ADDENDA

ANSI/ASHRAE/IES Addendum w to
ANSI/ASHRAE/IES Standard 90.1-2013

Energy Standard for Buildings Except Low-Rise Residential Buildings

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FOREWORD

This revision to Standard 90.1 was developed in response to the update of ASHRAE Standard 169-2013, Climatic Data for Building Design Standards. Standard 169-2013 includes more-recent weather data (resulting in changes in climate zone assignments for some locations, including approximately 10% of the 3000 counties in the United States) and the creation of a new Climate Zone 0. Standard 169 is now referenced for climatic data (though a new Reference Standard Reproduction Annex placed at the end of Standard 90.1 includes extracts from Standard 169). Criteria are now specified for Climate Zone 0 in most sections of Standard 90.1. Criteria for Climate Zone 0 for the mechanical systems portions of Section 6, Appendix C, and Appendix G will be included in a separate addendum.

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

Addendum w to 90.1-2013

Revise the Standard as follows (IP and SI Units).
Revise 3.2 as follows:

…

degree-day: the difference in temperature between the outdoor mean temperature over a twenty-four-hour period and a given base temperature. ~~For the purposes of determining building envelope requirements, t~~The classifications are defined as follows:

cooling degree-day base 50°F (CDD50) [10°C (CDD10)]: for any one day, when the mean temperature is more than 50°F (10°C), there are as many degree-days as degrees Fahrenheit temperature difference between the mean temperature for the day and 50°F (10°C). Annual cooling degree-days (CDDs) are the sum of the degree-days over a calendar year.

heating degree-day base 65°F (HDD65) [18°C (HDD18)]: for any one day, when the mean temperature is less than 65°F (18°C), there are as many degree-days as degrees Fahrenheit temperature difference between the mean temperature for the day and 65°F (18°C). Annual heating degree-days (HDDs) are the sum of the degree-days over a calendar year.

…

space: an *enclosed space* within a *building*. The classifications of spaces are as follows for the purpose of determining *building envelope* requirements:

conditioned space: a *cooled space*, *heated space*, or *indirectly conditioned space* defined as follows:

1. ***cooled space:*** an *enclosed space* within a building that is cooled by a cooling *system* whose sensible output capacity is greater than or equal to 3.4 Btu/h·ft^2 (10 W/m^2) of floor area.
2. ***heated space:*** an *enclosed space* within a *building* that is heated by a heating *system* whose output capacity relative to the floor area is greater than or equal to the criteria in Table 3.2.

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TABLE 3.2 Heated Space Criteria (IP Units)

Climate Zone	Heating Output (Btu/h·ft^2)
0	≥ 5
1	≥ 5
2	≥ 5
3A, 3B	≥ 9
3C	≥ 7
4A, 4B	≥ 10
4C	≥ 8
5	≥ 12
6	≥ 14
7	≥ 16
8	≥ 19

TABLE 3.2 Heated Space Criteria (SI Units)

Climate Zone	Heating Output (W/m^2)
0	≥ 15
1	≥ 15
2	≥ 15
3A, 3B	≥ 27
3C	≥ 21
4A, 4B	≥ 30
4C	≥ 24
5	≥ 36
6	≥ 42
7	≥ 48
8	≥ 57

2. ***indirectly conditioned space:*** an *enclosed space* within a *building* that is not a *heated space* or a *cooled space*, which is heated or cooled indirectly by being connected to adjacent *space(s)* provided:

   a. the product of the *U-factor(s)* and surface area(s) of the *space* adjacent to connected *space(s)*

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exceeds the combined sum of the product of the *U-factor(s)* and surface area(s) of the *space* adjoining the outdoors, *unconditioned spaces*, and to or from *semiheated spaces* (e.g., corridors) or

b. that air from heated or *cooled spaces* is intentionally transferred (naturally or mechanically) into the space at a rate exceeding 3 ach (e.g., atria).

semiheated space: an *enclosed space* within a *building* that is heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h·ft^2 (10 W/m^2) of floor area but is not a *conditioned space*.

unconditioned space: an *enclosed space* within a *building* that is not a *conditioned space* or a *semiheated space*. Crawlspaces, attics, and parking garages with natural or mechanical *ventilation* are not considered *enclosed spaces*.

