersections. Individual *point thermal bridges* and *linear thermal bridges* not addressed in Sections 5.5.5.1 through 5.5.5.4 shall comply with Equation 5.5.5.5.

$$\text{347 Btu·in./(ft}^2\text{·h·°F)} \times \text{0.003\%} \times \text{Above grade area of the building envelope} \geq (k_1 \times A_1) + (k_2 \times A_2) + (k_3 \times A_3) \ldots \quad \text{(5.5.5.5 I-P)}$$

Table 5.5.5.5 Allowable *Point Thermal Bridge* Cross-Sectional Area

Allowable Area per *Point Thermal Bridge*, in.^{2} (mm^2)	**Common Material Name**
3 (1935)	Carbon steel
9 (5800)	Stainless steel
65 (41935)	Concrete and masonry

$$\text{Above grade area of the building envelope} \geq \frac{50\ \text{W/(m·K)} \times 0.003\% \times}{(k_1 \times A_1) + (k_2 \times A_2) + (k_3 \times A_3) \ldots} \quad \text{(5.5.5.5 SI)}$$

where

$k_1, k_2, k_3 \ldots$ = thermal conductivity of material 1, material 2, material 3, etc., expressed in Btu·in./(ft^2·h·°F) (W/[m·K]) for point thermal bridge material 1, material 2, material 3, etc. (e.g., concrete, carbon steel, stainless steel, wood)

$A_1, A_2, A_3, \ldots$ = the total cross-sectional area of *point thermal bridges* and *linear thermal bridges* of material 1, material 2, material 3, etc., expressed in ft^2 (m^2)

Exceptions to 5.5.5.5:

1. Service penetrations, including mechanical, electrical, plumbing, telecommunications, and fire services, that pass through the *opaque building envelope*.
2. Insulated roof curbs and blocking.
3. Individual *point thermal bridges* that are less than the allowances in Table 5.5.5.5.

(***Informative Note:*** See *ASHRAE Handbook—Fundamentals* Appendix A, Chapter 26, or Chapter 33 for typical material thermal conductivity.)

Revise Section 5.6.1.1 as shown (I-P and SI).

5.6.1.1 All components of the *building envelope* shown on architectural drawings or installed in *existing buildings* shall be modeled in the *proposed design*. The *simulation program* model *fenestration* and *opaque building* envelope types and area shall be consistent with the *construction documents*. Any *building envelope* assembly not subject to the provisions of Section 5.5.5 that covers less than 5% of the total area of that assembly type (e.g., *exterior walls*) need not be separately described, provided it is similar to an assembly being modeled. If not separately described, the area of a *building envelope* assembly shall be added to the area of an assembly of that same type with the same *orientation* and thermal properties.

[. . .]

Revise Section 5.7.2 as shown (I-P and SI).

5.7.2 Permit Application Documentation. Application documents shall include, at a minimum, the type and *rated R-value of insulation* for each product; *opaque door* schedule showing the *U-factor* for each *opaque door* product as determined in accordance with Section 5.8.2; *fenestration* schedule showing the manufacturer, model number, orientation, area, *U-factor*, *SHGC*, and *VT* for each *fenestration* product as determined in accordance with Section 5.8.2; *air leakage* details in accordance with Section 5.4.3; and *point* and *linear thermal bridge* details in the *proposed building* shall be represented on the compliance documents in accordance with Section 5.5.5.

[. . .]

Insert new Section 5.8.2 as shown, and renumber subsequent sections accordingly (I-P and SI).

5.8.2 Fenestration and Doors

[. . .]

5.8.2.3 Manufacturer's Installation Instructions. Fenestration products shall be installed in accordance with *manufacturers*' instructions.

Modify Section 11, Table 11.5.1 as shown (I-P and SI).

Table 11.5.1 Modeling Requirements for Calculating *Design Energy Cost* and *Energy Cost Budget*

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
[. . .]	
5. *Building Envelope*	
All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as installed for *existing building envelopes*. All *opaque building envelope* components shall be modeled accounting for thermal mass effects. **Exceptions:** The following *building* elements are permitted to differ from architectural drawings. 1. Each *linear thermal bridge* and *point thermal bridge* as identified in Section 5.5.5 shall be modeled using either of the following techniques: a. A separate model of the assembly within the *energy* simulation model. b. Adjustment of the clear-field *U-factor* in accordance with Appendix A10.2. 2. Each uninsulated assembly not identified in Section 5.5.5 shall be modeled using either of the following techniques: a. A separate model of the assembly within the *energy* simulation model. b. The *U-factors* of uninsulated assemblies can be averaged with larger adjacent surfaces of the same *class of construction* using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model. ~~1~~3. Any other *building envelope* assembly, not subject to the requirements of Section 5.5.5, that covers less than 5% of the total area of that ~~assembly type (e.g., *exterior walls*)~~ *class of construction* need not be separately described, provided that it is similar to an assembly being modeled. If not separately described, the ~~area of a *building envelope* assembly must be added to the area of the adjacent assembly of the same type~~ U-factors of these assemblies shall be averaged with larger adjacent surfaces using an area-weighted average method. This average U-factor shall be modeled within the energy simulation model.	The *budget building design* shall have identical *conditioned floor area* and identical exterior dimensions and orientations as the *proposed design*, except as follows: a. *Opaque* assemblies, such as *roof*, *floors*, *doors*, and *walls*, shall be modeled as having the same heat capacity as the proposed design but with the minimum U-factor required in Section 5.5 for new *buildings* or *additions* and Section 5.1.3 for *alterations*. b. Where *linear thermal bridges* and *point thermal bridges,* as identified in Section 5.5.5.1 through 5.5.5.5, are included in the *proposed design*, they shall be modeled by adjusting the *U-factor* of the parent assembly in accordance with the default values in Section A10. If the proposed design does not have *linear thermal bridges* and *point thermal bridges,* as identified in Sections 5.5.5.1 through 5.5.5.5, they shall not be modeled in the *budget building design*. If the balcony length in the *proposed design* exceeds the maximum allowed by Section 5.5.5.2.2, the area shall be reduced proportionally for each balcony until the limit set in Section 5.5.5.2.2 is met. ~~b~~c. The exterior *roof* surfaces shall be modeled with a solar reflectance and thermal emittance as required in Section 5.5.3.1.1(a). All other *roofs*, including *roofs* exempted from the requirements in Section 5.5.3.1.1, shall be modeled the same as the *proposed design*. [. . .]
[. . .]	

