

# ADDENDA

**ANSI/ASHRAE/IES Addendum bf to  
ANSI/ASHRAE/IES Standard 90.1-2022**

# **Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings**

Approved by ASHRAE Standards committee on June 21, 2025; by the American National Standards Institute on July 18, 2025; and by the Illuminating Engineering Society on July 2, 2025.

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## FOREWORD

Addendum bf increases baseline prescriptive requirements where incremental insulation can be added without significant changes to the construction system.

A cost-effectiveness analysis was conducted both with and without the social cost of carbon. This analysis was used, along with professional judgment, to inform the changes made within this addendum.

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

## Addendum bf to Standard 90.1-2022

Revise Section 5.5, Tables 5.5-0 through 5.5-8 as shown (I-P).

Table 5.5-0 Building Envelope Requirements for Climate Zone 0 (A,B)

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.039	R-25 <i>c.i.</i>	U-0.032	R-30 <i>c.i.</i>	U-0.218	R-3.8 <i>c.i.</i>
<i>Metal building<sup>a</sup></i>	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
<i>Attic and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-0.580	NR	U-0.151 <sup>b</sup>	R-5.7 <i>c.i.</i> <sup>b</sup>	U-0.580	NR
<i>Metal building</i>	U-0.094	R-0 + R-9.8 <i>c.i.</i>	U-0.094	R-0 + R-9.8 <i>c.i.</i>	<del>U-0.352</del> <u>U-1.18</u>	NR
<i>Steel-framed</i>	<del>U-0.124</del> <u>U-0.118</u>	<del>R-13</del> <u>R-15</u>	<del>U-0.124</del> <u>U-0.118</u>	<del>R-13</del> <u>R-15</u>	U-0.352	NR
<i>Wood-framed and other</i>	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-1.140	NR	C-1.140	NR	C-1.140	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.322	NR	U-0.322	NR	U-0.322	NR
<i>Steel joist</i>	<del>U-0.350</del> <u>U-0.069</u>	<del>NR</del> <u>R-13</u>	<del>U-0.350</del> <u>U-0.069</u>	<del>NR</del> <u>R-13</u>	U-0.350	NR
<i>Wood-framed and other</i>	<del>U-0.282</del> <u>U-0.066</u>	<del>NR</del> <u>R-13</u>	<del>U-0.282</del> <u>U-0.066</u>	<del>NR</del> <u>R-13</u>	U-0.282	NR
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.730	NR	F-0.730	NR	F-0.730	NR
<i>Heated</i>	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.

[ ... ]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-1 Building Envelope Requirements for Climate Zone 1 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.048	R-20 <i>c.i.</i>	U-0.039	R-25 <i>c.i.</i>	U-0.218	R-3.8 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.115	R-10
<i>Attic and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.081	R-13
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-0.580	NR	U-0.151 <sup>b</sup>	R-5.7 <i>c.i.</i> <sup>b</sup>	U-0.580	NR
<i>Metal building</i>	U-0.094	R-0 + R-9.8 <i>c.i.</i>	U-0.094	R-0 + R-9.8 <i>c.i.</i>	<del>U-0.352</del> U-1.18	NR
<i>Steel-framed</i>	<del>U-0.124</del> U-0.118	<del>R-13</del> R-15	<del>U-0.124</del> U-0.118	<del>R-13</del> R-15	U-0.352	NR
<i>Wood-framed and other</i>	U-0.089	R-13	U-0.089	R-13	U-0.292	NR
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-1.140	NR	C-1.140	NR	C-1.140	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.322	NR	U-0.322	NR	U-0.322	NR
<i>Steel joist</i>	<del>U-0.350</del> U-0.069	<del>NR</del> R-13	<del>U-0.350</del> U-0.069	<del>NR</del> R-13	U-0.350	NR
<i>Wood-framed and other</i>	<del>U-0.282</del> U-0.066	<del>NR</del> R-13	<del>U-0.282</del> U-0.066	<del>NR</del> R-13	U-0.282	NR
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.730	NR	F-0.730	NR	F-0.730	NR
<i>Heated</i>	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.

[ . . . ]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-2 Building Envelope Requirements for Climate Zone 2 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.039	R-25 <i>c.i.</i>	U-0.039	R-25 <i>c.i.</i>	U-0.173	R-5 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.096	R-16
<i>Attic and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.053	R-19
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-0.151 <sup>b</sup>	R-5.7 <i>c.i.</i> <sup>b</sup>	<del>U-0.123</del> U-0.104	<del>R-7.6 <i>c.i.</i></del> R-9.5 <i>c.i.</i>	U-0.580	NR
<i>Metal building</i>	<del>U-0.094</del> U-0.084	<del>R-0 + R-9.8 <i>c.i.</i></del> R-11 + R-6.5 <i>c.i.</i> or R-11.1 <i>c.i.</i>	<del>U-0.094</del> U-0.084	<del>R-0 + R-9.8 <i>c.i.</i></del> R-11 + R-6.5 <i>c.i.</i> or R-11.1 <i>c.i.</i>	U-0.162	R-13
<i>Steel-framed</i>	<del>U-0.084</del> U-0.082	<del>R-13 + R-3.8 <i>c.i.</i></del> R-15 + R-3.8 <i>c.i.</i> or R-0 + R-9.2 <i>c.i.</i>	<del>U-0.064</del> U-0.063	<del>R-13 + R-7.5 <i>c.i.</i></del> R-15 + R-7.5 <i>c.i.</i> or R-0 + R-13 <i>c.i.</i>	U-0.124	R-13
<i>Wood-framed and other</i>	<del>U-0.089</del> U-0.083	<del>R-13</del> R-15	<del>U-0.089</del> U-0.083	<del>R-13</del> R-15	U-0.089	R-13
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-1.140	NR	C-1.140	NR	C-1.140	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.107	R-6.3 <i>c.i.</i>	U-0.087	R-8.3 <i>c.i.</i>	U-0.322	NR
<i>Steel joist</i>	U-0.038	R-30	U-0.038	R-30	U-0.069	R-13
<i>Wood-framed and other</i>	U-0.033	R-30	U-0.033	R-30	U-0.066	R-13
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.730	NR	F-0.730	NR	F-0.730	NR
<i>Heated</i>	F-0.900	R-10 for 24 in.	F-0.860	R-15 for 24 in.	F-1.020	R-7.5 for 12 in.

