



North/East Roofing Contractors Association
March 18, 2025
The Hard Rock Hotel & Casino -- Atlantic City, New Jersey

NRCA update on roofing industry technical issues



Mark S. Graham
Vice President, Technical Services
National Roofing Contractors Association
Rosemont, Illinois

2024 I-codes



Iowa

Kansas

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Louisiana

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Massachusetts

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Nevada

New Hampshire

Massachusetts Building Codes

Year

Current Adoption

2023 Provisions Governing the Conduct of Plumbing and Gas Fitting Work Performed

Effective Date: Apr 30, 2021

2020 Massachusetts Energy Code, Amended from the 2018 International Energy Conservation Code

2018 IECC Amended

2015 International Swimming Pool and Spa Code (ISPSC)

2015 International Mechanical Code - Cover Update (IMC)

2015 International Building Code (IBC)

2023 Massachusetts Uniform State Plumbing Code

Effective Date: Dec 08, 2023

2018 International Energy Conservation Code (IECC)

2015 International Residential Code (IRC)

2015 International Existing Building Code (IEBC)

2009 International Fuel Gas Code (IFGC)

Info

Key

Massachusetts

The Massachusetts Building Code is approved and administered by the Board of Building Regulations and Standards (BBRS), consisting of eleven members and is staffed by the Office of Public Safety and Inspections. The Board of Fire Prevention Regulations (BFPR) is a fourteen-member board responsible for promulgating a comprehensive fire safety code (527 CMR) for the Commonwealth.

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CHAPTER 15 ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

First Version: Aug 2023

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SECTION 1503 WEATHER PROTECTION

SECTION 1504 PERFORMANCE REQUIREMENTS

SECTION 1505 FIRE CLASSIFICATION

SECTION 1506 MATERIALS

SECTION 1507 REQUIREMENTS FOR ROOF COVERINGS

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CHAPTER 15 ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

User notes:

About this chapter: Chapter 15 provides minimum requirements for the design and construction of roof assemblies and rooftop structures. The criteria address the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier. The chapter is largely prescriptive in nature and is based on decades of experience with various traditional materials, but it also recognizes newer products. Section 1511 addresses rooftop structures, which include penthouses, tanks, towers and spires. Rooftop penthouses larger than prescribed in this chapter must be treated as a story under Chapter 5.

Code development reminder: Code change proposals to sections preceded by the designation [BF] or [PI] will be considered by one of the code development committees meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2023 (Group B) Code Development Cycle.

SECTION 1501
GENERAL

1501.1 Scope.

The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

SECTION 1502
ROOF DRAINAGE

[PI] 1502.1 General.

Design and installation of roof drainage systems shall comply with this section, Section 1611 of this code and Chapter 11 of the International Plumbing Code.

[PI] 1502.2 Secondary (emergency overflow) drains or scuppers.

Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Section 1611 of this code and Chapter 11 of the International Plumbing Code.


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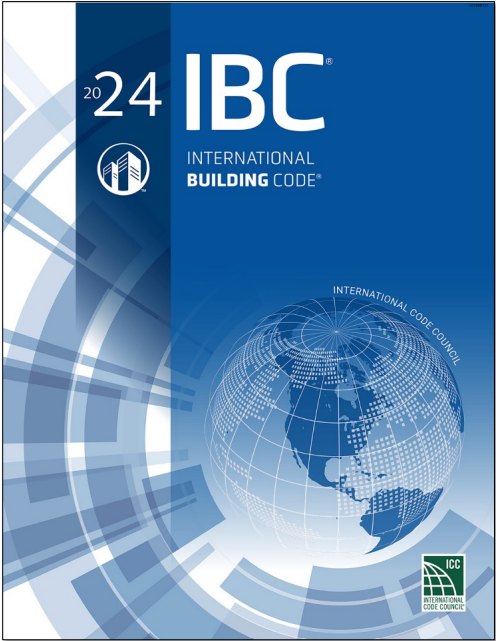
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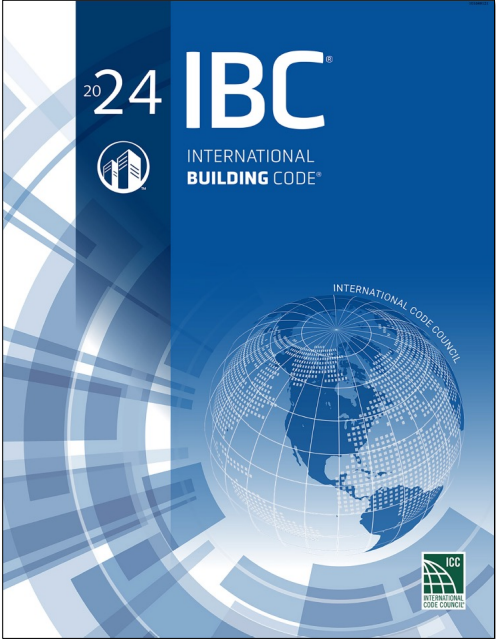


New to the 2024 I-codes

- Single column text format
- Updated font styles
- QR codes identifying changes
- Streamlined lists
- Consistent grouping of related text (e.g., tables follow parent sections)
- Shaded table headers and notes

iccsafe.org/design-updates

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IBC 2024

- Ch. 15: Roof Assemblies and Rooftop Structures
- Ch. 27: Electrical
- Ch. 13: Interior Environment
- Ch. 16: Structural Design

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CHAPTER
15

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

User notes:
About this chapter: Chapter 15 provides minimum requirements for the design and construction of roof assemblies and rooftop structures. The

Code development reminder: Code change proposals to sections preceded by the designation [BF] or [P] will be considered by one of the code development committees meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 (Group B) Code Development Cycle.

SECTION 1501—GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

SECTION 1502—ROOF DRAINAGE

Scan the QR code

9462530

[P] 1502.1 General. Design and installation of roof drainage systems shall comply with this section, Section 1611 of this code and Chapter 11 of the International Plumbing Code.

[P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Section 1611 of this code and Chapter 11 of the International Plumbing Code.

1502.3 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or not less than Schedule 40 plastic pipe.

SECTION 1503—WEATHER PROTECTION

Scan the QR code

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1503.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed in accordance with this code, and installed in accordance with this code and the manufacturer's approved instructions.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent water from entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.483 mm) (No. 26 galvanized sheet).