Modify Section 12 as shown (I-P and SI).

Reference	Title
[. . .]	
International Organization for Standardization (ISO) **1, rue de Varembe, Case postale 56, CH-1211 Geneve 20, Switzerland**	
[. . .]	
ISO 10211 (2017)	Thermal bridges in building construction—Heat flows and surface temperatures—Detailed calculations
[. . .]	
ISO 14683 (2017)	Thermal bridges in building construction—Linear thermal transmittance—Simplified methods and default values
[. . .]	

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

A1. GENERAL

[. . .]

A1.3 Applicant-Determined Psi-Factors and Chi-Factors for Thermal Bridges. The applicant shall determine values for *point thermal bridges* and *linear thermal bridges* using the assumptions in Section A10.

[. . .]

A10. THERMAL BRIDGING CHI FACTORS AND PSI FACTORS

A10.1 Determination of Psi-Factors and Chi-Factors. *Psi-factor* (ψ) and *chi-factor* (χ) values representative of an as-designed *thermal bridging* condition shall be determined in accordance with one of the following:

a. From simulation models compliant with ISO 10211 using details representative of the actual construction and modeling assumptions consistent with generally accepted architectural and engineering practice.
b. From ISO 14683.
c. From testing of the assembly in accordance with ASTM C1363 with and without the presence of the *thermal bridge* condition to determine a linear transmittance value or point transmittance value for the *thermal bridge* condition.
d. From application of heat transfer theory in accordance with generally accepted engineering practice and where approved by the a*uthority having jurisdiction*.
e. As indicated in Table A10.1. The default column shall be used where the thermal bridge meets prescriptive requirements. The unmitigated column shall be used where the thermal bridge does not meet the prescriptive requirements.

(***Informative Note:*** In Table A10.1, the values for *thermal bridge* details prescribed in Section 5.5.5 are based on data from ASHRAE Research Project 1365 and the BC Hydro Thermal Bridging Guide listed in Informative Appendix E.)

A10.2 Assembly U-Factor Adjustment for Simulation of Thermal Bridges. For the purpose of incorporating the effects of thermal bridges in simulations as required by Section 11 and Normative Appendix G, where a thermal bridge is not modeled as a separate element, the clear-field U-factors of modeled assemblies shall be modified in accordance with Equation A10.2. This modification shall be achieved in the simulation model by altering the conductance value assigned to any one or more insulation layers within the modeled assembly without altering the properties of modeled building material layers.

$$U_{tot} = \{[(\sum \psi_i \times L_i) + (\sum \chi_j \times n_j)]/A_{total}) + U_o\} \quad \text{(A10.2)}$$

where

U_{tot} = overall thermal transmittance, including the effect of *linear thermal bridges* and *point thermal bridges* not included in the *construction* assembly U_o-factor, Btu/(h·ft^2·°F) W/(m^2·K)

U_o = clear-field thermal transmittance of the *construction* assembly as determined in accordance with Section 5, Btu/(h·ft^2·°F) (W/[m^2·K])

A_{total} = total *opaque* projected surface area of the *construction* assembly, ft^2 (m^2)

ψ_i = *psi-factor*, thermal transmittance for each type of *linear thermal bridge*, Btu/(h·ft·°F) (W/[m·K])

L_i = length of a particular *linear thermal bridge* as measured on the outside surface of the *building envelope*, ft (m)

χ_i = *chi-factor*, thermal transmittance for each detail type of *point thermal bridge*, Btu/(h·°F) (W/K)

n_i = number of occurrences a particular type of *point thermal bridge*

Table A10.1 Thermal Bridging Psi-Factors and Chi-Factors for *Thermal Bridges* (I-P)