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-3 Building Envelope Requirements for Climate Zone 3 (A,B,C)\***

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	<del>U-0.039</del> U-0.032	<del>R-25 c.i.</del> R-30 c.i.	<del>U-0.039</del> U-0.032	<del>R-25 c.i.</del> R-30 c.i.	U-0.119	R-7.6 c.i.
<i>Metal building<sup>a</sup></i>	U-0.041	R-10 + R-19 FC	U-0.041	R-10 + R-19 FC	U-0.096	R-16
<i>Attic and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.053	R-19
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.123</del> U-0.104	<del>R-7.6 c.i.</del> R-9.5 c.i.	U-0.104	R-9.5 c.i.	U-0.580	NR
<i>Metal building</i>	<del>U-0.094</del> U-0.079	<del>R-0 + R-9.8 c.i.</del> R-13 + R-6.5 c.i. or R-12.5 c.i.	U-0.072	R-0 + R-13 c.i.	U-0.162	R-13
<i>Steel-framed</i>	<del>U-0.077</del> U-0.075	<del>R-13 + R-5 c.i.</del> R-15 + R-5 c.i. or R-20.9 + R-3.8 c.i.	<del>U-0.064</del> U-0.063	<del>R-13 + R-7.5 c.i.</del> R-15 + R-7.5 c.i. or R-0 + R-13 c.i.	U-0.124	R-13
<i>Wood-framed and other</i>	<del>U-0.089</del> U-0.083	<del>R-13</del> R-15	<del>U-0.064</del> U-0.063	<del>R-13</del> R-15 + R-3.8 c.i. or <del>R-20</del> R-21	U-0.089	R-13
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-1.140	NR	C-1.140	NR	C-1.140	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.074	R-10 c.i.	U-0.074	R-10 c.i.	U-0.137	R-4.2 c.i.
<i>Steel joist</i>	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
<i>Wood-framed and other</i>	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.730	NR	F-0.540	R-10 for 24 in.	F-0.730	NR
<i>Heated</i>	F-0.860	R-15 for 24 in.	F-0.860	R-15 for 24 in.	F-1.020	R-7.5 for 12 in.

[...]

\* The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

**Table 5.5-4 Building Envelope Requirements for Climate Zone 4 (A,B,C)\***

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.032	R-30 <i>c.i.</i>	U-0.032	R-30 <i>c.i.</i>	<del>U-0.093</del> U-0.091	<del>R-10 <i>c.i.</i></del> R-11 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.037	R-19 + R-11 Ls or R-25 + R-8 Ls	U-0.037	R-19 + R-11 Ls or R-25 + R-8 Ls	U-0.082	R-19
<i>Attic and other</i>	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-0.104	R-9.5 <i>c.i.</i>	<del>U-0.090</del> U-0.089	<del>R-11.4 <i>c.i.</i></del> R-12.5 <i>c.i.</i>	U-0.580	NR
<i>Metal building</i>	U-0.060	R-0 + R-15.8 <i>c.i.</i>	U-0.050	R-0 + R-19 <i>c.i.</i>	U-0.162	R-13
<i>Steel-framed</i>	<del>U-0.064</del> U-0.063	<del>R-13 + R-7.5 <i>c.i.</i></del> R-15 + R-7.5 <i>c.i.</i> or R-0 + R-13 <i>c.i.</i>	<del>U-0.064</del> U-0.063	<del>R-13 + R-7.5 <i>c.i.</i></del> R-15 + R-7.5 <i>c.i.</i> or R-0 + R-13 <i>c.i.</i>	<del>U-0.124</del> U-0.118	<del>R-13</del> R-15
<i>Wood-framed and other</i>	<del>U-0.064</del> U-0.063	<del>R-13</del> R-15 + R-3.8 <i>c.i.</i> or <del>R-20</del> R-21	<del>U-0.064</del> U-0.063	<del>R-13</del> R-15 + R-3.8 <i>c.i.</i> or <del>R-20</del> R-21	<del>U-0.089</del> U-0.083	<del>R-13</del> R-15
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.119	R-7.5 <i>c.i.</i>	C-0.092	R-10 <i>c.i.</i>	C-1.140	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.057	R-14.6 <i>c.i.</i>	U-0.051	R-16.7 <i>c.i.</i>	U-0.107	R-6.3 <i>c.i.</i>
<i>Steel joist</i>	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
<i>Wood-framed and other</i>	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.520	R-15 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
<i>Heated</i>	F-0.843	R-20 for 24 in.	F-0.688	R-20 for 48 in.	F-0.900	R-10 for 24 in.