1503.3 Parapet walls. Parapet walls shall be coped or covered in accordance with Sections 1503.3.1 and 1503.3.2. The top surface of the parapet wall shall provide positive drainage.

1503.3.1 Fire-resistance-rated parapet walls. Parapet walls required by Section 705.12 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall such that the fire-resistance rating of the wall is not decreased.

1503.3.2 Other parapet walls. Parapet walls meeting one of the exceptions in Section 705.12 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall.

Deleted 1502.3-Scuppers

1503.4 Attic and rafter ventilation. Intake and exhaust vents for ventilation of attic and enclosed rafter assemblies shall be provided in accordance with Section 1202.2 and the vent product manufacturer's installation instructions.

Exception: Unvented attic and unvented enclosed rafter assemblies in accordance with Section 1202.3.

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North/East Roofing Contractors Association

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1504—PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed in accordance with Section

1504.

Wind speed: Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D1545 and the required classification in Table 1504.2.

Exception: Asphalt shingles not included in the scope of ASTM D1545 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table 1504.2.

TABLE 1504.3—CLASSIFICATION OF STEEP SLOPE ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161 OR D1545			
MAXIMUM BASIC WIND SPEED, V_b , FROM FIGURES 1609.3(1)–(4) OR ASCE 7 (mph)	MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V_{sd} , FROM TABLE 1609.3.1 (mph)	ASTM D1545 ^a CLASSIFICATION	ASTM D3161 or UL 7103 CLASSIFICATION
110	85	D, G or H	A ₁ , D or F
116	90	D, G or H	A ₁ , D or F
129	100	G or H	A ₁ , D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

^a For 30° to 34° pitch, 1 mph = 1.488 ft/s.

^b The standard calculations contained in ASTM D1545 assume Exposure Category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

1504.3 Wind resistance of clay and concrete tile. Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.6.

1504.3.1 Testing. Testing of concrete and clay roof tiles shall be in accordance with Sections 1504.3.1.1, 1504.3.1.2 and 1504.3.1.3.

1504.3.1.1 Overturning resistance. Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with Chapter 15 and other SBCI SSTD 11 or ASTM C1568.

1504.3.1.2 Wind tunnel testing. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with Chapter 15 and other SBCI SSTD 11 or ASTM C1569.

1504.3.1.3 Air permeability testing. The air coefficient for concrete and clay tile shall be 0.2 or shall be determined in accordance with SBCI SSTD 11 or ASTM C1570.

1504.4 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.6.2. The wind load on the roof covering shall be permitted to be determined using allowable stress design.

1504.4.1 Other roof systems. Built-up, modified bitumen, fully adhered or mechanically attached single-ply roof systems, metal panel roof systems applied to a solid or closely fitted deck and other types of membrane roof coverings shall be tested in accordance with FM 4474, UL 580 or UL 1897.

1504.4.2 Structural metal panel roof systems. Where the metal roof panel functions as the roof deck and roof covering and it provides both weather protection and support for loads, the structural metal panel roof system shall comply with this section. Structural standing-seam metal panel roof systems shall be tested in accordance with ASTM E1592 or FM 4474. Structural through-fastened metal panel roof systems shall be tested in accordance with ASTM E1592, FM 4474 or UL 580.

Exceptions:

1. Metal roofs constructed of cold-formed steel shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2204.1.
2. Metal roofs constructed of aluminum shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2002.1.

1504.4.3 Metal roof shingles. Metal roof shingles applied to a solid or closely fitted deck shall be tested in accordance with ASTM

1504.4.4 Slate shingles. Slate shingles shall be tested in accordance with ASTM D3161. Slate packaging shall bear a label indicating compliance with ASTM D3161 and the required classification in Table 1504.2.

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1504.5 Ballasted low-slope single-ply roof systems. Ballasted low-slope single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems on a low-slope roof shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic wind speed, V_b , shall be determined from Figures 1609.3.1 through 1609.3.4b, as applicable.

1504.6.1 Gutter securement for low-slope roofs. Gutters that are used to secure the perimeter edge of the roof membrane on low-slope built-up, modified bitumen, and single-ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4712 or the "Resistance to Foot Traffic Test" in FM 4470.

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.8. Such parapets shall be provided on the perimeter of the roof at all exterior sides except where an adjacent wall extends above the roof to a height at least equivalent to that required for the parapet. For roofs with differing surface elevations due to slope or sections at different elevations, the minimum parapet height shall be determined based on each roof surface elevation, and at no point shall the parapet height be less than that required by Table 1504.8.

Exception: Ballasted single-ply roof coverings shall be designed and installed in accordance with Section 1504.5.

TABLE 1504.8—MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS ^{a,b,c,d,e,f}	AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC WIND SPEED, V (MPH)																																			

Deleted 1504.7-Physical properties

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1504.5 Ballasted low-slope single-ply roof systems. Ballasted **low-slope** single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems on a **low-slope** roof shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except *basic wind speed, V*, shall be determined from Figures 1609.3(1) through 1609.3(4), as applicable.

1504.6.1 Gutter securement for low-slope roofs. Gutters that are used to secure the perimeter edge of the roof membrane on *low-slope* built-up, modified bitumen, and single-ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

1504.7 Impact resistance. *Roof coverings* installed on **low-slope** roofs in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272 or the “Resistance to Foot Traffic Test” in FM 4470.

15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	26	30	34	38

[BS] **LOW-SLOPE. A roof slope less than 2 units vertical in 12 units horizontal (17-percent slope).**

150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
15	2	2	2	2	12	12	15	18	2	2	2	13	15	17	22	26	30	
20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For S1: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Parapet height is measured vertically from the top surface of the coping down to the surface of the roof covering in the field of the roof adjacent to the parapet and outboard of any cant strip.

b. Interpolation shall be permitted for wind speed, mean roof height and parapet height. Extrapolation is not permitted.

c. Basic wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.

d. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.


e. The tabulated values apply only to conditions where the topographic factor (*K_{zt}*) determined in accordance with Chapter 26 of ASCE 7 is 1.0 or where *K_{zt}* is incorporated in the basic wind speed in Section 1609.

f. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

SECTION 1505—FIRE CLASSIFICATION

[BF] 1505.1 General. Fire classification of roof assemblies shall be in accordance with Section 1505. The minimum fire classification of roof assemblies installed on buildings shall comply with Table 1505.1 based on type of construction of the building. Class A, B and C roof assemblies, and roof coverings required to be listed by this section shall be tested in accordance with ASTM E108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D2898.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.