…

Add new Section 4.1.9 as follows:

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

Revise 5.1.2 as follows:

5.1.2 Space-Conditioning Categories

5.1.2.1 Separate exterior building envelope requirements are specified for each of three categories of conditioned space: (a) nonresidential conditioned space, (b) residential conditioned space, and (c) semiheated space.

5.1.2.2 The minimum skylight area requirements in Section 5.5.4.2.3 are also specified for unconditioned spaces.

5.1.2.3 Spaces shall be assumed to be conditioned spaces and shall comply with the requirements for conditioned spaces at the time of construction, regardless of whether mechanical or electrical equipment is included in the building permit application or installed at that time.

5.1.2.4 ~~In Climate Zones 3 through 8, a~~ A space may be designated as either a semiheated space or an unconditioned space only if approved by the building official.

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Revise 5.1.4 as follows:

5.1.4 Climate. Determine the climate zone for the location. For U.S. locations, follow the procedure in Section 5.1.4.1. For international locations, follow the procedure in Section 5.1.4.2.

5.1.4.1 United States Locations. ~~Use Figure B1-1 or Table B1-1 in Appendix B~~ For locations in the United States and its territories, use ASHRAE Standard 169, Table B-1, "U.S. Climate Zones by State and County," to determine the ~~required~~ assigned climate zone and, where required, the assigned climate zone letter.

Exception: If there are recorded historical climatic data available for a construction site, they may be used to determine compliance if approved by the building official.

Informative Note: Reference Standard Reproduction Annex ASHRAE Standard 169 (included at the end of this document) contains an extraction of ASHRAE Standard 169, Table B-1, "U.S. Climate Zones by State and County."

5.1.4.2 International Locations. For locations in Canada that are listed in ~~Table B1-2 in Appendix B~~ ASHRAE Standard 169, Table A-5, "Canada Stations and Climate Zones," use this table to determine the required assigned climate zone number and, where required, the assigned climate zone letterwhen a climate zone ~~letter is also required, use Table B1-4 and the Major Climate Type Definitions in Appendix B to determine the letter (A, B, or C)~~. For locations in other international countries that are listed in ~~Table B1-3~~ ASHRAE Standard 169, Table A-6, "International Stations and Climate Zones," use this table to determine the required climate zone number and, where required, the assigned climate zone letter~~when a climate zone letter is also required, use Table B1-4 and the Major Climate Type Definitions in Appendix B to determine the letter (A, B, or C)~~. For all international locations that are not listed either in ~~Table B1-2 or B1-3, use Table B1-4 and the Major Climate Type Definitions in Appendix B~~ ASHRAE Standard 169, Table A-5, "Canada Stations and Climate Zones," or Table A-6, "International Stations and Climate Zones," use ASHRAE Standard 169, Section A3, "Climate Zone Definitions ," and Table A-3, "Thermal Climate Zone Definitions," to determine both the climate zone number and letter ~~and number~~.

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

Revise 5.4.3.1 as follows:

5.4.3.1 Continuous Air Barrier. The entire building envelope shall be designed and constructed with a continuous air barrier.

Exceptions:

1. Semiheated spaces in Climate Zones ~~1~~ 0 through 6.
2. Single wythe concrete masonry buildings in Climate Zone 2B.

(No changes to subsections of 5.4.3.1)

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Revise 5.4.3.2 as follows:

5.4.3.2 Fenestration and Doors…

Exceptions:

1. …
2. Metal coiling doors in semiheated spaces in Climate Zones ~~1~~ 0 through 6.
3. …

Revise 5.4.3.3 as follows:

5.4.3.3 Loading Dock Weatherseals. In Climate Zones 0 and 4 through 8, cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.

Revise 5.4.3.4 as follows:

5.4.3.4 Vestibules. Building entrances that separate conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than 7 ft (2.1 m) when in the closed position. The floor area of each vestibule shall not exceed the greater of 50 ft^2 (5 m^2) or 2% of the gross conditioned floor area for that level of the building. The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space. The interior and exterior envelope of unconditioned vestibules shall comply with the requirements for a semiheated space.