			Unmitigated		Default	
Class of Construction—Wall, above Grade	**Thermal Bridge Type**	**Section**	**Psi-Factor Btu/(h·ft·°F)**	**Chi-Factor Btu/(h·°F)**	**Psi-Factor Btu/(h·ft·°F)**	**Chi-Factor Btu/(h·°F)**
Steel framed and *metal buildings*	Roof edge	5.5.5.1.1	0.450	N/A	0.140	N/A
	Parapet	5.5.5.1.2	0.289		0.151	
	Intermediate floor to *wall* intersection	5.5.5.2.1	0.487		0.177	
	Intermediate floor balcony or overhang to opaque *wall* intersection	5.5.5.2.2	0.487		0.177	
	Intermediate floor balcony in contact with *vertical fenestration*	5.5.5.2.2	0.974		0.177	
	Cladding Support	5.5.5.3	0.314		0.217	
	Wall to *vertical fenestration* intersection	5.5.5.4	0.262		0.112	
	Other element and assembly intersections	5.5.5.5	N/A	1.73	N/A	0.91
Mass (exterior or integral)	Roof edge	5.5.5.1.1	0.500	N/A	0.100	N/A
	Parapet	5.5.5.1.2	0.238		0.125	
	Intermediate floor to *wall* intersection	5.5.5.2	0.476		0.179	
	Intermediate floor balcony or overhang to opaque *wall* intersection	5.5.5.2.2	0.476		0.179	
	Intermediate floor balcony in contact with *vertical fenestration*	5.5.5.2	0.974		0.177	
	Cladding support	5.5.5.3	0.270		0.186	
	Wall to *vertical fenestration* intersection	5.5.5.4	0.188		0.131	
	Other element and assembly intersections	5.5.5.5	N/A	0.91	N/A	0.19
Mass (interior)	Roof edge	5.5.5.1.1	0.500	N/A	0.100	N/A
	Parapet	5.5.5.1.2	0.511		0.227	
	Intermediate floor to *wall* intersection	5.5.5.2	0.476		0.286	
	Intermediate floor balcony or overhang to opaque *wall* intersection	5.5.5.2.2	0.476		0.286	
	Intermediate floor balcony in contact with *vertical fenestration*	5.5.5.2	0.974		0.177	
	Cladding support	5.5.5.3	Same as *mass* (exterior)			
	Wall to *vertical fenestration* intersection	5.5.5.4	0.313	N/A	0.083	N/A
	Other element and assembly intersections	5.5.5.5	Same as *mass* (exterior)			
Wood-framed and other	Roof edge	5.5.5.1.1	0.450	N/A	0.140	N/A
	Parapet	5.5.5.1.2	0.032		0.032	
	Intermediate floor to *wall* intersection	5.5.5.2.1	0.336		0.049	
	Cladding support	5.5.5.3	0.186		0.043	
	Wall to *vertical fenestration* intersection	5.5.5.4	0.150		0.099	
	Other element and assembly intersections	5.5.5.5	N/A	0.33	N/A	0.07

N/A = not applicable

Table A10.1 Thermal Bridging Psi-Factors and Chi-Factors for *Thermal Bridges* (SI)

			Unmitigated		Default	
Class of Construction—Wall, above Grade	**Thermal Bridge Type**	**Section**	**Psi-Factor W /m K**	**Chi-Factor W /m K**	**Psi-Factor W /m K**	**Chi-Factor W /m K**
Steel framed and *metal buildings*	Roof edge	5.5.5.1.1	0.650	N/A	0.020	N/A
	Parapet	5.5.5.1	0.500		0.260	
	Intermediate floor to *wall* intersection	5.5.5.2	0.842		0.307	
	Intermediate floor balcony or overhang to opaque *wall* intersection	5.5.5.2.2	0.842		0.307	
	Intermediate floor balcony in contact with *vertical fenestration*	5.5.5.2	1.686		0.307	
	Cladding support	5.5.5.2	0.554		0.376	
	Wall to *vertical fenestration* intersection	5.5.5.3	0.505		0.194	
	Other element and assembly intersections	5.5.5.~~5~~4	N/A	0.92	N/A	0.48
Mass (exterior or integral)	Roof edge	5.5.5.1.1	0.750	N/A	0.150	N/A
	Parapet	5.5.5.1	0.412		0.217	
	Intermediate floor to *wall* intersection	5.5.5.2	0.824		0.205	
	Intermediate floor balcony or overhang to opaque *wall* intersection	5.5.5.2.2	0.824		0.205	
	Intermediate floor balcony in contact with *vertical fenestration*	5.5.5.2	1.686		0.307	
	Cladding support	5.5.5.2	0.476		0.322	
	Wall to *vertical fenestration* intersection	5.5.5.3	0.325		0.226	
	Other element and assembly intersections	5.5.5.~~5~~4	N/A	0.46	N/A	0.33
Mass (interior)	Roof edge	5.5.5.1.1	0.750	N/A	0.150	N/A
	Parapet	5.5.5.1.2	0.884		0.393	
	Intermediate floor to *wall* intersection	5.5.5.2	0.824		0.495	
	Intermediate floor balcony or overhang to opaque *wall* intersection	5.5.5.2.2	0.824		0.495	
	Intermediate floor balcony in contact with *vertical fenestration*	5.5.5.2	1.686		0.307	
	Cladding support	5.5.5.3	Same as *mass* (exterior)			
	Wall to *vertical fenestration* intersection	5.5.5.4	0.543	N/A	0.143	N/A
	Other element and assembly intersections	5.5.5.5	Same as *mass* (exterior)			
Wood-framed and other	Roof edge	5.5.5.1.1	0.150	N/A	0.020	N/A
	Parapet	5.5.5.1	0.056		0.056	
	Intermediate floor to *wall* intersection	5.5.5.2	0.582		0.084	
	Cladding support	5.5.5.2	0.322		0.074	
	Wall to *vertical fenestration* intersection	5.5.5.3	0.260		0.171	
	Other element and assembly intersections	5.5.5.4	N/A	0.33	N/A	0.04

N/A = not applicable

Modify Normative Appendix C, Section C1 as shown (I-P and SI).

C1.2.7 For Thermal Bridges Identified in Section 5.5.5. *Thermal bridge* inputs and specifications shall be individually identified for the thermal bridges indicated in Section 5.5.5 according to one of the following:

a. Where the thermal bridge complies with one of the requirements of Sections 5.5.5.1 through 5.5.5.5, no additional inputs shall be required.
b. Where the thermal bridge does not comply with one or more of the requirements of Sections 5.5.5.1 through 5.5.5.5, the *linear thermal bridge* type or *point thermal bridge* type, length or count, the assembly interrupted by this *thermal bridge*, and the *Psi-factor* or *Chi-Factor* shall be specified. The input shall be a user-defined value or one of the unmitigated values from Table A10.1.
c. Where Section 5.5.5 and Sections 5.5.5.1 through 5.5.5.5, including exceptions, are not applicable to the *thermal bridge,* no additional inputs shall be required.