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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1504.5 Ballasted low-slope single-ply roof systems. Ballasted low-slope single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems on a low-slope roof shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except *basic wind speed, V*, shall be determined from Figures 1609.3(1) through 1609.3(4), as applicable.

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.8. Such parapets shall be provided on the perimeter of the roof at all exterior sides except where an adjacent wall extends above the roof to a height at least equivalent to that required for the parapet. For roofs with differing surface elevations due to slope or sections at different elevations, the minimum parapet height shall be determined based on each roof surface elevation, and at no point shall the parapet height be less than that required by Table 1504.8.

Exception: Ballasted single-ply roof coverings shall be designed and installed in accordance with Section 1504.5.

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC WIND SPEED, V (MPH)																	
		Exposure B								Exposure C									
		≤ 95	100	105	110	115	120	130	140	150	≤ 95	100	105	110	115	120	130	140	150
ASTM D1863 (No. 7 or No. 67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	43	47	53
ASTM D1863 (No. 6)	15	2	2	2	2	12	12	15	18	2	2	13	15	17	22	26	30		
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For S1: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Parapet height is measured vertically from the top surface of the coping down to the surface of the roof covering in the field of the roof adjacent to the parapet and outboard of any cant strip.

b. Interpolation shall be permitted for wind speed, mean roof height and parapet height. Extrapolation is not permitted.

c. Basic wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.

d. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.


e. The tabulated values apply only to conditions where the topographic factor (*K_{zt}*) determined in accordance with Chapter 26 of ASCE 7 is 1.0 or where *K_{zt}* is incorporated in the basic wind speed in Section 1609.

f. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

SECTION 1505—FIRE CLASSIFICATION

[BF] 1505.1 General. Fire classification of roof assemblies shall be in accordance with Section 1505. The minimum fire classification of roof assemblies installed on buildings shall comply with Table 1505.1 based on type of construction of the building. Class A, B and C roof assemblies, and roof coverings required to be listed by this section shall be tested in accordance with ASTM E108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D2898.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.



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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1504.5 Ballasted low-slope single-ply roof systems. Ballasted low-slope single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems on a low-slope roof shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RS-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic wind speed, *V*, shall be determined from Figures 1609.3(1) through 1609.3(4), as applicable.

1504.6.1 Gutter securement for low-slope roofs. Gutters that are used to secure the perimeter edge of the roof membrane on low-slope built-up, modified bitumen, and single-ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272 or the "Resistance to Foot Traffic Test" in FM 4470.

1504.8 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.8. Such parapets shall be provided on the perimeter of the roof at all exterior sides except where an adjacent wall extends above the roof to a height at least equivalent to that required for the parapet. For roofs with differing surface elevations due to slope or sections at different elevations, the minimum parapet height shall be determined based on each roof surface elevation, and at no point shall the parapet height be less than that required by Table 1504.8.

Exception: Ballasted single-ply roof coverings shall be designed and installed in accordance with Section 1504.5.

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	Exposure B										Exposure C									
		WIND EXPOSURE AND BASIC WIND SPEED, <i>V</i> (MPH)																			
		≤95	100	105	110	115	120	130	140	150	≤95	100	105	110	115	120	130	140	150		
ASTM D1863 (No. 7 or No. 6)	15	2	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	32	37		
	20	2	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34		
	30	2	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	42		
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47		
	100	14	14	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53		
ASTM D1863 (No. 6)	150	17	19	22	25	27	30	34	41	46	23	26	29	32	35	38	44	50	56		
	15	2	2	2	2	2	12	12	16	18	2	2	2	13	15	17	22	26	30		
	20	2	2	2	2	2	12	12	13	17	21	2	2	2	12	15	17	19	23		
	30	2	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31		
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39		
	100	12	12	14	16	18	21	24	28	35	16	18	21	24	26	29	34	39	45		
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48		

^aFor SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

^bParapet height is measured vertically from the top surface of the coping down to the surface of the roof covering in the field of the roof adjacent to the parapet and outboard of any cant strip.

^cInterpretation shall be permitted for wind speed, mean roof height and parapet height. Interpolation is not permitted.

^dBasic wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.

^eWhere the minimum required parapet height is less than 2 inches (51 mm), a gable stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.

^fThe tabulated values apply only to conditions where the topographic factor *K_t* determined in accordance with Chapter 16 of ASCE 7 is 1.0 or where *K_t* is incorporated in the basic wind speed in Section 1609.

[BF] 1505.1 General. Fire classification of roof assemblies shall be in accordance with Section 1505. The minimum fire classification of roof assemblies installed on buildings shall comply with Table 1505.1 based on type of construction of the building. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D2898.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[BF] TABLE 1505.1—MINIMUM ROOF ASSEMBLY CLASSIFICATION FOR TYPES OF CONSTRUCTION^{a,b}

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C ^c	B	C ^c	B	B	C ^c

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

a. Unless otherwise required in accordance with the *International Wildland-Urban Interface Code* or due to the location of the building within a fire district in accordance with Appendix D.

b. Nonclassified roof coverings shall be permitted on buildings of Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.

c. Buildings that are not more than two stories above grade plane and having not more than 6,000 square feet of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles constructed in accordance with Section 1505.7.

[BF] 1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exceptions:

- Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
- Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on noncombustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.
- Class A roof assemblies include minimum 16 ounce per square foot (0.0416 kg/m²) copper sheets installed over combustible decks.
- Class A roof assemblies include slate installed over ASTM D226, Type II or ASTM D4869, Type IV underlayment over combustible decks.

listed in this chapter.

1506.3 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

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North/East Roofing Contractors Association

March 18, 2025

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1507.1 Scope. *Roof coverings* shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.

1507.1.1 Underlayment. *Underlayment* in accordance with this section is required for asphalt shingles, clay and concrete tile, *metal roof shingles*, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and *BIPV roof coverings*. Such underlayment shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D2626, D4869, D6380 Class M, D6757 or D8257 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). *Underlayment* shall be fastened in accordance with Table 1507.1.1(2). *Underlayment* shall be attached in accordance with Table 1507.1.1(3).