Exceptions:

1. Building entrances with revolving doors
2. Doors not intended to be used as a building entrance
3. Doors opening directly from a dwelling unit
4. Building entrances in buildings located in Climate Zone 1 or 2
5. Building entrances in buildings that are located in Climate Zone 3 less than four stories above grade, and less than 10,000 ft^2 (1000 m^2) in gross conditioned floor area
6. Building entrances in buildings that are located in Climate Zones 0, 4, 5, 6, 7, or 8 and are less than 1000 ft^2 (100 m^2) in gross conditioned floor area
7. Doors that open directly from a space that is less than 3000 ft^2 (300 m^2) in area and is separate from the building entrance
8. Semiheated spaces
9. Enclosed elevator lobbies for building entrances directly from parking garages

(No changes to subsections of 5.4.3.4)

Revise 5.5.1 as follows:

5.5.1 For a conditioned space, the exterior building envelope shall comply with either the nonresidential or residential requirements in Tables ~~5.5-1~~ 5.5-0 through 5.5-8 for the appropriate climate.

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Revise 5.5.2 as follows:

5.5.2 If a building contains any semiheated space or unconditioned space, then the semiexterior building envelope shall comply with the requirements for semiheated space in Tables ~~5.5-1~~ 5.5-0 through 5.5-8 for the appropriate climate. (See Figure 5.5.2.)

Revise 5.5.3 as follows:

5.5.3 Opaque Areas.

5.5.3.1 Roof Insulation. All roofs shall comply with the insulation values specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8…

5.5.3.1.1 Roof Solar Reflectance and Thermal Emittance. Roofs in Climate Zones ~~1~~ 0 through 3 shall have one of the following:

a. A minimum three-year-aged solar reflectance of 0.55 and a minimum three-year-aged thermal emittance of 0.75 when tested in accordance with CRRC-1 Standard
b. A minimum Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 Btu/h·ft^2·°F, based on three-year-aged solar reflectance and three-year-aged thermal emittance tested in accordance with CRRC-1 Standard
c. Increased roof insulation levels found in Table 5.5.3.1.1

Exceptions: …

Table 5.5.3.1.1 Increased Roof Insulation Levels

Roofs	Nonresidential		Residential	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Climate Zone 0				
Insulation entirely above deck	U-0.027	R-36 c.i.	U-0.027	R-36 c.i.
Metal buildings	U-0.028	R-35		
Climate Zones 1-3				
Insulation entirely above deck	U-0.030	R-33 c.i.	U-0.029	R-34 c.i.
Metal buildings	U-0.028	R-35		

5.5.3.2 Above-Grade Wall Insulation. All above-grade walls shall comply with the insulation values specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8.

Exception: Alternatively, for mass walls, where the requirement in Tables ~~5.5-1~~ 5.5-0 through 5.5-8 is for…

In addition, for Climate Zone 0, above-grade walls shall comply with one of the following:

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1. For east and west walls, a minimum of 75% of the opaque *wall* area shall have a minimum *SRI* of 29. For the portion of the opaque wall that is glass spandrel area, a minimum solar reflectance of 29% determined in accordance with NFRC 300 or ISO 9050 shall be permitted. Each *wall* is allowed to be considered separately.
2. For east and west walls, a minimum of 30% of the above-grade wall area shall be shaded through the use of shade-providing *plants*, manmade structures, existing buildings, hillsides, permanent building projections, *on-site renewable energy systems,* or a combination of these. Shade coverage shall be calculated at 10 a.m. for the east *walls* and 3 p.m. for the west *walls* on the summer solstice.

The building is allowed to be rotated up to 45 degrees to the nearest cardinal orientation for purposes of calculations and showing compliance.

5.5.3.3 Below-Grade Wall Insulation. Below-grade walls shall have a rated R-value of insulation no less than the insulation values specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8...

5.5.3.4 Floor Insulation. All floors shall comply with the insulation values specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8.

5.5.3.5 Slab-on-Grade Floor Insulation. All slab-on-grade floors, including heated slab-on-grade floors and unheated slab-on-grade floors, shall comply with the insulation values specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8.

5.5.3.6 Opaque Doors. All opaque doors shall have a U-factor not greater than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8.