Modify Normative Appendix C, Section C2 as shown (I-P and SI).

C2.9 For thermal bridges,

a. confirmation that the proposed design complies with the each of the requirements of Sections 5.5.5.1 through 5.5.5.5 including exceptions or
b. where the proposed design does not comply with each of the individual requirements of Sections 5.5.5.1 through 5.5.5.5, list the *thermal bridges*, the proposed *psi-factors*, proposed *chi-factors*, and source information.

Modify Normative Appendix C, Section C3.5.5.4 as shown (I-P and SI).

C3.5.5.4 Thermal Bridges. *Linear* and *point thermal bridges* in the *proposed design* shall be either of the following:

a. Not modeled where option (a) or (c) is selected in Section C1.2.7.
b. Entered as individual *thermal bridge* inputs of length or count where option (b) is selected in Section C1.2.7 and addressed as follows:
    1. Individual *thermal bridges* in the proposed design that are indicated to comply with the requirements of Sections 5.5.5.1 through 5.5.5.5 need not be modeled.
    2. Individual *thermal bridges* in the proposed design that are indicated to not comply with the requirements of Sections 5.5.5.1 through 5.5.5.5 shall be modeled.
    3. Individual *thermal bridges* in the proposed design that are indicated to be not applicable with the requirements of Sections 5.5.5.1 through 5.5.5.5 need not be modeled.

Modify Normative Appendix C, Section C3.6 as shown (I-P and SI).

C3.6 Calculation of Base Envelope Performance Factor. The simulation model for calculating the *base envelope performance factor* shall modify the simulation model for calculating the *proposed envelope performance factor* as follows:

a. All *opaque* assemblies shall be modeled with ~~maximum~~ the *U-factor* not greater than that required in Section 5.5.3 for the appropriate *class of construction*, *space-conditioning category*, and climate zone. *Mass walls* and *mass floors* shall be modeled with HC equal to 7.2 Btu/ft^2·°F (147 kJ/m^2·K). All other *opaque* assemblies shall be modeled with the same HC as the *proposed design*. *Mass walls* shall be modeled with equal mass on each side of the insulation. All other *opaque* assemblies shall be modeled with insulation on the exterior. *Thermal bridges* shall modify assembly *U-factors* in accordance with item C3.6b.
b. *Thermal bridges*:
    1. Where option (a) is selected in Section C1.2.7, no modifications to the assembly *U-factors* are required.
    2. Where option (b) is selected in Section C1.2.7, the *U-factor* of the assembly interrupted shall be modified per Section A10.2 using the default values in Table A10.1 for the appropriate *class of construction*. Each of the *linear thermal bridges* or *point thermal bridges* identified in Sections 5.5.5.1 through 5.5.5.5 shall be modeled in the simulation model for calculating the proposed envelope performance. Where the balcony length in the proposed

design is greater than allowed by Section 5.5.5.2.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.5.2.2 is met.

3. Where option (c) is selected in Section C1.2.7, no modifications to the assembly *U-factors* are required.

~~b~~c. The exterior *roof* surfaces shall be modeled [. . .]

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

ASHRAE
~~1791 Tullie Circle~~
~~Atlanta, GA 30329-2305~~
~~(*After 10/30/2020:*~~
180 Technology Parkway
Peachtree Corners, GA 30092~~)~~

[. . .]

BC Hydro
Corporate Head Office
333 Dunsmuir Street
Vancouver, B. C. V6B 5R3

Subsection No.	Reference	Title/Source
[. . .]		
Table A10.1	BC Hydro New Construction Program Orientation Manual (June 2016)	https://www.bchydro.com/powersmart/business/programs/new-construction.html#thermal
Table A10.1	ASHRAE Research Project 1365	The Impact of Thermal Bridges on Effective Thermal Resistance and Energy Use in Mid and High Rise Buildings
[. . .]		

Modify Appendix G, Table G3.1 as follows:

Table G3.1 Modeling Requirements for Calculating *Proposed Building Performance* and *Baseline Building Performance*

No. Proposed Building Performance	Baseline Building Performance
[. . .]	
5. *Building Envelope*	
a. All components of the *building envelope* in the *proposed design* shall be modeled as shown on architectural drawings or as built for *existing building envelopes*. All *opaque building envelope* components shall be modeled accounting for thermal mass effects. **Exceptions:** The following *building* elements shall be permitted to differ from architectural drawings: 1. ~~All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate floor slabs, concrete floor beams over parking garages, *roof* parapet)~~ Each *linear thermal bridge* and *point thermal bridge* as identified in Section 5.5.5 shall be ~~separately~~ modeled using either of the following techniques: a. A s~~S~~eparate model of ~~each of these assemblies~~ the assembly within the *energy* simulation model. b. Adjustment of the clear-field *U-factor* in accordance with Section A10.2. 2. Each uninsulated assembly not identified in Section 5.5.5 shall be modeled using either of the following techniques: a. A separate model of the assembly within the *energy* simulation model. b. ~~Separate calculation of the *U-factor* for each of these assemblies.~~ The *U-factors* of ~~these~~ uninsulated assemblies ~~are then~~ can be averaged with larger adjacent surfaces of the same *class of construction* using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model. 3. Any other *building envelope* assembly, that covers less than 5% of the total area of that *class of construction* (e.g., *exterior walls*) need not be separately described, provided that it is similar to an assembly being modeled. If not separately described, the *U-factors* of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average *U-factor* is modeled within the *energy* simulation model. ~~2~~4. Exterior surfaces whose azimuth *orientation* and tilt differ by less than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers. [. . .]	Equivalent dimensions shall be assumed for each *building envelope* component type as in the *proposed design*; i.e., the total gross area of *walls* shall be the same in the *proposed design* and *baseline building design*. The same shall be true for the areas of *roofs*, *floors*, and *doors*, and the exposed perimeters of concrete *slab on grade floors* shall also be the same in the *proposed design* and *baseline building design*. The following additional requirements shall apply to the modeling of the *baseline building design*: [. . .] c. ***Linear* and *Point Thermal Bridges.*** Where *linear thermal bridges* and *point thermal bridges*, as identified in Section 5.5.5, are modeled in the *proposed design*, they shall not be modeled in the *budget building design*. [. . .]