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

**Table 5.5-5 Building Envelope Requirements for Climate Zone 5 (A,B,C)\***

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.032	R-30 <i>c.i.</i>	U-0.032	R-30 <i>c.i.</i>	<del>U-0.063</del> U-0.055	<del>R-15</del> R-18 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.037	R-19 + R-11 <i>Ls</i> or R-25 + R-8 <i>Ls</i>	U-0.037	R-19 + R-11 <i>Ls</i> or R-25 + R-8 <i>Ls</i>	U-0.082	R-19
<i>Attic and other</i>	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.090</del> U-0.089	<del>R-11.4 <i>c.i.</i></del> R-12.5 <i>c.i.</i>	<del>U-0.080</del> U-0.076	<del>R-13.3 <i>c.i.</i></del> R-15.0 <i>c.i.</i>	<del>U-0.151<sup>b</sup></del> U-0.131	<del>R-5.7 <i>c.i.</i><sup>b</sup></del> R-7.5 <i>c.i.</i>
<i>Metal building</i>	U-0.050	R-0 + R-19 <i>c.i.</i>	U-0.050	R-0 + R-19 <i>c.i.</i>	U-0.094	R-0 + R-9.8 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.055</del> U-0.053	<del>R-13 + R-10 <i>c.i.</i></del> R-15 + R-10.4 <i>c.i.</i> or R-21 + R-9.3 <i>c.i.</i>	<del>U-0.055</del> U-0.053	<del>R-13 + R-10 <i>c.i.</i></del> R-15 + R-10.4 <i>c.i.</i> or R-21 + R-9.3 <i>c.i.</i>	<del>U-0.084</del> U-0.081	<del>R-13 + R-3.8 <i>c.i.</i></del> R-15 + R-3.8 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.051</del> U-0.049	<del>R-13</del> R-15 + R-7.5 <i>c.i.</i> or R-19R-21 + R-5 <i>c.i.</i>	<del>U-0.051</del> U-0.049	<del>R-13</del> R-15 + R-7.5 <i>c.i.</i> or R-19R-21 + R-5 <i>c.i.</i>	<del>U-0.089</del> U-0.083	<del>R-13</del> R-15
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.119	R-7.5 <i>c.i.</i>	C-0.092	R-10 <i>c.i.</i>	C-1.140	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.057	R-14.6 <i>c.i.</i>	U-0.051	R-16.7 <i>c.i.</i>	U-0.107	R-6.3 <i>c.i.</i>
<i>Steel joist</i>	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
<i>Wood-framed and other</i>	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.520	R-15 for 24 in.	F-0.510	R-20 for 48 in.	F-0.730	NR
<i>Heated</i>	F-0.688	R-20 for 48 in.	F-0.688	R-20 for 48 in.	F-0.900	R-10 for 24 in.

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-6 Building Envelope Requirements for Climate Zone 6 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.032	R-30 <i>c.i.</i>	U-0.032	R-30 <i>c.i.</i>	<del>U-0.063</del> U-0.055	<del>R-1 <i>c.i.</i></del> R-18 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.031	R-25 + R-11 <i>Ls</i>	U-0.029	R-30 + R-11 <i>Ls</i>	U-0.060	R-19 + R-19
<i>Attic and other</i>	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.080</del> U-0.076	<del>R-13.3 <i>c.i.</i></del> R-15.0 <i>c.i.</i>	<del>U-0.071</del> U-0.067	<del>R-15.2 <i>c.i.</i></del> R-17.5 <i>c.i.</i>	<del>U-0.151<sup>b</sup></del> U-0.131	<del>R-5.7 <i>c.i.</i><sup>b</sup></del> R-7.5 <i>c.i.</i>
<i>Metal building</i>	U-0.050	R-0 + R-19 <i>c.i.</i>	U-0.050	R-0 + R-19 <i>c.i.</i>	U-0.094	R-0 + R-9.8 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.049</del> U-0.048	<del>R-13 + R-12.5 <i>c.i.</i></del> R-15 + R-12.5 <i>c.i.</i>	<del>U-0.049</del> U-0.048	<del>R-13 + R-12.5 <i>c.i.</i></del> R-15 + R-12.5 <i>c.i.</i>	<del>U-0.084</del> U-0.081	<del>R-13 + R-3.8 <i>c.i.</i></del> R-15 + R-3.8 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.051</del> U-0.049	<del>R-13R-15</del> + R-7.5 <i>c.i.</i> or R-19R-21 + R-5 <i>c.i.</i>	<del>U-0.051</del> U-0.049	<del>R-13R-15</del> + R-7.5 <i>c.i.</i> or R-19R-21 + R-5 <i>c.i.</i>	<del>U-0.089</del> U-0.083	<del>R-13</del> R-15
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.092	R-10 <i>c.i.</i>	C-0.063	R-15 <i>c.i.</i>	C-0.119	R-7.5 <i>c.i.</i>
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.051	R-16.7 <i>c.i.</i>	U-0.051	R-16.7 <i>c.i.</i>	U-0.087	R-8.3 <i>c.i.</i>
<i>Steel joist</i>	U-0.032	R-38	U-0.032	R-38	U-0.052	R-19
<i>Wood-framed and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.051	R-19
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.510	R-20 for 24 in.	F-0.434	R-20 for 48 in	F-0.730	NR
<i>Heated</i>	F-0.688	R-20 for 48 in.	F-0.671	R-25 for 48 in.	F-0.860	R-15 for 24 in.

[ . . . ]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-7 Building Envelope Requirements for Climate Zone 7 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.028	R-35 <i>c.i.</i>	U-0.028	R-35 <i>c.i.</i>	U-0.039	R-25 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.029	R-30 + R-11 <i>Ls</i>	U-0.029	R-30 + R-11 <i>Ls</i>	U-0.037	R-19 + R-11 <i>Ls</i> or R-25 + R-8 <i>Ls</i>
<i>Attic and other</i>	U-0.017	R-60	U-0.017	R-60	U-0.027	R-38
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.071</del> U-0.067	<del>R-15.2 <i>c.i.</i></del> R-17.5 <i>c.i.</i>	<del>U-0.071</del> U-0.067	<del>R-15.2 <i>c.i.</i></del> R-17.5 <i>c.i.</i>	<del>U-0.123</del> U-0.104	<del>R-7.6 <i>c.i.</i></del> R-9.5 <i>c.i.</i>
<i>Metal building</i>	U-0.044	R-0 + R-22.1 <i>c.i.</i>	U-0.044	R-0 + R-22.1 <i>c.i.</i>	U-0.072	R-0 + R-13 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.049</del> U-0.048	<del>R-13 + R-12.5 <i>c.i.</i></del> R-15 + R-12.5 <i>c.i.</i>	<del>U-0.042</del> U-0.041	<del>R-13 + R-15.6 <i>c.i.</i></del> R-15 + R-15.7 <i>c.i.</i> or R-19 + R-15 <i>c.i.</i>	<del>U-0.064</del> U-0.062	<del>R-13 + R-7.5 <i>c.i.</i></del> R-15 + R-7.5 <i>c.i.</i> or R-0 + R-13 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.051</del> U-0.049	<del>R-13R-15</del> + R-7.5 <i>c.i.</i> or <del>R-19R-21</del> + R-5 <i>c.i.</i>	<del>U-0.051</del> U-0.049	<del>R-13R-15</del> + R-7.5 <i>c.i.</i> or <del>R-19R-21</del> + R-5 <i>c.i.</i>	<del>U-0.064</del> U-0.063	<del>R-13 + R-3.8 <i>c.i.</i></del> R-15 + R-3.8 <i>c.i.</i> or R-21
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.063	R-15 <i>c.i.</i>	C-0.063	R-15 <i>c.i.</i>	C-0.119	R-7.5 <i>c.i.</i>
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.042	R-20.9 <i>c.i.</i>	U-0.042	R-20.9 <i>c.i.</i>	U-0.074	R-10.4 <i>c.i.</i>
<i>Steel joist</i>	U-0.032	R-38	U-0.032	R-38	U-0.052	R-19
<i>Wood-framed and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.051	R-19
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.510	R-20 for 24 in.	F-0.434	R-20 for 48 in.	F-0.730	NR
<i>Heated</i>	F-0.671	R-25 for 48 in.	F-0.671	R-25 for 48 in.	F-0.860	R-15 for 24 in.