Exception: Structural metal panels that do not require a substrate or underlayment.

ROOF COVERING	SECTION	MAXIMUM BASIC WIND SPEED, V < 130 MPH IN HURRICANE-PRONE REGIONS OR V < 140 MPH OUTSIDE HURRICANE-PRONE REGIONS	MAXIMUM BASIC WIND SPEED, V ≥ 130 MPH IN HURRICANE-PRONE REGIONS OR V ≥ 140 MPH OUTSIDE HURRICANE-PRONE REGIONS
Asphalt shingles	1507.2	ASTM D226 Type I or II ASTM D1970 ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM D8257	ASTM D226 Type II ASTM D1970 ASTM D4869 Type III or IV ASTM D8257
Wood shingles	1507.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or IV
Wood shakes applied to a solid sheathing roof deck	1507.9	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or IV

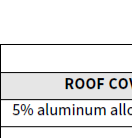
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1507.4.3—METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
5% aluminum alloy-coated steel	ASTM A875, GF60
Aluminum	ASTM B209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-coated steel	ASTM A463, T2 65
55% aluminum-zinc alloy coated steel	ASTM A792 AZ 50
Cold-rolled copper	ASTM B370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A653 G-90 zinc-coated. ^a
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B101
Prepainted steel	ASTM A755
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A240, 300 Series Alloys
Steel	ASTM A924
Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high-grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m², 1 pound per square foot = 4.882 kg/m², 1 inch = 25.4 mm, 1 pound = 0.454 kg.
a. For Group U buildings, the minimum coating thickness for ASTM A653 galvanized steel roofing shall be G60.

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch × 4-inch (25 mm × 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center or greater, additional 1-inch × 4-inch (25 mm × 102 mm) boards shall be installed between the sheathing boards. When wood shingles are installed over spaced sheathing and the underside of the shingles are exposed to the *attic* space, the *attic* shall be ventilated in accordance with Section 1202.2. The shingles shall not be backed with materials that will occupy the required air gap space and prevent the free movement of air on the interior side of the spaced sheathing.

1507.8.5

TABLE 1507.8.5—WOOD SHINGLE MATERIAL REQUIREMENTS			
MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES	
Wood shingles of naturally durable wood	1, 2 or 3	CSSB	
CSSB - Cedar Shake and Shingle Bureau			

1507.8.6 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 1/4 inch (19.1 mm) into the sheathing. For sheathing less than 1/2 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with not fewer than two fasteners.

1507.8.7 Application. Wood shingles shall be laid with a side lap not less than 1 1/2 inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be 1/2 to 1 1/4 inch (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.7.

TABLE 1507.8.7—WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE				
ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3.75	5
		No. 2	3.5	4
		No. 3	3	3.5
	18	No. 1	4.25	5.5
		No. 2	4	4.5
		No. 3	3.5	4
For 16 1/8 inch × 25.4 mm	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

1507.8.8 Flashing. At the junction of the roof and vertical surface, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall be not less than 0.019-inch (0.48 mm) No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet bearing a label indicating compliance with ASTM D1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.8.9 Label required. Each bundle of shingles shall be identified by a label of an approved grading or inspection bureau or agency.

1507.9 Wood shakes. The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. Where wood shakes are installed over spaced sheathing and the underside of the shakes are exposed to the *attic* space, the *attic* shall be ventilated in accordance with Section 1202.2. The shakes shall not be backed with materials that will occupy the required air gap space and prevent the free movement of air on the interior side of the spaced sheathing.

1507.9.1.1 Solid sheathing required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.6)	1 or 2	TFS
CSSB - Cedar Shake and Shingle Bureau. TFS - Forest Products Laboratory of the U.S. Forest Service.		

1507.9.7 Attachment. Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 1/4 inch (19.1 mm) into the sheathing. For sheathing less than 1/2 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with not fewer than two fasteners.

1507.9.8 Application. Wood shakes shall be laid with a side lap not less than 1 1/2 inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 1/2 to 1 1/4 inch (6.4 to 9.5 mm) for shakes and taper sawn shakes of naturally durable wood and shall be 1/2 to 1 1/4 inch (6.4 to 9.5 mm) for preservative-treated taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.8.

TABLE 1507.9.8—WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE			
ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 1	7.5
Preservative-treated taper sawn shakes of Southern yellow pine	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
For 16 1/8 inch × 25.4 mm. a. For 24 inch by 5.75 inch tongue-and-groove shakes, the maximum exposure is 7.5 inches.	24	No. 2	7.5