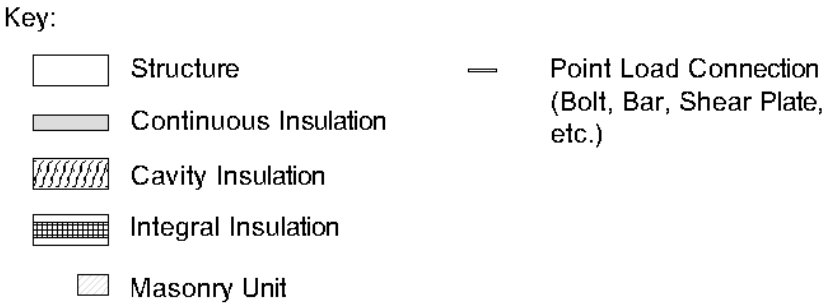
Add Informative Appendix J as shown (I-P and SI).

(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 J
INFORMATIVE FIGURES

This appendix contains informative reference figures for Sections 5.5.5.1 through 5.5.5.4 for the convenience of users of Standard 90.1 and not for use as specific details required for compliance. These figures are not intended to include all detailed variations that may meet the requirements. It is not intended that the figures represent all possible compliant configurations. The figures do not show roof membrane or wall cladding.

SYMBOLS



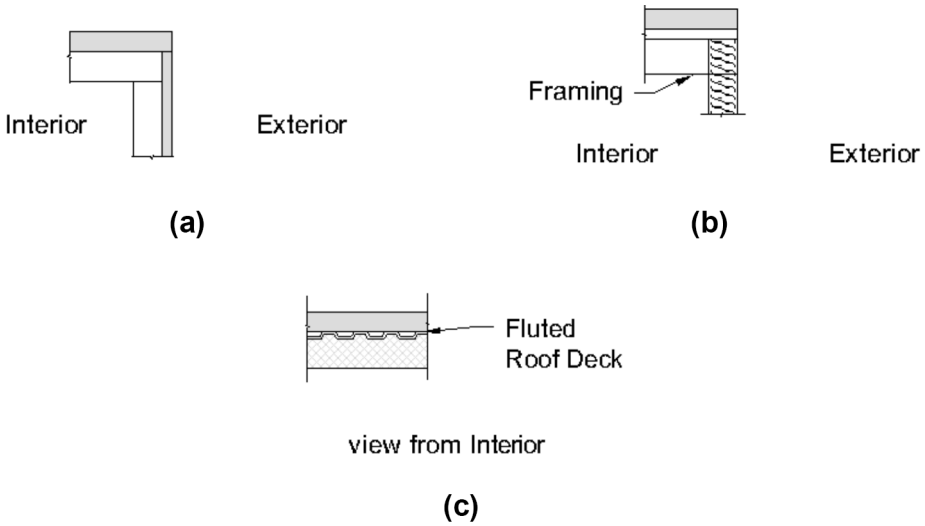


Figure J-1 Key:

a. Wall with exterior continuous insulation (Section 5.5.5.1.1[a])
b. Wall with cavity insulation (Section 5.5.5.1.1[b])
c. Wall with interior or cavity insulation (Sections 5.5.5.1.1[b] and [c])
d. Mass wall with interior insulation—I-P, SI (Section 5.5.5.1.1[c][1])
e. Mass wall with interior insulation—I-P, SI (Section 5.5.5.1.1[c][2])