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

**Table 5.5-8 Building Envelope Requirements for Climate Zone 8 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.028	R-35 <i>c.i.</i>	U-0.028	R-35 <i>c.i.</i>	U-0.039	R-25 <i>c.i.</i>
<i>Metal building<sup>a</sup></i>	U-0.026	R-25 + R-11+R-11 <i>Ls</i>	U-0.026	R-25 + R-11+R-11 <i>Ls</i>	U-0.037	R-19+R-11 <i>Ls</i> or R-25 + R-8 <i>Ls</i>
<i>Attic and other</i>	U-0.017	R-60	U-0.017	R-60	U-0.027	R-38
<i>Walls, above-Grade</i>						
<i>Mass</i>	<u>U-0.048</u> <u>U-0.046</u>	<u>R-19 <i>c.i.</i></u> <u>R-20 <i>c.i.</i></u>	<u>U-0.048</u> <u>U-0.046</u>	<u>R-19 <i>c.i.</i></u> <u>R-20 <i>c.i.</i></u>	<u>U-0.104</u> <u>U-0.090</u>	<u>R-9.5 <i>c.i.</i></u> <u>R-11.4 <i>c.i.</i></u>
<i>Metal building</i>	U-0.039	R-0 + R-25 <i>c.i.</i>	U-0.039	R-0 + R-25 <i>c.i.</i>	U-0.060	R-0 + R-15.8 <i>c.i.</i>
<i>Steel-framed</i>	<u>U-0.037</u> <u>U-0.035</u>	<u>R-13 + R-18.8 <i>c.i.</i></u> <u>R-15 + R-20 <i>c.i.</i></u> <u>or R-21 + R-19.5 <i>c.i.</i></u>	<u>U-0.037</u> <u>U-0.035</u>	<u>R-13 + R-18.8 <i>c.i.</i></u> <u>R-15 + R-20 <i>c.i.</i></u> <u>or R-21 + R-19.5 <i>c.i.</i></u>	<u>U-0.064</u> <u>U-0.062</u>	<u>R-13 + R-7.5 <i>c.i.</i></u> <u>R-15 + R-7.5 <i>c.i.</i></u> <u>or R-0 + R-13 <i>c.i.</i></u>
<i>Wood-framed and other</i>	<u>U-0.032</u> <u>U-0.029</u>	<u>R-13 + R-18.8 <i>c.i.</i></u> <u>R-13 + R-22.3 <i>c.i.</i></u>	<u>U-0.032</u> <u>U-0.029</u>	<u>R-13 + R-18.8 <i>c.i.</i></u> <u>R-13 + R-22.3 <i>c.i.</i></u>	<u>U-0.051</u> <u>U-0.048</u>	<u>R-13 + R-7.5 <i>c.i.</i></u> <u>R-15 + R-7.5 <i>c.i.</i></u> <u>or R-21 + R-5 <i>c.i.</i></u>
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.063	R-15 <i>c.i.</i>	C-0.063	R-15 <i>c.i.</i>	C-0.119	R-7.5 <i>c.i.</i>
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.038	R-23 <i>c.i.</i>	U-0.038	R-23 <i>c.i.</i>	U-0.064	R-12.5 <i>c.i.</i>
<i>Steel joist</i>	U-0.032	R-38	U-0.032	R-38	U-0.052	R-19
<i>Wood-framed and other</i>	U-0.027	R-38	U-0.027	R-38	U-0.033	R-30
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.434	R-20 for 48 in.	F-0.424	R-25 for 48 in.	F-0.540	R-10 for 24 in.
<i>Heated</i>	F-0.671	R-25 for 48 in.	F-0.373	R-20 full slab	F-0.860	R-15 for 24 in.

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

[...]

**Revise Exception to Section 5.5.3.2 as shown (I-P).**

**Exception to 5.5.3.2:** For *mass walls*, where the requirement in Tables 5.5-0 through 5.5-8 is for a maximum assembly U-0.151 followed by footnote “b,” concrete masonry unit (CMU) walls complying with ASTM C90 that are ungrouted or partially grouted at 32 in. or greater on center vertically and 48 in. or greater on center horizontally, shall have their ungrouted openings (e.g., cores, cells) filled with insulating material having a maximum thermal conductivity of 0.25-0.44 Btu·in./h·ft<sup>2</sup>·°F.

**Revise Section 5.5, Tables 5.5-0 through 5.5-8 as shown (SI).**

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

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.220	R-4.4 <i>c.i.</i>	U-0.184	R-5.3 <i>c.i.</i>	U-1.240	R-0.7 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	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
<i>Attic and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-3.293	NR	U-0.857 <sup>b</sup>	R-1.0 <i>c.i.</i> <sup>b</sup>	U-3.293	NR
<i>Metal building</i>	U-.533	R-0 + R-1.7 <i>c.i.</i>	U-0.533	R-0 + R-1.7 <i>c.i.</i>	<del>U-1.998</del> U-6.69	NR
<i>Steel-framed</i>	<del>U-0.705</del> U-0.670	<del>R-2.3</del> R-2.6	<del>U-0.705</del> U-0.670	<del>R-2.3</del> R-2.6	U-1.988	NR
<i>Wood-framed and other</i>	U-0.504	R-2.3	U-0.504	R-2.3	U-1.988	NR
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-6.473	NR	C-6.473	NR	C-6.473	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-1.825	NR	U-1.825	NR	U-1.825	NR
<i>Steel joist</i>	<del>U-1.986</del> U-0.390	<del>NR</del> R-2.3	<del>U-1.986</del> U-0.390	<del>NR</del> R-2.3	U-1.986	NR
<i>Wood-framed and other</i>	<del>U-1.599</del> U-0.380	<del>NR</del> R-2.3	<del>U-1.599</del> U-0.380	<del>NR</del> R-2.3	U-1.599	NR
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-1.264	NR	F-1.264	NR	F-1.264	NR
<i>Heated</i>	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.