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	<div><div>ELECTRICAL</div><div><div>SECTION 2703—LIGHTNING PROTECTION SYSTEMS</div><div><div>2703.1 General.</div><div>Where provided, lightning protection systems shall comply with Sections 2703.2 through 2703.3.</div></div><div><div>2703.2 Installation.</div><div>Lightning protection systems shall be installed in accordance with NFPA 780 or UL 96A. UL 96A shall not be utilized for <i>buildings</i> used for the production, handling or storage of ammunition, <i>explosives</i>, <i>flammable liquids</i>, <i>flammable gases</i> or other <i>explosive</i> ingredients including dust.</div></div><div><div>2703.2.1 Surge protection.</div><div>Where lightning protection systems are installed, surge protective devices shall also be installed in accordance with NFPA 70 and either NFPA 780 or UL 96A, as applicable.</div></div><div><div>2703.3 Interconnection of systems.</div><div>All lightning protection systems on a <i>building</i> or <i>structure</i> shall be interconnected in accordance with NFPA 780 or UL 96A, as applicable.</div></div></div></div>
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	<div><div>ROOF ASSEMBLIES AND ROOFTOP STRUCTURES</div><div><div>[BG] 1511.9 Raised-deck systems installed over a roof assembly.</div><div><i>Raised-deck systems</i> installed above a <i>roof assembly</i> shall comply with Sections 1511.9.1 through 1511.9.5.</div></div><div><div>[BG] 1511.9.1 Installation.</div><div>The installation of a <i>raised-deck system</i> shall comply with all of the following:</div></div><div><div>1.</div><div>The perimeter of the <i>raised-deck system</i> shall be surrounded on all sides by walls or by a noncombustible enclosure approved to prevent fire intrusion below the <i>raised-deck system</i>. The wall or enclosure shall extend at least from the <i>roof assembly</i> to the top surface of the <i>raised-deck system</i>. The enclosure shall not impede roof drainage in accordance with Section 1511.9.5.</div></div><div><div>2.</div><div>A <i>raised-deck system</i> shall be installed above a listed <i>roof assembly</i>.</div></div><div><div>Exception:</div><div>Where the <i>roof assembly</i> is not required to have a fire classification in accordance with Section 1505.2.</div></div><div><div>3.</div><div>A <i>raised-deck system</i> shall be installed in accordance with the manufacturer's installation instructions.</div></div><div><div>4.</div><div>A <i>raised-deck system</i> shall not impede the operation of plumbing or mechanical vents, exhaust, air inlets or roof drains. Where required, access for inspection, cleaning or maintenance shall be provided.</div></div><div><div>[BG] 1511.9.2 Fire classification.</div><div>The <i>raised-deck system</i> shall be listed and identified with a fire classification in accordance with Section 1505 and shall be tested in accordance with either Section 1511.9.2.1 or 1511.9.2.2.</div></div><div><div>[BG] 1511.9.2.1 Fire testing of the raised deck system installed over a classified roof assembly.</div><div>The <i>raised-deck system</i> shall be tested separately from the <i>roof assembly</i> over which it is installed. The fire classification of the <i>raised-deck system</i> shall be not less than the fire classification for the <i>roof assembly</i> over which it is installed.</div></div><div><div>Exception:</div><div>Where the decking or pavers of the <i>raised-deck system</i> consists of brick, masonry, concrete or other noncombustible materials, fire testing of the <i>raised-deck system</i> is not required.</div></div><div><div>[BG] 1511.9.2.2 Fire testing of the raised deck system together with the roof assembly.</div><div>The <i>roof assembly</i> and the <i>raised-deck system</i> shall be tested together.</div></div><div><div>[BG] 1511.9.3 Pedestals or supports.</div><div>The pedestals or supports for the <i>raised-deck system</i> shall be installed in accordance with manufacturer's installation instructions.</div></div><div><div>[BG] 1511.9.4 Structural requirements.</div><div>The <i>raised-deck system</i> shall be designed for all applicable loads in accordance with Chapter 16 and performance requirements in Section 1504.5.</div></div><div><div>[BG] 1511.9.5 Roof drainage.</div><div>The <i>raised-deck system</i>, including the wall or enclosure between the <i>roof assembly</i> and the raised deck, shall be designed and installed to allow for the operation of the roof drainage system as required by Section 1502 and the <i>International Plumbing Code</i>. The roof structure shall be designed to support any standing water resulting from the installation of the <i>raised-deck system</i>.</div></div><div><div>[BG] 1511.9.6 Accessibility and egress.</div><div>The <i>raised-deck system</i> shall be accessible in accordance with Chapter 11 and means of egress shall be provided in accordance with Chapter 10.</div></div></div>
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	<div>ROOF ASSEMBLIES AND ROOFTOP STRUCTURES</div> <div><p>[BG] 1511.8 Structural fire resistance. The structural frame and roof construction supporting loads imposed upon the roof by any rooftop structure shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note a, shall not apply to roofs containing rooftop structures.</p><p>[BG] 1511.9 Raised-deck systems installed over a roof assembly. Raised-deck systems installed above a roof assembly shall comply with Sections 1511.9.1 through 1511.9.5.</p><p>[BG] 1511.9.1 Installation. The installation of a raised-deck system shall comply with all of the following:</p><ol style="list-style-type: none">1. The perimeter of the raised-deck system shall be surrounded on all sides by walls or by a noncombustible enclosure approved to prevent fire intrusion below the raised-deck system. The wall or enclosure shall extend at least from the roof assembly to the top surface of the raised-deck system. The enclosure shall not impede roof drainage in accordance with Section 1511.9.5.2. A raised-deck system shall be installed above a listed roof assembly.<p>Exception: Where the roof assembly is not required to have a fire classification in accordance with Section 1505.2.</p><ol style="list-style-type: none">3. A raised-deck system shall be installed in accordance with the manufacturer's installation instructions.4. A raised-deck system shall not impede the operation of plumbing or mechanical vents, exhaust, air inlets or roof drains. Where required, access for inspection, cleaning or maintenance shall be provided.<p>[BG] 1511.9.2 Fire classification. The raised-deck system shall be listed and identified with a fire classification in accordance with Section 1505 and shall be tested in accordance with either Section 1511.9.2.1 or 1511.9.2.2.</p><p>[BG] 1511.9.2.1 Fire testing of the raised-deck system installed over a classified roof assembly. The raised-deck system shall be tested separately from the roof assembly over which it is installed. The fire classification of the raised-deck system shall be not less than the fire classification for the roof assembly over which it is installed.</p><p>Exception: Where the decking or pavers of the raised-deck system consists of brick, masonry, concrete or other noncombustible materials, fire testing of the raised-deck system is not required.</p><p>[BG] 1511.9.2.2 Fire testing of the raised-deck system together with the roof assembly. The roof assembly and the raised-deck system shall be tested together.</p><p>[BG] 1511.9.3 Pedestals or supports. The pedestals or supports for the raised-deck system shall be installed in accordance with manufacturer's installation instructions.</p><p>[BG] 1511.9.4 Structural requirements. The raised-deck system shall be designed for all applicable loads in accordance with Chapter 16 and performance requirements in Section 1504.5.</p><p>[BG] 1511.9.5 Roof drainage. The raised-deck system, including the wall or enclosure between the roof assembly and the raised deck, shall be designed and installed to allow for the operation of the roof drainage system as required by Section 1502 and the International Plumbing Code. The roof structure shall be designed to support any standing water resulting from the installation of the raised-deck system.</p><p>[BG] 1511.9.6 Accessibility and egress. The raised-deck system shall be accessible in accordance with Chapter 11 and means of egress shall be provided in accordance with Chapter 10.</p></div>	
1512.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.	<div>SECTION 1512—REROOFING</div> <div><p>Exceptions:</p><ol style="list-style-type: none">1. Roof replacement or roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2.2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502.2 for roofs that provide for positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502.2.</div> <div><div>Scan for Changes</div><div>a4df0bb</div></div>	