(No changes to the remainder of the text in 5.5.3)

Revise 5.5.4 as follows:

5.5.4 Fenestration.

5.5.4.1 General. …

5.5.4.2 Fenestration Area.

5.5.4.2.1 Vertical Fenestration Area. The total vertical fenestration area shall not be greater than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8…

5.5.4.2.2 Maximum Skylight Fenestration Area. The total skylight area shall not be greater than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8…

5.5.4.2.3 Minimum Skylight Fenestration Area. …

Exceptions:

1. Enclosed spaces in Climate Zones 6 through 8

5.5.4.3 Fenestration U-Factor. Fenestration shall have a U-factor not greater than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8.

~~However, for locations in Climate Zone 1 with a cooling design temperature of 95°F and greater, the maximum allowed U-factors for vertical fenestration for all conditioned spaces, nonresidential and residential, are U-0.32 for nonmetal framing, U-0.50 for fixed metal framing, U-0.65 for operable metal framing, and U-0.83 for entrance door metal framing.~~

Exception: The U-factor for skylights is permitted to be increased to no greater than 0.90 Btu/h·ft^2·°F in Climate Zones ~~1~~ 0 through 3 and...

5.5.4.4 Fenestration Solar Heat Gain Coefficient (SHGC)

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5.5.4.4.1 SHGC of Vertical Fenestration. Vertical fenestration shall have an SHGC not greater than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8…

Exceptions:

5. Vertical fenestration that is north-oriented shall be allowed to have a maximum solar heat gain coefficient SHGC-0.05 greater than that specified in Tables 5.5-1 through 5.5-8....

5.5.4.4.2 SHGC of Skylights. Skylights shall have an SHGC not greater than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8…

5.5.4.5 Fenestration Orientation…

$SHGC_C$ = SHGC criteria in Tables ~~5.5-1~~ 5.5-0 through 5.5-8 for each climate zone…

Exceptions:

5. Buildings where the west-oriented and east-oriented vertical fenestration area (as defined in Section 5.5.4.5) does not exceed 20% of the gross wall area for each of those façades, and SHGC on those facades is no greater than 90% of the criteria in Tables ~~5.5-1~~ 5.5-0 through 5.5-8....

5.5.4.6 Visible Transmittance/SHGC Ratio. Where automatic daylighting controls are required in accordance with Section 9.4.1.1(e) or (f), fenestration shall have a ratio of VT divided by SHGC not less than that specified in Tables ~~5.5-1~~ 5.5-0 through 5.5-8...

(No changes to the remainder of the text in 5.5.4)

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Add new Table 5.5-0 as follows.

Table 5.5-0 Building Envelope Requirements for Climate Zone 0 (A,B)* [I-P]

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Roofs						
Insulation Entirely above Deck	U-0.039	R-25 c.i.	U-0.032	R-30 c.i.	U-0.218	R-3.8 c.i.
Metal Building[a]	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
Attic and Other	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
Walls, above Grade						
Mass	U-0.580	NR	U-0.151[b]	R-5.7 c.i.[b]	U-0.580	NR
Metal Building	U-0.094	R-0 + R-9.8 c.i.	U-0.094	R-0 + R-9.8 c.i.	U-0.352	NR
Steel Framed	U-0.124	R-13	U-0.124	R-13	U-0.352	NR
Wood Framed and Other	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
Wall, below Grade						
Below Grade Wall	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.322	NR	U-0.322	NR	U-0.322	NR
Steel Joist	U-0.350	NR	U-0.350	NR	U-0.350	NR
Wood Framed and Other	U-0.282	NR	U-0.282	NR	U-0.282	NR
Slab-on-Grade Floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-1.450		U-0.500		U-1.450	

Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**
Vertical Fenestration, 0%–40% of Wall		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.32	SHGC-0.25	1.10	U-0.32	SHGC-0.25	1.10	U-0.93	NR	NR
Metal framing, fixed	U-0.50			U-0.50			U-1.20		

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Metal framing, operable	U-0.65			U-0.65			U-1.20		
Metal framing, entrance door	U-0.83			U-0.83			U-1.10		
Skylight, 0%–3% of Roof	-	-	-	-	-	-	-	-	-
All types	U-0.75	SHGC-0.35	NR	U-0.75	SHGC-0.35	NR	U-1.80	NR	NR

* The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), Ls = liner system (see Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building roofs, a thermal spacer block is required (see Section A2.3.2).

b. Exception to Section 5.5.3.2 applies for mass walls above grade.