[ ... ]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-1 Building Envelope Requirements for Climate Zone 1 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.273	R-3.5 <i>c.i.</i>	U-0.220	R-4.4 <i>c.i.</i>	U-1.240	R-0.7 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	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
<i>Attic and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.459	R-2.3
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-3.293	NR	U-0.857 <sup>b</sup>	R-1.0 <i>c.i.</i> <sup>b</sup>	U-3.293	NR
<i>Metal building</i>	U-0.533	R-0 + R-1.7 <i>c.i.</i>	U-0.533	R-0 + R-1.7 <i>c.i.</i>	<del>U-1.998</del> U-6.69	NR
<i>Steel-framed</i>	<del>U-0.704</del> U-0.670	<del>R-2.3</del> R-2.6	<del>U-0.705</del> U-0.670	<del>R-2.3</del> R-2.6	U-1.998	NR
<i>Wood-framed and other</i>	U-0.504	R-2.3	U-0.504	R-2.3	U-1.660	NR
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-6.473	NR	C-6.473	NR	C-6.473	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-1.825	NR	U-1.825	NR	U-1.825	NR
<i>Steel joist</i>	<del>U-1.986</del> U-0.390	<del>NR</del> R-2.3	<del>U-1.986</del> U-0.390	<del>NR</del> R-2.3	U-1.986	NR
<i>Wood-framed and other</i>	<del>U-1.599</del> U-0.380	<del>NR</del> R-2.3	<del>U-1.559</del> U-0.380	<del>NR</del> R-2.3	U-1.559	NR
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-1.264	NR	F-1.264	NR	F-1.264	NR
<i>Heated</i>	F-1.766	R-1.3 for 12 in.	F-1.766	R-1.3 for 12 in.	F-1.766	R-1.3 for 12 in.

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-2 Building Envelope Requirements for Climate Zone 2 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.220	R-4.4 <i>c.i.</i>	U-0.220	R-4.4 <i>c.i.</i>	U-0.982	R-0.9 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.545	R-2.8
<i>Attic and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.300	R-3.3
<i>Walls, above-Grade</i>						
<i>Mass</i>	U-0.857 <sup>b</sup>	R-1.0 <i>c.i.</i> <sup>b</sup>	<del>U-0.701</del> U-0.591	<del>R-1.3 <i>c.i.</i></del> R-1.7 <i>c.i.</i>	U-3.293	NR
<i>Metal building</i>	<del>U-0.533</del> U-0.480	<del>R-0 + R-1.7 <i>c.i.</i></del> R-1.9+R-1.1 <i>c.i.</i> or R-2.0 <i>c.i.</i>	<del>U-0.533</del> U-0.480	<del>R-0 + R-1.7 <i>c.i.</i></del> R-1.9+R-1.1 <i>c.i.</i> or R-2 <i>c.i.</i>	U-0.920	R-2.3
<i>Steel-framed</i>	<del>U-0.479</del> U-0.460	<del>R-2.3 + R-0.7 <i>c.i.</i></del> R-2.6 + R-0.7 <i>c.i.</i> or R-0 + R-1.6 <i>c.i.</i>	<del>U-0.365</del> U-0.350	<del>R-2.3 + R-1.3 <i>c.i.</i></del> R-2.6 + R-1.3 <i>c.i.</i> or R-0 + R-2.3 <i>c.i.</i>	U-0.705	R-2.3
<i>Wood-framed and other</i>	<del>U-0.504</del> U-0.470	<del>R-2.3</del> R-2.6	<del>U-0.504</del> U-0.470	<del>R-2.3</del> R-2.6	U-0.504	R-2.3
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-6.473	NR	C-6.473	NR	C-6.473	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.606	R-1.9 <i>c.i.</i>	U-0.496	R-1.5 <i>c.i.</i>	U-1.825	NR
<i>Steel joist</i>	U-0.214	R-5.3	U-0.214	R-5.3	U-0.390	R-2.3
<i>Wood-framed and other</i>	U-0.188	R-5.3	U-0.188	R-5.3	U-0.376	R-2.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-1.264	NR	F-1.264	NR	F-1.264	NR
<i>Heated</i>	F-1.558	R-1.8 for 600 mm	F-1.558	R-2.6 for 600 mm	F-1.766	R-1.3 for 300 mm