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	<div>ROOF ASSEMBLIES AND ROOFTOP STRUCTURES</div> <div><p>[BG] 1511.8 Structural fire resistance. The structural frame and roof construction supporting loads imposed upon the roof by any rooftop structure shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note a, shall not apply to roofs containing rooftop structures.</p><p>[BG] 1511.9 Raised-deck systems installed over a roof assembly. Raised-deck systems installed above a roof assembly shall comply with Sections 1511.9.1 through 1511.9.5.</p><p>[BG] 1511.9.1 Installation. The installation of a raised-deck system shall comply with all of the following:</p><ol style="list-style-type: none">1. The perimeter of the raised-deck system shall be surrounded on all sides by walls or by a noncombustible enclosure approved to prevent fire intrusion below the raised-deck system. The wall or enclosure shall extend at least from the roof assembly to the top surface of the raised-deck system. The enclosure shall not impede roof drainage in accordance with Section 1511.9.5.2. A raised-deck system shall be installed above a listed roof assembly.<p>Exception: Where the roof assembly is not required to have a fire classification in accordance with Section 1505.2.</p><ol style="list-style-type: none">3. A raised-deck system shall be installed in accordance with the manufacturer's installation instructions.4. A raised-deck system shall not impede the operation of plumbing or mechanical vents, exhaust, air inlets or roof drains. Where required, access for inspection, cleaning or maintenance shall be provided.<p>[BG] 1511.9.2 Fire classification. The raised-deck system shall be listed and identified with a fire classification in accordance with Section 1505 and shall be tested in accordance with either Section 1511.9.2.1 or 1511.9.2.2.</p><p>[BG] 1511.9.2.1 Fire testing of the raised-deck system installed over a classified roof assembly. The raised-deck system shall be tested separately from the roof assembly over which it is installed. The fire classification of the raised-deck system shall be not less than the fire classification for the roof assembly over which it is installed.</p><p>Exception: Where the decking or pavers of the raised-deck system consists of brick, masonry, concrete or other noncombustible materials, fire testing of the raised-deck system is not required.</p><p>[BG] 1511.9.2.2 Fire testing of the raised-deck system together with the roof assembly. The roof assembly and the raised-deck system shall be tested together.</p><p>[BG] 1511.9.3 Pedestals or supports. The pedestals or supports for the raised-deck system shall be installed in accordance with manufacturer's installation instructions.</p><p>[BG] 1511.9.4 Structural requirements. The raised-deck system shall be designed for all applicable loads in accordance with Chapter 16 and performance requirements in Section 1504.5.</p><p>[BG] 1511.9.5 Roof drainage. The raised-deck system, including the wall or enclosure between the roof assembly and the raised deck, shall be designed and installed to allow for the operation of the roof drainage system as required by Section 1502 and the International Plumbing Code. The roof structure shall be designed to support any standing water resulting from the installation of the raised-deck system.</p><p>[BG] 1511.9.6 Accessibility and egress. The raised-deck system shall be accessible in accordance with Chapter 11 and means of egress shall be provided in accordance with Chapter 10.</p></div>	
1512.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.	<div>SECTION 1512—REROOFING</div> <div><p>Exceptions:</p><ol style="list-style-type: none">1. Roof replacement or roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2.2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502.2 for roofs that provide for positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502.2.</div> <div><div>Scan for Changes</div><div>a4df0bb</div></div>	
1512.2 Roof replacement. Roof replacement shall include the removal of all existing layers of roof assembly materials down to the roof deck.	<div><p>Exceptions:</p><ol style="list-style-type: none">1. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck and the existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 where permitted by the roof covering manufacturer and new ice barrier underlayment manufacturer.</div> <div><div>2024 INTERNATIONAL BUILDING CODE®</div><div>INTERNATIONAL CODE COUNCIL</div><div>431</div></div>	

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	<div><div>ROOF ASSEMBLIES AND ROOFTOP STRUCTURES</div><div><p>[B6] 1511.8 Structural fire resistance. The structural frame and roof construction supporting loads imposed upon the roof by any rooftop structure shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note A, shall not apply to roofs containing rooftop structures.</p><p>[B6] 1511.9 Raised-deck systems installed over a roof assembly. Raised-deck systems installed above a roof assembly shall comply with Sections 1511.9.1 through 1511.9.5.</p><p>[B6] 1511.9.1 Installation. The installation of a raised-deck system shall comply with all of the following:</p><ol style="list-style-type: none">1. The perimeter of the raised-deck system shall be surrounded on all sides by walls or by a noncombustible enclosure approved to prevent fire intrusion below the raised-deck system. The wall or enclosure shall extend at least from the roof assembly to the top surface of the raised-deck system. The enclosure shall not impede roof drainage in accordance with Section 1511.9.5.2. A raised-deck system shall be installed above a listed roof assembly.<p>Exception: Where the roof assembly is not required to have a fire classification in accordance with Section 1505.2.</p><ol style="list-style-type: none">3. A raised-deck system shall be installed in accordance with the manufacturer's installation instructions.4. A raised-deck system shall not impede the operation of plumbing or mechanical vents, exhaust, air inlets or roof drains.<p>Where required, access for inspection, cleaning or maintenance shall be provided.</p><p>[B6] 1511.9.2 Fire classification. The raised-deck system shall be listed and identified with a fire classification in accordance with Section 1505 and shall be tested in accordance with either Section 1511.9.2.1 or 1511.9.2.2.</p><p>[B6] 1511.9.2.1 Fire testing of the raised-deck system installed over a classified roof assembly. The raised-deck system shall be tested separately from the roof assembly over which it is installed. The fire classification of the raised-deck system shall be not less than the fire classification for the roof assembly over which it is installed.</p><p>Exception: Where the decking or pavers of the raised-deck system consists of brick, masonry, concrete or other noncombustible materials, fire testing of the raised-deck system is not required.</p><p>[B6] 1511.9.2.2 Fire testing of the raised-deck system together with the roof assembly. The roof assembly and the raised-deck system shall be tested together.</p><p>[B6] 1511.9.3 Pedestals or supports. The pedestals or supports for the raised-deck system shall be installed in accordance with manufacturer's installation instructions.</p><p>[B6] 1511.9.4 Structural requirements. The raised-deck system shall be designed for all applicable loads in accordance with Chapter 16 and performance requirements in Section 1504.5.</p><p>[B6] 1511.9.5 Roof drainage. The raised-deck system, including the wall or enclosure between the roof assembly and the raised deck, shall be designed and installed to allow for the operation of the roof drainage system as required by Section 1502 and the International Plumbing Code. The roof structure shall be designed to support any standing water resulting from the installation of the raised-deck system.</p><p>[B6] 1511.9.6 Accessibility and egress. The raised-deck system shall be accessible in accordance with Chapter 11 and means of egress shall be provided in accordance with Chapter 10.</p></div><div>SECTION 1512—REROOFING</div><div><p>1512.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.</p><p>Exceptions:</p><ol style="list-style-type: none">1. Roof replacement or roof recover of existing low-slope roof coverings shall not be required to meet the</div><div><div>Scan for updates</div><div>401</div></div></div>
27	<div><p>1512.2 Roof replacement. Roof replacement shall include the removal of all existing layers of roof assembly materials down to the roof deck.</p><p>Exceptions:</p><ol style="list-style-type: none">1. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck and the existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 where permitted by the roof covering manufacturer and new ice barrier underlayment manufacturer.</div> <div><div>2024 INTERNATIONAL BUILDING CODE®</div><div>INTERNATIONAL CODE COUNCIL</div><div>401</div></div>