Table 5.5-0 Building Envelope Requirements for Climate Zone 0 (A,B)* [SI]

-	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Roofs		-		-		-
Insulation Entirely above Deck	U-0.220	R-4.4 c.i.	U-0.184	R-5.3 c.i.	U-1.240	R-0.7 c.i.
Metal Building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.653	R-1.8
Attic and Other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
Walls, above Grade	-	- -	-	- -	-	- -
Mass	U-3.293	NR	U-0.857[b]	R-1.0 c.i.[b]	U-3.293	NR
Metal Building	U-0.533	R-0 + R-1.7 c.i.	U-0.533	R-0 + R-1.7 c.i.	U-1.998	NR
Steel Framed	U-0.705	R-2.3	U-0.705	R-2.3	U-1.998	NR
Wood Framed and Other	U-0.504	R-2.3	U-0.504	R-2.3	U-1.660	NR
Wall, below Grade	-	- -	-	- -	-	- -
Below Grade Wall	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors	-	- -	-	- -	-	- -
Mass	U-1.825	NR	U-1.825	NR	U-1.825	NR
Steel Joist	U-1.986	NR	U-1.986	NR	U-1.986	NR
Wood Framed and Other	U-1.599	NR	U-1.599	NR	U-1.599	NR
Slab-on-Grade Floors	-	- -	-	- -	-	- -
Unheated	F-1.264	NR	F-1.264	NR	F-1.264	NR
Heated	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm
Opaque Doors	-	- -	-	- -	-	- -
Swinging	U-3.975	-	U-2.839	-	U-3.975	-

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Nonswinging	U-8.233		-	U-2.839		-	U-8.233		-
Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**
Vertical Fenestration, 0%–40% of Wall	-	(for all frame types)		-	(for all frame types)		-	(for all frame types)	
Nonmetal framing, all	U-1.82			U-1.82			U-5.28		
Metal framing, fixed	U-2.84			U-2.84			U-6.81		
Metal framing, operable	U-3.69	SHGC-0.25	1.10	U-3.69	SHGC-0.25	1.10	U-6.81	NR	NR
Metal framing, entrance door	U-4.71			U-4.71			U-6.25		
Skylight, 0%–3% of Roof	-	-	-	-	-	-	-	-	-
All types	U-4.26	SHGC-0.35	NR	U-4.26	SHGC-0.35	NR	U-10.22	NR	NR

* The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), Ls = liner system (see Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building roofs, a thermal spacer block is required (see Section A2.3.2).

b. Exception to Section 5.5.3.2 applies for mass walls above grade.

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Revise Table 5.5-1 as follows:

Table 5.5-1 Building Envelope Requirements for Climate Zone 1 (A,~~B,C~~)* [I-P]

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

Fenestration	Assembly Max. U	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Min. VT/SHGC
Vertical Fenestration, 0%–40% of Wall		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-0.50[e]	SHGC-0.25	1.10	U-0.50[e]	SHGC-0.25	1.10	U-0.93	NR	NR
Metal framing, fixed	U-0.57[e]			U-0.57[e]			U-1.20		

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Metal framing, operable	U-0.65[e]			U-0.65[e]			U-1.20		
Metal framing, entrance door	U-1.10[e]			U-1.10[e]			U-1.10[e]		
Skylight, 0%–3% of Roof									
All types	U-0.75	SHGC-0.35	NR	U-0.75	SHGC-0.35	NR	U-1.80	NR	NR

* The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), Ls = liner system (see Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building roofs, a thermal spacer block is required (see Section A2.3.2).

b. Exception to Section 5.5.3.2 applies for mass walls above grade.