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-3 Building Envelope Requirements for Climate Zone 3 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	<del>U-0.220</del> U-0.180	<del>R-4.4 c.i.</del> R-5.3 c.i.	<del>U-0.220</del> U-0.180	<del>R-4.4 c.i.</del> R-5.3 c.i.	U-0.677	R-1.3 c.i.
<i>Metal building<sup>a</sup></i>	U-0.233	R-1.8 + R-3.3 FC	U-0.233	R-1.8 + R-3.3 FC	U-0.545	R-2.8
<i>Attic and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.300	R-3.3
<i>Walls, above Grade</i>						
<i>Mass</i>	<del>U-0.701</del> U-0.592	<del>R-1.3 c.i.</del> R-1.7 c.i.	U-0.592	R-1.7 c.i.	U-3.293	NR
<i>Metal building</i>	<del>U-0.533</del> U-0.449	<del>R-0 + R-1.7 c.i.</del> R-2.3 + R-1.2 c.i. or R-2.2 c.i.	U-0.410	R-0 + R-2.3 c.i.	U-0.920	R-2.3
<i>Steel-framed</i>	<del>U-0.435</del> U-0.426	<del>R-2.3 + R-0.9 c.i.</del> R-2.6 + R-0.8 c.i. or R-3.8 + R-0.7 c.i.	<del>U-0.365</del> U-0.358	<del>R-2.3 + R-1.3 c.i.</del> R-2.6 + R-1.3 c.i. or R-0 + R-2.6 c.i.	U-0.705	R-2.3
<i>Wood-framed and other</i>	<del>U-0.504</del> U-0.470	<del>R-2.3</del> R-2.6	<del>U-0.365</del> U-0.358	<del>R-2.3</del> R-2.6 + R-0.7 c.i. or <del>R-3.5</del> R-3.7	U-0.504	R-2.3
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-6.473	NR	C-6.473	NR	C-6.473	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.420	R-1.8 c.i.	U-0.420	R-1.8 c.i.	U-0.780	R-0.7 c.i.
<i>Steel joist</i>	U-0.214	R-5.3	U-0.214	R-5.3	U-0.296	R-3.3
<i>Wood-framed and other</i>	U-0.188	R-5.3	U-0.188	R-5.3	U-0.288	R-3.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-1.264	NR	F-0.935	R-1.8 for 600 mm	F-1.264	NR
<i>Heated</i>	F-1.489	R-2.6 for 600 mm	F-1.489	R-2.6 for 600 mm	F-1.766	R-1.3 for 300 mm

[...]

\* The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

**Table 5.5-4 Building Envelope Requirements for Climate Zone 4 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.184	R-5.3 <i>c.i.</i>	U-0.184	R-5.3 <i>c.i.</i>	<del>U-0.527</del> U-0.480	<del>R-1.8 <i>c.i.</i></del> R-1.9 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.210	R-3.3 + R-1.9 Ls or R-4.4 + R-1.4 Ls	U-0.210	R-3.3 + R-1.9 Ls or R-4.4 + R-1.4 Ls	U-0.466	R-3.3
<i>Attic and other</i>	U-0.119	R-8.6	U-0.119	R-8.6	U-0.192	R-5.3
<i>Walls, above Grade</i>						
<i>Mass</i>	U-0.592	R-1.7 <i>c.i.</i>	<del>U-0.513</del> U-0.505	<del>R-2.0 <i>c.i.</i></del> R-2.2 <i>c.i.</i>	U-3.293	NR
<i>Metal building</i>	U-0.341	R-0 + R-2.8 <i>c.i.</i>	U-0.286	R-0 + R-3.3 <i>c.i.</i>	U-0.920	R-2.3
<i>Steel-framed</i>	<del>U-0.365</del> U-0.358	<del>R-2.3 + R-1.3 <i>c.i.</i></del> R-2.6 + R-1.3 <i>c.i.</i> or R-0 + R-2.3 <i>c.i.</i>	<del>U-0.365</del> U-0.358	<del>R-2.3 + R-1.3 <i>c.i.</i></del> R-2.6 + R-1.3 <i>c.i.</i> or R-0 + R-2.3 <i>c.i.</i>	<del>U-0.705</del> U-0.670	<del>R-2.3</del> R-2.6
<i>Wood-framed and other</i>	<del>U-0.365</del> U-0.358	<del>R-2.3</del> R-2.6 + R-0.7 <i>c.i.</i> or <del>R-3.5</del> R-3.7	<del>U-0.365</del> U-0.358	<del>R-2.3</del> R-2.6 + R-0.7 <i>c.i.</i> or <del>R-3.5</del> R-3.7	<del>U-0.504</del> U-0.470	<del>R-2.3</del> R-2.6
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-6.473	NR	C-6.473	NR	C-6.473	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.321	R-2.6 <i>c.i.</i>	U-0.287	R-2.9 <i>c.i.</i>	U-0.606	R-1.1 <i>c.i.</i>
<i>Steel joist</i>	U-0.214	R-5.3	U-0.214	R-5.3	U-0.296	R-3.3
<i>Wood-framed and other</i>	U-0.188	R-5.3	U-0.188	R-5.3	U-0.288	R-3.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.900	R-2.6 for 600 mm	F-0.900	R-2.6 for 600 mm	F-1.264	NR
<i>Heated</i>	F-1.459	R-3.5 for 600 mm	F-1.191	R-3.5 for 1200 mm	F-1.558	R-1.8 for 600 mm
[ ... ]						

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).



**Table 5.5-5 Building Envelope Requirements for Climate Zone 5 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.184	R-5.3 <i>c.i.</i>	U-0.184	R-5.3 <i>c.i.</i>	<del>U-0.360</del> U-0.300	<del>R-2.6 <i>c.i.</i></del> R-3.2 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.210	R-3.3 + R-1.9 Ls or R-4.4 + R-1.4 Ls	U-0.210	R-3.3 + R-1.9 Ls or R-4.4 + R-1.4 Ls	U-0.466	R-3.3
<i>Attic and other</i>	U-0.119	R-8.6	U-0.119	R-8.6	U-0.192	R-5.3
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.513</del> U-0.505	<del>R-2.0 <i>c.i.</i></del> R-2.2 <i>c.i.</i>	<del>U-0.453</del> U-0.432	<del>R-2.3 <i>c.i.</i></del> R-2.6 <i>c.i.</i>	<del>U-0.857<sup>b</sup></del> U-0.744	<del>R-1.0 <i>c.i.</i><sup>b</sup></del> R-1.3 <i>c.i.</i>
<i>Metal building</i>	U-0.286	R-0 + R-3.3 <i>c.i.</i>	U-0.286	R-0 + R-3.3 <i>c.i.</i>	U-0.533	R-0 + R-1.7 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.315</del> U-0.301	<del>R-2.3 + R-1.8 <i>c.i.</i></del> R-2.6 + R-1.8 <i>c.i.</i> or R-3.7 + R-1.6 <i>c.i.</i>	<del>U-0.315</del> U-0.301	<del>R-2.3 + R-1.8 <i>c.i.</i></del> R-2.6 + R-1.8 <i>c.i.</i> or R-3.7 + R-1.6 <i>c.i.</i>	<del>U-0.479</del> U-0.460	<del>R-2.3 + R-1.7 <i>c.i.</i></del> R-2.6 + R-0.7 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.291</del> U-0.278	<del>R-2.3R-2.6 + R-1.30.9</del> <i>c.i.</i> or R-3.3R-3.7 + R-0.80.9 <i>c.i.</i>	<del>U-0.291</del> U-0.278	<del>R-2.3R-2.6 + R-1.30.9</del> <i>c.i.</i> or R-3.3R-3.7 + R-0.80.9 <i>c.i.</i>	<del>U-0.504</del> U-0.470	<del>R-2.3</del> R-2.6
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.678	R-1.3 <i>c.i.</i>	C-0.522	R-1.8 <i>c.i.</i>	C-6.473	NR
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.321	R-2.6 <i>c.i.</i>	U-0.287	R-2.9 <i>c.i.</i>	U-0.606	R-1.1 <i>c.i.</i>
<i>Steel joist</i>	U-0.214	R-5.3	U-0.214	R-5.3	U-0.296	R-3.3
<i>Wood-framed and other</i>	U-0.188	<del>R-6.7</del> R-5.3	U-0.188	<del>R-6.7</del> R-5.3	U-0.288	R-3.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.900	R-2.6 for 600 mm	F-0.882	R-2.6 for 600 mm	F-1.264	NR
<i>Heated</i>	F-1.191	R-3.5 for 1200 mm	F-1.191	R-3.5 for 1200 mm	F-1.558	R-1.8 for 600 mm