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	<div><div>ROOF ASSEMBLIES AND ROOFTOP STRUCTURES</div><div><ol style="list-style-type: none">2. Where the existing roof includes a self-adhered underlayment and the existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing, the existing self-adhered underlayment shall be permitted to remain in place and covered with an underlayment complying with Tables 1507.1.1(1), 1507.1.1(2) and 1507.1.1(3).3. Where the existing roof includes one layer of self-adhered underlayment and the existing layer cannot be removed without damaging the roof deck, a second layer of self-adhered underlayment is permitted to be installed over the existing self-adhered underlayment provided that the following conditions are met:<ol style="list-style-type: none">3.1. It is permitted by the roof covering manufacturer and self-adhered underlayment manufacturer.3.2. The existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing.3.3. The second layer of self-adhered underlayment is installed such that buildup of material at walls, valleys, roof edges, end laps and side laps does not exceed two layers.</div><div><p>not adequate as a base for additional roofing.</p><ol style="list-style-type: none">2. The existing roof covering is slate, clay, cement or asbestos-cement tile.3. The existing roof has two or more applications of any type of roof covering.<p>1512.1.1 Roof recovering over wood shingles or shakes. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum panel products, mineral fiber, glass fiber or other approved materials securely fastened in place.</p><p>1512.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counter-flashings shall not be reinstalled where rusted, damaged or deteriorated. Existing balustr that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.</p><p>1512.5 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.</p></div><div><div>432</div><div>2024 INTERNATIONAL BUILDING CODE®</div><div>INTERNATIONAL CODE COUNCIL</div></div></div>
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	<div><div>ROOF ASSEMBLIES AND ROOFTOP STRUCTURES</div><div><div>2.</div><div>Where the existing roof includes a self-adhered underlayment and the existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing, the existing self-adhered underlayment shall be permitted to remain in place and covered with an underlayment complying with Tables 1507.1.1(1), 1507.1.1(2) and 1507.1.1(3).</div></div><div><div>3.</div><div>Where the existing roof includes one layer of self-adhered underlayment and the existing layer cannot be removed without damaging the roof deck, a second layer of self-adhered underlayment is permitted to be installed over the existing self-adhered underlayment provided that the following conditions are met:<div><div>3.1.</div><div>It is permitted by the roof covering manufacturer and self-adhered underlayment manufacturer.</div><div><div>3.2.</div><div>The existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing.</div><div><div>3.3.</div><div>The second layer of self-adhered underlayment is installed such that buildup of material at walls, valleys, roof edges, end laps and side laps does not exceed two layers.</div></div></div></div></div></div></div>	
	<div><div>1512.3 Roof recover.</div><div>The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:<div><div>1.</div><div>Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.</div><div><div>2.</div><div>Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.</div><div><div>3.</div><div>Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1512.3.1.</div><div><div>4.</div><div>The application of a new protective roof coating over an existing protective roof coating, metal roof panel, built-up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.</div></div></div><div><div>Exception:</div><div>A roof recover shall not be permitted where any of the following conditions occur:<div><div>1.</div><div>The existing roof or roof covering is water-soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.</div><div><div>2.</div><div>The existing roof covering is slate, clay, cement or asbestos-cement tile.</div><div><div>3.</div><div>The existing roof has two or more applications of any type of roof covering.</div></div></div></div></div></div></div></div></div></div>	
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	<div><div>CHAPTER 12</div><div>INTERIOR ENVIRONMENT</div><div><div>Chapter 12 provides minimum provisions for the interior of buildings—the occupied environment. Ventilation, lighting, and space heating are directly regulated in this chapter and in conjunction with the International Mechanical Code® and the International Energy Conservation Code®. Minimum room size, maximum room-to-room sound transmission and classroom acoustics are set for educational occupancies.</div><div><div>Code development reminder:</div><div>Code change proposals to sections preceded by the designation (P) will be considered by a code development committee meeting during the 2024 Group A/C Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 Group B/C Code Development Cycle.</div></div></div></div>	
	<div><div>SECTION 1201—GENERAL</div><div><div>1201.1 Scope.</div><div>The provisions of this chapter shall govern ventilation, temperature control, lighting, yards and courts, sound transmission, enhanced classroom acoustics, interior space dimensions, access to unoccupied spaces, toilet and bathroom requirements and ultraviolet (UV) germicidal irradiation systems associated with the interior spaces of buildings.</div></div><div><div>SECTION 1202—VENTILATION</div><div><div>1202.1 General.</div><div>Buildings shall be provided with natural ventilation in accordance with Section 1202.5, or mechanical ventilation in accordance with the International Mechanical Code.</div><div><div>Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403 of the International Mechanical Code. Ambulatory care facilities and Group I-2 occupancies shall be ventilated by mechanical means in accordance with Section 407 of the International Mechanical Code.</div></div><div><div>1202.2 Roof ventilation.</div><div>Roof assemblies shall be ventilated in accordance with this section or shall comply with Section 1202.3.</div><div><div>1202.2.1 Ventilated attics and rafter spaces.</div><div>Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. An airspace of not less than 1 inch (25 mm) shall be provided between the insulation and the roof sheathing. The net free ventilating area shall be not less than 1/100 of the area of the space ventilated. Ventilators shall be installed in accordance with manufacturer's installation instructions.</div><div><div>Exception:</div><div>The net free cross-ventilation area shall be permitted to be reduced to 1/100 provided both of the following conditions are met:<div><div>1.</div><div>In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.</div><div><div>2.</div><div>At least 40 percent and not more than 50 percent of the required venting area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.</div></div></div></div><div><div>1202.2.2 Openings into attic.</div><div>Exterior openings into the attic space of any building intended for human occupancy shall be protected to prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. Openings for ventilation having a least dimension of not less than 3/16 inch (1.6 mm) and not more than 1/4 inch (6.4 mm) shall be permitted. Openings for ventilation having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of not less than 3/16 inch (1.6 mm) and not more than 1/4 inch (6.4 mm). Where combustion air is obtained from an attic area, it shall be in accordance with Chapter 7 of the International Mechanical Code.</div></div><div><div>1202.3 Unvented attic and unvented enclosed rafter assemblies.</div><div>Unvented attics and unvented enclosed roof framing assemblies shall be applied directly to the underside of roof framing members/rafters and the structural roof sheathing at the top of the roof framing members shall be permitted where all of the following conditions are met:<div><div>1.</div><div>The unvented attic space is completely within the building thermal envelope.</div><div><div>2.</div><div>No interior Class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed roof framing assembly.</div><div><div>3.</div><div>Where wood shingles or shakes are used, not less than a 3/4-inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.</div></div></div></div></div></div></div></div></div></div></div></div>	
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	<p>INTERIOR ENVIRONMENT</p> <p>4. In Climate Zones 5, 6, 7 and 8, any <i>air-impermeable insulation</i> shall be a Class II vapor retarder or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.</p> <p>5. Insulation shall comply with either Item 5.1 or 5.2, and additionally Item 5.3.</p> <p>5.1. Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.</p> <p>5.1.1. Where only <i>air-impermeable insulation</i> is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.</p> <p>5.1.2. Where <i>air-permeable insulation</i> is provided inside the building thermal envelope, it shall be installed in accordance with Item 5.1.1. In addition to the <i>air-permeable insulation</i> installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R-value percentages in Table 1202.3 for condensation control.</p> <p>5.1.3. Where both <i>air-impermeable</i> and <i>air-permeable insulation</i> are provided, the <i>air-impermeable insulation</i> shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the R-value percentages in Table 1202.3 for condensation control. The <i>air-permeable insulation</i> shall be installed directly under the <i>air-impermeable insulation</i>.</p> <p>5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.</p>										
5.2.	<p>In Climate Zones 1, 2 and 3, <i>air-permeable insulation</i> installed in unvented <i>attics</i> shall meet the following requirements:</p> <p>5.2.1. A <i>vapor diffusion port</i> shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.</p> <p>5.2.2. The port area shall be greater than or equal to $\frac{1}{150}$ of the ceiling area. Where there are multiple ports in the <i>attic</i>, the sum of the port areas shall be greater than or equal to the area requirement.</p> <p>5.2.3. The <i>vapor permeable</i> membrane in the <i>vapor diffusion port</i> shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.</p>										
	<p>1,000 square feet (93 m²) of ceiling.</p> <p>5.3. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating. Where preformed insulation board is used as the <i>air-impermeable insulation</i> layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> Section 1202.3 does not apply to special use structures or enclosures such as swimming pool enclosures, data processing centers, hospitals or art galleries. Section 1202.3 does not apply to enclosures in Climate Zones 5 through 8 that are humidified beyond 35 percent during the three coldest months. 										
	<p>TABLE 1202.3—INSULATION FOR CONDENSATION CONTROL</p> <table> <tr> <th>CLIMATE ZONE</th><th>MINIMUM R-VALUE OF AIR-IMPERMEABLE INSULATION*</th></tr> <tr> <td>2B and 3B (for roof only)</td><td>0 (none required)</td></tr> <tr> <td>1, 2A, 2B, 3A, 3B, 3C</td><td>10%</td></tr> <tr> <td>4C</td><td>20%</td></tr> <tr> <td>4A, 4B</td><td>30%</td></tr> </table>	CLIMATE ZONE	MINIMUM R-VALUE OF AIR-IMPERMEABLE INSULATION*	2B and 3B (for roof only)	0 (none required)	1, 2A, 2B, 3A, 3B, 3C	10%	4C	20%	4A, 4B	30%
CLIMATE ZONE	MINIMUM R-VALUE OF AIR-IMPERMEABLE INSULATION*										
2B and 3B (for roof only)	0 (none required)										
1, 2A, 2B, 3A, 3B, 3C	10%										
4C	20%										
4A, 4B	30%										
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CHAPTER
16