~~c. For locations in Climate Zone 1 with a cooling design temperature of 95°F and greater, see Section 5.5.4.3 for the maximum U-factors for vertical fenestration.~~

Table 5.5-1 Building Envelope Requirements for Climate Zone 1 (A,B,~~C~~)* [SI]

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.273	R-3.5 c.i.	U-0.220	R-4.4 c.i.	U-1.240	R-0.7 c.i.
Metal Building[a]	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.653	R-1.8
Attic and Other	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
Walls, above Grade						
Mass	U-3.293	NR	U-0.857[b]	R-1.0 c.i.[b]	U-3.293	NR
Metal Building	U-0.533	R-0 + R-1.7 c.i.	U-0.533	R-0 + R-1.7 c.i.	U-1.998	NR
Steel Framed	U-0.705	R-2.3	U-0.705	R-2.3	U-1.998	NR
Wood Framed and Other	U-0.504	R-2.3	U-0.504	R-2.3	U-1.660	NR
Wall, below Grade						
Below Grade Wall	C-6.473	NR	C-6.473	NR	C-6.473	NR
Floors						
Mass	U-1.825	NR	U-1.825	NR	U-1.825	NR
Steel Joist	U-1.986	NR	U-1.986	NR	U-1.986	NR
Wood Framed and Other	U-1.599	NR	U-1.599	NR	U-1.599	NR
Slab-on-Grade Floors						
Unheated	F-1.264	NR	F-1.264	NR	F-1.264	NR
Heated	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm	F-1.766	R-1.3 for 300 mm
Opaque Doors						
Swinging	U-3.975		U-2.839		U-3.975	

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Nonswinging	U-8.233			U-2.839			U-8.233		
Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. VT/SHGC**
Vertical Fenestration, 0%–40% of Wall		(for all frame types)			(for all frame types)			(for all frame types)	
Nonmetal framing, all	U-2.84[e]			U-2.84[e]			U-5.28		
Metal framing, fixed	U-3.24[e]			U-3.24[e]			U-6.81		
Metal framing, operable	U-3.69[e]	SHGC-0.25	1.10	U-3.69[e]	SHGC-0.25	1.10	U-6.81	NR	NR
Metal framing, entrance door	U-6.25[e]			U-6.25[e]			U-6.25[e]		
Skylight, 0%–3% of Roof									
All types	U-4.26	SHGC-0.35	NR	U-4.26	SHGC-0.35	NR	U-10.22	NR	NR

* The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), Ls = liner system (see Section A2.3.2.4), NR = no (insulation) requirement.

a. When using the R-value compliance method for metal building roofs, a thermal spacer block is required (see Section A2.3.2).

b. Exception to Section 5.5.3.2 applies for mass walls above grade.

~~c. For locations in Climate Zone 1 with a cooling design temperature of 35°C and greater, see Section 5.5.4.3 for the maximum U-factors for vertical fenestration.~~

Add new Section 6.1.2 as follows:

6.1.2 Climate. Climate Zones shall be determined in accordance with Section 5.1.4.

Add new Section 9.1.5 as follows:

9.1.5 Climate. Climate Zones shall be determined in accordance with Section 5.1.4.

Revise Table 11.5.1 as follows:

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

No.	Proposed Building Design (Column A) Design Energy Cost (DEC)	Budget Building Design (Column B) Energy Cost Budget (ECB)
1-4…		
5. Building Envelope		
…	…	
	c. No shading projections are to be modeled; fenestration shall be assumed to be flush with the exterior wall or roof. If the fenestration area for new buildings or additions exceeds the maximum allowed by Section 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.4.2 is met. If the vertical fenestration area facing west or east of the proposed building exceeds the area limit set in Section 5.5.4.5 then the energy cost budget shall be generated by simulating the budget building design with its actual orientation and again after rotating the entire budget building design 90, 180, and 270 degrees and then averaging the results. Fenestration U-factor shall be equal to the criteria	

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	from Tables ~~5.5-1~~ 5.5-0 through 5.5-8 for the appropriate climate, and the SHGC shall be equal to the criteria from Tables ~~5.5-1~~ 5.5-0 through 5.5-8 for the appropriate climate. For portions of those tables where there are no SHGC requirements, the SHGC shall be equal to that determined in accordance with Section C3.6(c). The VT shall be equal to that determined in accordance with Section C3.6(c). The fenestration model for envelope alterations shall reflect the limitations on area, U-factor, and SHGC as described in Section 5.1.3. …
6 through 14…	