[ . . . ]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-6 Building Envelope Requirements for Climate Zone 6 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.184	R-5.3 <i>c.i.</i>	U-0.184	R-5.3 <i>c.i.</i>	<del>U-0.360</del> U-0.300	<del>R-2.6 <i>c.i.</i></del> R-3.2 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.210	R-3.3 + R-1.9 Ls	U-0.163	R-5.3 + R-1.9 Ls	U-0.341	R-3.3 + R-3.3
<i>Attic and other</i>	U-0.119	R-8.6	U-0.119	R-8.6	U-0.192	R-5.3
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.453</del> U-0.432	<del>R-2.3 <i>c.i.</i></del> R-2.6 <i>c.i.</i>	<del>U-0.404</del> U-0.380	<del>R-2.7 <i>c.i.</i></del> R-3.1 <i>c.i.</i>	<del>U-0.857<sup>b</sup></del> U-0.744	<del>R-1.0 <i>c.i.</i><sup>b</sup></del> R-1.3 <i>c.i.</i>
<i>Metal building</i>	U-0.286	R-0 + R-3.3 <i>c.i.</i>	U-0.286	R-0 + R-3.3 <i>c.i.</i>	U-0.533	R-0 + R-1.7 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.277</del> U-0.273	<del>R-2.3 + R-2.2 <i>c.i.</i></del> R-2.6 + R-2.2 <i>c.i.</i>	<del>U-0.277</del> U-0.273	<del>R-2.3 + R-2.2 <i>c.i.</i></del> R-2.6 + R-2.2 <i>c.i.</i>	<del>U-0.479</del> U-0.460	<del>R-2.3 + R-0.7 <i>c.i.</i></del> R-2.6 + R-0.7 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.291</del> U-0.278	<del>R-2.3</del> R-2.6 + R-1.30.9 <i>c.i.</i> or R-3.3R-3.7 + R-0.80.9 <i>c.i.</i>	<del>U-0.291</del> U-0.278	<del>R-2.3</del> R-2.6 + R-1.30.9 <i>c.i.</i> or R-3.3R-3.7 + R-0.80.9 <i>c.i.</i>	<del>U-0.504</del> U-0.470	<del>R-2.3</del> R-2.6
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.522	R-1.8 <i>c.i.</i>	C-0.358	R-2.6 <i>c.i.</i>	C-0.678	R-1.3 <i>c.i.</i>
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.287	R-2.9 <i>c.i.</i>	U-0.287	R-2.9 <i>c.i.</i>	U-0.496	R-1.5 <i>c.i.</i>
<i>Steel joist</i>	U-0.183	R-6.7	U-0.183	R-6.7	U-0.296	R-3.3
<i>Wood-framed and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.288	R-3.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.882	R-3.5 for 600 mm	F-0.750	R-3.5 for 1200 mm	F-1.264	NR
<i>Heated</i>	F-1.191	R-3.5 for 1200 mm	F-1.162	R-4.4 for 1200 mm	F-1.489	R-2.6 for 600 mm

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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 5.5-7 Building Envelope Requirements for Climate Zone 7 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.158	R-6.2 <i>c.i.</i>	U-0.158	R-6.2 <i>c.i.</i>	U-0.220	R-4.4 <i>c.i.</i>
<i>Metal building</i> <sup>a</sup>	U-0.163	R-5.3 + R-1.9 <i>Ls</i>	U-0.163	R-5.3 + R-1.9 <i>Ls</i>	U-0.210	R-3.3 + R-1.9 <i>Ls</i> or R-4.4 + R-1.4 <i>Ls</i>
<i>Attic and other</i>	U-0.098	R-10.6	U-0.098	R-10.6	U-0.153	R-6.7
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.404</del> U-0.380	<del>R-2.7 <i>c.i.</i></del> R-3.1 <i>c.i.</i>	<del>U-0.404</del> U-0.380	<del>R-2.7 <i>c.i.</i></del> R-3.1 <i>c.i.</i>	<del>U-0.701</del> U-0.592	<del>R-1.3 <i>c.i.</i></del> R-1.7 <i>c.i.</i>
<i>Metal building</i>	U-0.248	R-0 + R-3.9 <i>c.i.</i>	U-0.248	R-0 + R-3.9 <i>c.i.</i>	U-0.410	R-0 + R-2.3 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.277</del> U-0.273	<del>R-2.3</del> R-2.6 + R-2.2 <i>c.i.</i>	<del>U-0.240</del> U-0.233	<del>R-2.3 + R-2.7 <i>c.i.</i></del> R-2.6 + R-2.9 <i>c.i.</i> or R-3.3 + R-2.6 <i>c.i.</i>	<del>U-0.365</del> U-0.352	<del>R-2.3 + R-1.3 <i>c.i.</i></del> R-2.6 + R-1.3 <i>c.i.</i> or R-0 + R-2.3 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.291</del> U-0.278	<del>R-2.3</del> R-2.6 + R-1.3 <i>c.i.</i> or <del>R-3.3</del> R-3.7 + R-0.9 <i>c.i.</i>	<del>U-0.291</del> U-0.278	<del>R-2.3</del> R-2.6 + R-1.3 <i>c.i.</i> or <del>R-3.3</del> R-3.7 + R-0.9 <i>c.i.</i>	<del>U-0.365</del> U-0.358	<del>R-2.3 + R-0.7 <i>c.i.</i></del> R-2.6 + R-0.7 <i>c.i.</i> or R-3.7
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.358	R-2.6 <i>c.i.</i>	C-0.358	R-2.6 <i>c.i.</i>	C-0.678	R-1.3 <i>c.i.</i>
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.236	R-3.7 <i>c.i.</i>	U-0.236	R-3.7 <i>c.i.</i>	U-0.420	R-1.8 <i>c.i.</i>
<i>Steel joist</i>	U-0.183	R-6.7	U-0.183	R-6.7	U-0.296	R-3.3
<i>Wood-framed and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.288	R-3.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.882	R-3.5 for 600 mm	F-0.750	R-3.5 for 1200 mm	F-1.264	NR
<i>Heated</i>	F-1.162	R-4.4 for 1200 mm	F-1.162	R-4.4 for 1200 mm	F-1.489	R-2.6 for 600 mm