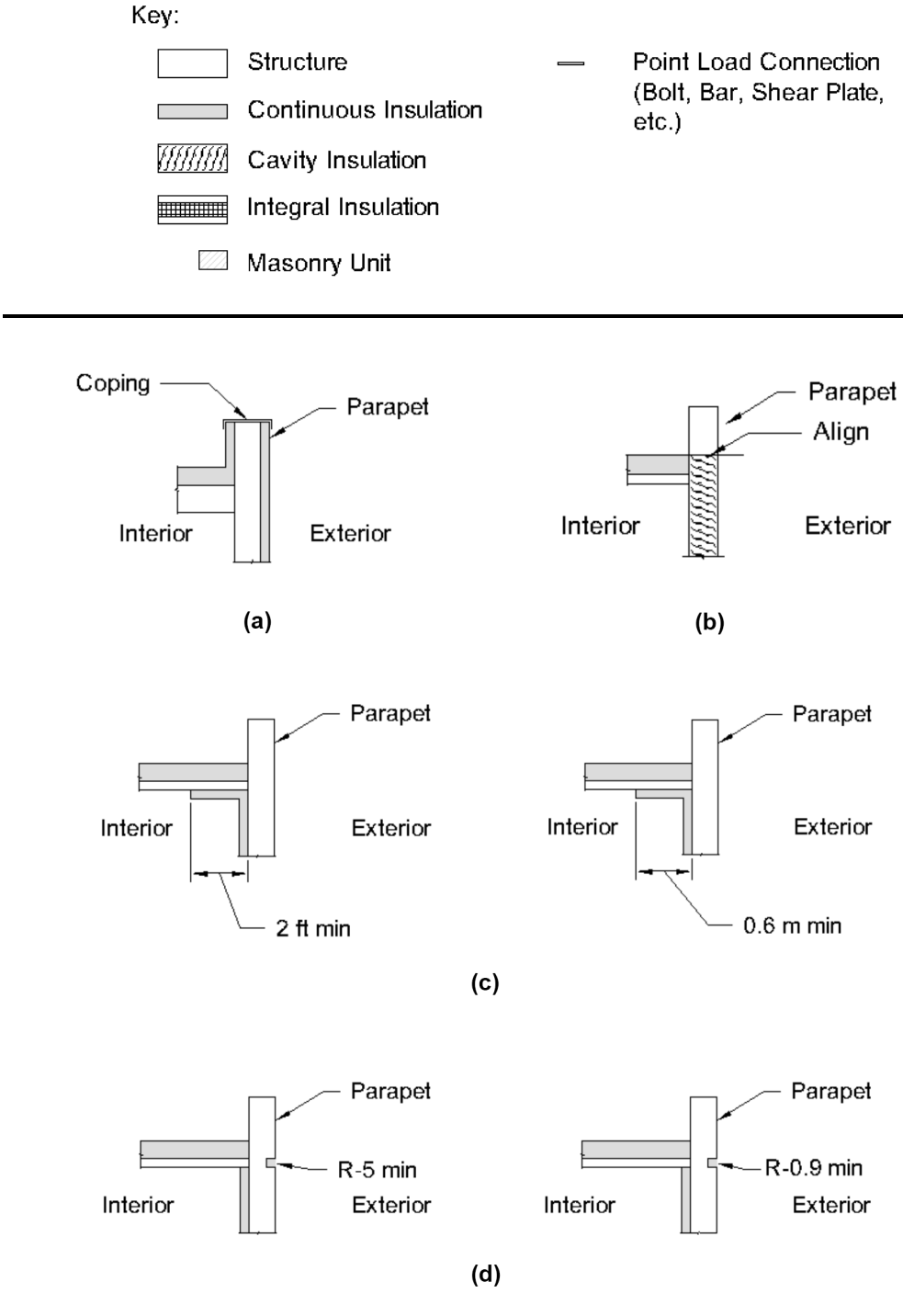
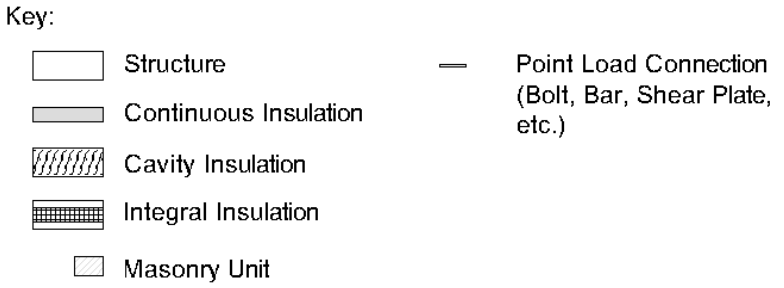


Figure J-2 Key:

a. Wall with exterior continuous insulation (Section 5.5.5.1.2[a])
b. Wall with cavity insulation (Section 5.5.5.1.2[b][1])
c. Mass wall with interior insulation—I-P, SI (Section 5.5.5.1.2[c][1])
d. Mass wall with interior insulation—I-P, SI (Section 5.5.5.1.21[c][2])



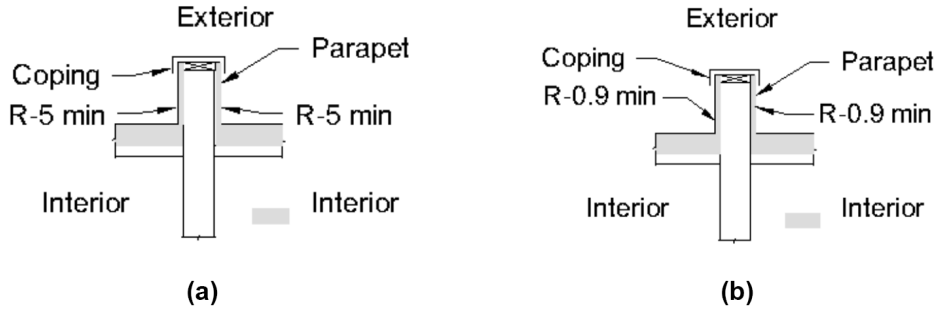
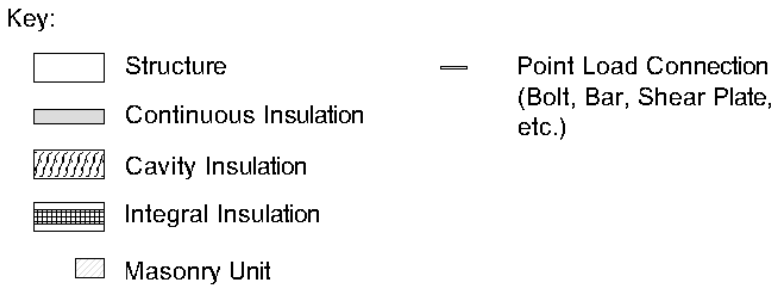


Figure J-3 Parapet within field of roof (a) I-P and (b) SI (Section 5.5.5.1.3).