Revise Section 12 as follows:

12. NORMATIVE REFERENCES

Reference	Title
…	
ASHRAE **1791 Tullie Circle, NE, Atlanta, GA 30329**	
…	
ANSI/ASHRAE Standard 169-2013	Climatic Data for Building Design Standards
~~Briggs, R.S., R.G. Lucas, and Z.T. Taylor. 2003~~	~~Climate classification for building energy codes and standards: Part 1—Development process~~
…	
International Organization for Standardization (ISO) **1, rue de Varembe, Case postale 56, CH-1211 Geneve 20, Switzerland**	
…	
ISO 9050 (2003)	Glass in building — Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors

Revise Appendix A, Table A2.4.2.4 as follows:

Table A2.4.2.4 Single-Rafter Roofs

Climate Zone	Minimum Insulation R-Value or Maximum Assembly U-Factor		
	Wood Rafter Depth, *d* (Actual)		
	d **≤ 8 in.**	**8 < *d* ≤ 10 in.**	**10 < *d* ≤ 12 in.**
~~1~~0–7	R-19/U-0.055	R-30/U-0.036	R-38/U-0.028
8	R-21/U-0.052	R-30/U-0.036	R-38/U-0.028

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Delete Normative Appendix B and replace with the following Informative Appendix B:

(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 B

(retained for future use)

Informative Note: Climatic data is no longer contained in this appendix. See Section 5.1.4 for requirements. However, Reference Standard Reproduction Annex ASHRAE Standard contains:

1. an extraction of ASHRAE Standard 169, Table B-1, "U.S. Climate Zones by State and County" (which is normative for Standard 90.1),
2. an extraction of ASHRAE Standard 169, Figure B-1, "Climate Zone for United States Counties" (which is informative for Standard 90.1),
3. an extraction of ASHRAE Standard 169, Table A-5, "Canada Stations and Climate Zones" (which is normative for Standard 90.1),
4. an extraction of ASHRAE Standard 169, Table A-6, "International Stations and Climate Zones" (which is normative for Standard 90.1),
5. an extraction of ASHRAE Standard 169, Section A3, "Climate Zone Definitions" (which is normative for Standard 90.1),
6. an extraction of ASHRAE Standard 169, Table A-3, "Thermal Climate Zone Definitions" (which is normative for Standard 90.1),
7. an extraction of ASHRAE Standard 169, Figure A-1, "Thermal Climate Zones as a Function of Heating and Cooling Degree Days" (which is informative for Standard 90.1), and
8. an extraction of ASHRAE Standard 169, Figure C-2, "World Climate Zones Map" (which is informative for Standard 90.1).

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Delete Normative Appendix D and replace with the following Informative Appendix D:

(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 D

(retained for future use)

Informative Note: Climatic data is no longer contained in this appendix. See Section 5.1.4 for requirements. However, Reference Standard Reproduction Annex ASHRAE Standard 169 contains extracts of material from ASHRAE Standard 169.

Revise Appendix E as follows:

INFORMATIVE APPENDIX E
INFORMATIVE REFERENCES

This appendix contains informative references for the convenience of users of Standard 90.1 and to acknowledge source documents when appropriate. Some documents are also included in Section 12, "Normative References," because there are other citations of those documents within the standard that are normative.

Address/Contact Information

…

CWEC Data
Environment Canada
http://climate.weather.gc.ca/prods_servs/engineering_e.html
…

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

TMY~~2~~3 Data
National Renewable Energy Laboratory
NREL/RReDC
Attn: Pamela Gray-Hann
1617 Cole Blvd., MS-1612
Golden, Colorado, USA 80401
~~http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/~~
http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/
…

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~~**WYEC2 Data**~~
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~~(F) 404-321-5478~~
~~www.ashrae.org/bookstore~~