[ . . . ]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

[ . . . ]

**Table 5.5-8 Building Envelope Requirements for Climate Zone 8 (A,B)**

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
<i>Roofs</i>						
<i>Insulation entirely above deck</i>	U-0.158	R-6.2 <i>c.i.</i>	U-0.158	R-6.2 <i>c.i.</i>	U-0.220	R-4.4 <i>c.i.</i>
<i>Metal building<sup>a</sup></i>	U-0.147	R-4.4 + R-1.9 + R-1.9 <i>Ls</i>	U-0.147	R-4.4 + R-1.9 + R-1.9 <i>Ls</i>	U-0.210	R-3.3 + R-1.9 <i>Ls</i> or R-4.4 + R-1.4 <i>Ls</i>
<i>Attic and other</i>	U-0.098	R-10.6	U-0.098	R-10.6	U-0.153	R-6.7
<i>Walls, above-Grade</i>						
<i>Mass</i>	<del>U-0.273</del> U-0.261	<del>R-3.3 <i>c.i.</i></del> R-3.5 <i>c.i.</i>	<del>U-0.273</del> U-0.261	<del>R-3.3 <i>c.i.</i></del> R-3.5 <i>c.i.</i>	<del>U-0.592</del> U-0.513	<del>R-1.7 <i>c.i.</i></del> R-2.0 <i>c.i.</i>
<i>Metal building</i>	U-0.220	R-0 + R-4.4 <i>c.i.</i>	U-0.220	R-0 + R-4.4 <i>c.i.</i>	U-0.341	R-0 + R-2.8 <i>c.i.</i>
<i>Steel-framed</i>	<del>U-0.212</del> U-0.199	<del>R-2.3 + R-3.3 <i>c.i.</i></del> R-2.6 + R-3.5 <i>c.i.</i> or R-3.7 + R-3.4 <i>c.i.</i>	<del>U-0.212</del> U-0.199	<del>R-2.3 + R-3.3 <i>c.i.</i></del> R-2.6 + R-3.5 <i>c.i.</i> or R-3.7 + R-3.4 <i>c.i.</i>	<del>U-0.365</del> U-0.352	<del>R-2.3 + R-1.3 <i>c.i.</i></del> R-2.6 + R-1.3 <i>c.i.</i> or R-0 + R-2.3 <i>c.i.</i>
<i>Wood-framed and other</i>	<del>U-0.182</del> U-0.165	<del>R-2.3 + R-3.3 <i>c.i.</i></del> R-2.3 + R-3.9 <i>c.i.</i>	<del>U-0.182</del> U-0.165	<del>R-2.3 + R-3.3 <i>c.i.</i></del> R-2.3 + R-3.9 <i>c.i.</i>	<del>U-0.291</del> U-0.273	<del>R-2.3 + R-1.3 <i>c.i.</i></del> R-2.6 + R-1.3 <i>c.i.</i> or R-3.7 + R-0.9 <i>c.i.</i>
<i>Wall, below-Grade</i>						
<i>Below-grade wall</i>	C-0.358	R-2.6 <i>c.i.</i>	C-0.358	R-2.6 <i>c.i.</i>	C-0.678	R-1.3 <i>c.i.</i>
<i>Envelope Floors</i>						
<i>Mass</i>	U-0.217	R-4.1 <i>c.i.</i>	U-0.217	R-4.1 <i>c.i.</i>	U-0.363	R-2.2 <i>c.i.</i>
<i>Steel joist</i>	U-0.183	R-6.7	U-0.183	R-6.7	U-0.296	R-3.3
<i>Wood-framed and other</i>	U-0.153	R-6.7	U-0.153	R-6.7	U-0.288	R-3.3
<i>Slab-on-Grade Floors</i>						
<i>Unheated</i>	F-0.750	R-3.5 for 1200 mm	F-0.734	R-4.4 for 1200 mm	F-0.935	R-1.8 for 600 mm
<i>Heated</i>	F-1.162	R-4.4 for 1200 mm	F-0.646	R-3.5 full slab	F-1.489	R-2.6 for 600 mm

[...]

\* The following definitions apply: *c.i.* = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), 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).

**Revise Exception to Section 5.5.3.2 as shown (SI).**

**Exception to 5.5.3.2:** For *mass walls*, where the requirement in Tables 5.5-0 through 5.5-8 is for a maximum assembly U-0.857 followed by footnote “b,” concrete masonry unit (CMU) walls complying with ASTM C90 that are ungrouted or partially grouted at 800 mm. or greater on center vertically and 1200 mm or greater on center horizontally, shall have their ungrouted openings (e.g., cores, cells) filled with insulating material having a maximum thermal conductivity of 0.036-0.063 W/m·K.

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

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