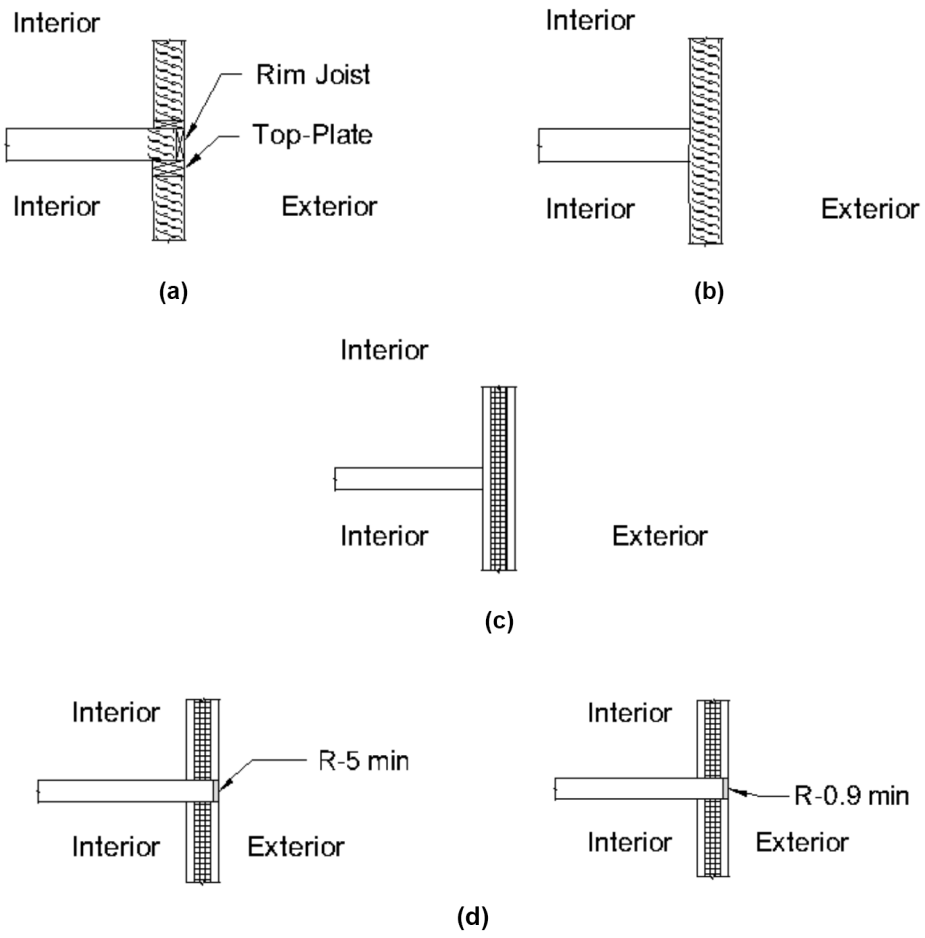
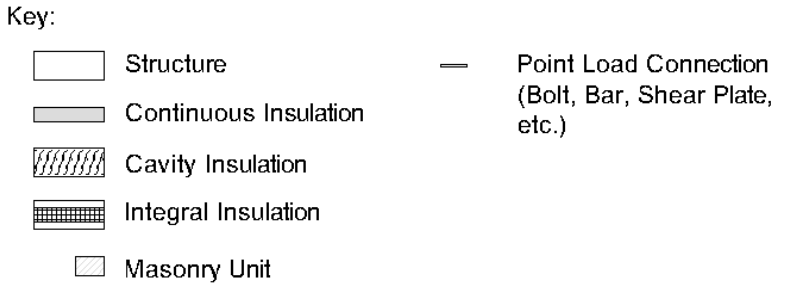
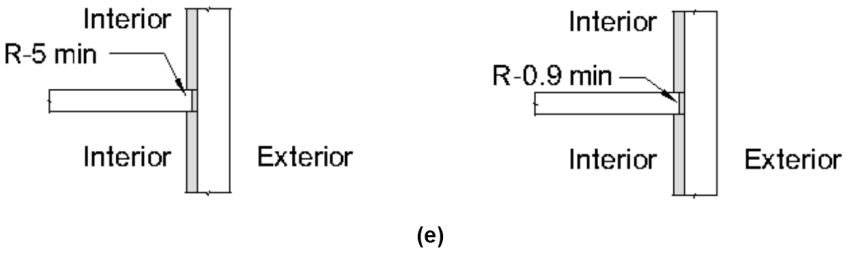


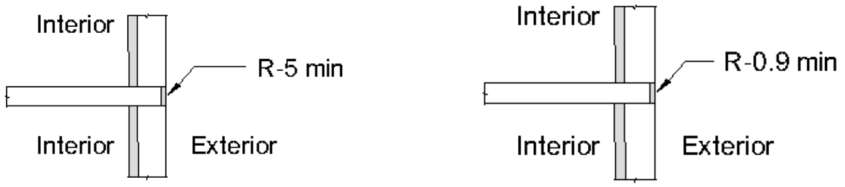
Figure J-4 Key:

a. Wall with cavity insulation (Section 5.5.5.2.1[b])
b. Wall with cavity insulation (Section 5.5.5.2.1[b])
c. Wall with integral insulation (Section 5.5.5.2.1[c])
d. Mass wall with integral insulation—IP, SI (Section 5.5.5.2.1[c])