Subsection No.	Reference	Title/Source
…		
11.2.2	CWEC	Canadian Weather for Energy Calculations
11.2.2	IWEC2	International Weather for Energy Calculations Generation 2
11.2.2	TMY3 ~~2 Data~~	Typical Meteorological Year Generation 3
~~Appendix B~~	~~U.S. Climate Zone Map~~	~~Briggs, R.S., R.G. Lucas, and Z.T. Taylor. 2003. Climate classification for building energy codes and standards: Part 1-Development process. ASHRAE Transactions 109(1):109-21.~~

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Revise Appendix G, Table G3.1, as follows:

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

No.	Proposed Building Performance	Baseline Building Performance
1 through 4…		
5. Building Envelope		
…	…	
	b. **Opaque Assemblies.** Opaque assemblies used for new buildings, existing buildings, or additions shall conform with the following common, lightweight assembly types and shall match the appropriate assembly maximum U-factors in Tables ~~5.5-1~~ 5.5-0 through 5.5-8: o Roofs—Insulation entirely above deck o Above-grade walls—Steel framed o Floors—Steel joist o Opaque door types shall match the proposed design and conform to the U-factor requirements from the same tables. o Slab-on-grade floors shall match the F-factor for unheated slabs from the same tables.	
	c. **Vertical Fenestration Areas.** For building area types included in Table G3.1.1-1, vertical fenestration areas for new buildings and additions shall equal that in Table G3.1.1-1 based on gross above-grade exterior wall area. Where a building has multiple building area types, each type shall use the values in the table. The vertical fenestration shall be distributed on each face of the building in the same proportion as in the proposed design. For building areas not shown in Table G3.1.1-1, vertical fenestration areas for new buildings and additions shall equal that in the proposed design or the maximum allowed in Tables ~~5.5-1~~ 5.5-0 through 5.5-8, whichever is smaller, and shall be distributed on each face of the building in the same proportions in the proposed design. 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. For portions of those tables where there are no SHGC requirements, the SHGC shall be equal to that determined in accordance with Section C3.6(c). The VT shall be equal to that determined in accordance with Section C3.6(c).	
	d. **Vertical Fenestration Assemblies.** Fenestration for new buildings, existing buildings, and additions shall comply with the following: o Fenestration U-factors shall match the appropriate requirements in Tables ~~5.5-1~~ 5.5-0 through 5.5-8. o Fenestration SHGCs shall match the appropriate requirements in Tables ~~5.5-1~~ 5.5-0 through 5.5-8. o All vertical fenestration shall be assumed to be flush with the exterior wall, and no shading projections shall be modeled. o Manual window shading devices such as blinds or shades are not required to be modeled.	

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e. **Skylights and Glazed Smoke Vents.** Skylight area shall be equal to that in the proposed building design or the maximum allowed in Tables ~~5.5-1~~ 5.5-0 through 5.5-8, whichever is smaller. If the skylight area of the proposed building design is greater than the maximum area allowed in Tables ~~5.5-1~~ 5.5-0 through 5.5-8, baseline skylight area shall be decreased by an identical percentage in all roof components in which skylights are located to reach the maximum allowed in Tables ~~5.5-1~~ 5.5-0 through 5.5-8. Skylight orientation and tilt shall be the same as in the proposed building design. Skylight U-factor and SHGC properties shall match the appropriate requirements in Tables ~~5.5-1~~ 5.5-0 through 5.5-8.

…

6-15…

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Add new Reference Standard Reproduction Annex ASHRAE Standard 169.

(The reference standard reproduction annexes contain normative material from other ASHRAE standards that is cited in this standard. The reference standard reproduction annexes are not part of this standard; they are merely informative but are included in the publication of this standard to facilitate its use.)

REFERENCE STANDARD REPRODUCTION ANNEX
ASHRAE STANDARD 169

The reference standard reproduction annex contains extractions of the following material from ASHRAE Standard 169 in the following order:

ASHRAE Standard 169 Material
Table B-1, U.S. States by State and County
Figure B-1, Climate Zones for United States Counties
Table A-5 Canada Stations and Climate Zones
Table A-6 International Stations and Climate Zones
Section A3 Climate Zone Definitions
Table A-3 Thermal Climate Zone Definitions
Figure A-1 Thermal Climate Zones as a Function of Heating and Cooling Degree Days
Figure C-2, World Climate Zones Map
Section 4, Climatic Design Data and Climate Zones

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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