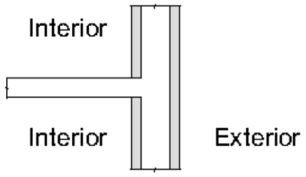




(e)



(f)



(g)

Figure J-4 (continued) Key:

e. Mass wall with interior insulation—I-P, SI (Section 5.5.5.2.1[d][1])
f. Mass wall with interior insulation—I-P, SI (Section 5.5.5.2.1[d][2])
g. Mass wall with exterior continuous insulation plus interior insulation (Section 5.5.5.2.1[e])

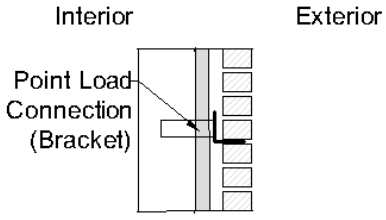


Figure J-5 Shelf angles supporting exterior cladding (Section 5.5.5.3).

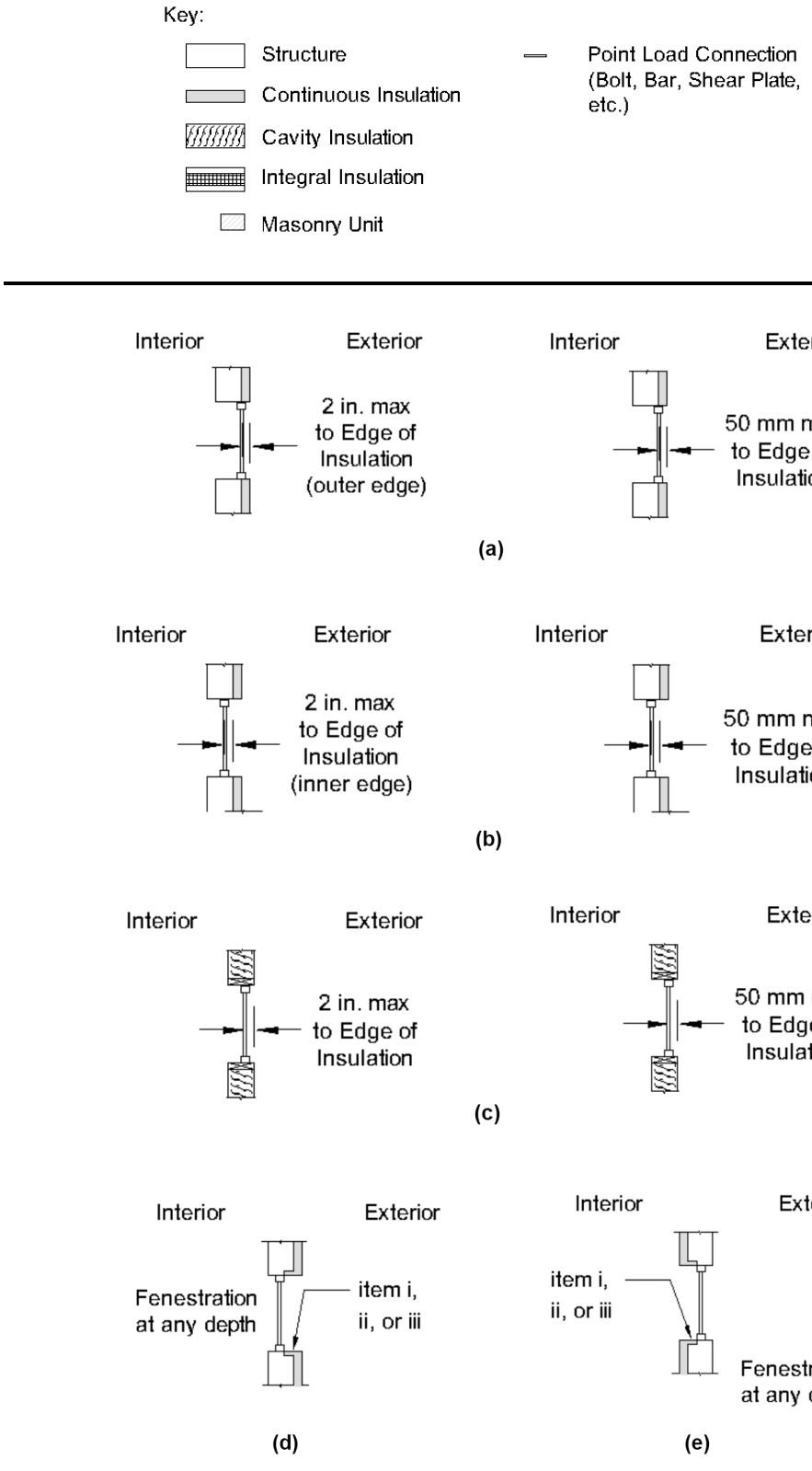


Figure J-6 Key:

a. Fenestration and continuous insulation—I-P, SI (Section 5.5.5.4[a])
b. Fenestration and continuous insulation—I-P, SI (Section 5.5.5.4[a])
c. Fenestration and no continuous insulation—I-P, SI (Section 5.5.5.4[b])
d. Insulation between fenestration and wall (Section 5.5.5.4[c])
e. Insulation between fenestration and wall (Section 5.5.5.4[c])

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.

ASHRAE · 180 Technology Parkway · Peachtree Corners, GA 30092 · www.ashrae.org

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.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards, and connect on LinkedIn, Facebook, Twitter, and YouTube.

Visit the ASHRAE Bookstore

ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous version. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at www.ashrae.org/bookstore.

IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.

7/22