STRUCTURAL DESIGN

Your notes:

About this chapter: Chapter 16 establishes minimum design requirements so that the structural components of buildings are proportioned to resist the loads that are likely to be encountered. In addition, this chapter assigns buildings and structures to risk categories that are indicative of their intended use. The loads specified herein along with the required load combinations have been established through research and service performance of buildings and structures. The application of these loads and adherence to the serviceability criteria enhance the protection of life and property.

Code development reminder: Code change proposals to this chapter will be considered by the IBC – Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 1601—GENERAL

1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof.

SECTION 1602—NOTATIONS

1602.1 Notations. The following notations are used in this chapter:

D = Dead
D_s = Wind
E = Earth
F = Live
F_a = Flood
H = Ice
L = Load
L_i = Roof
P_{area} = Area
P_r = Rain
R = Risk
S = Snow
T = Cat
V_{wind} = ASCE 7
V = Basic wind speed; V_{basic} is determined from Figure 1603.1.1 through 1603.1.9 of ASCE 7.
V_t = Tornado speed, mph (m/s), determined from Chapter 32 of ASCE 7.
W = Load due to wind pressure.
W_c = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

Significant changes:

- ASCE 7-22
- Tornado loads
- Construction documents
- Rain loads

SECTION 1603—CONSTRUCTION DOCUMENTS

1603.1 General. Construction documents shall show the material, size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the construction documents.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

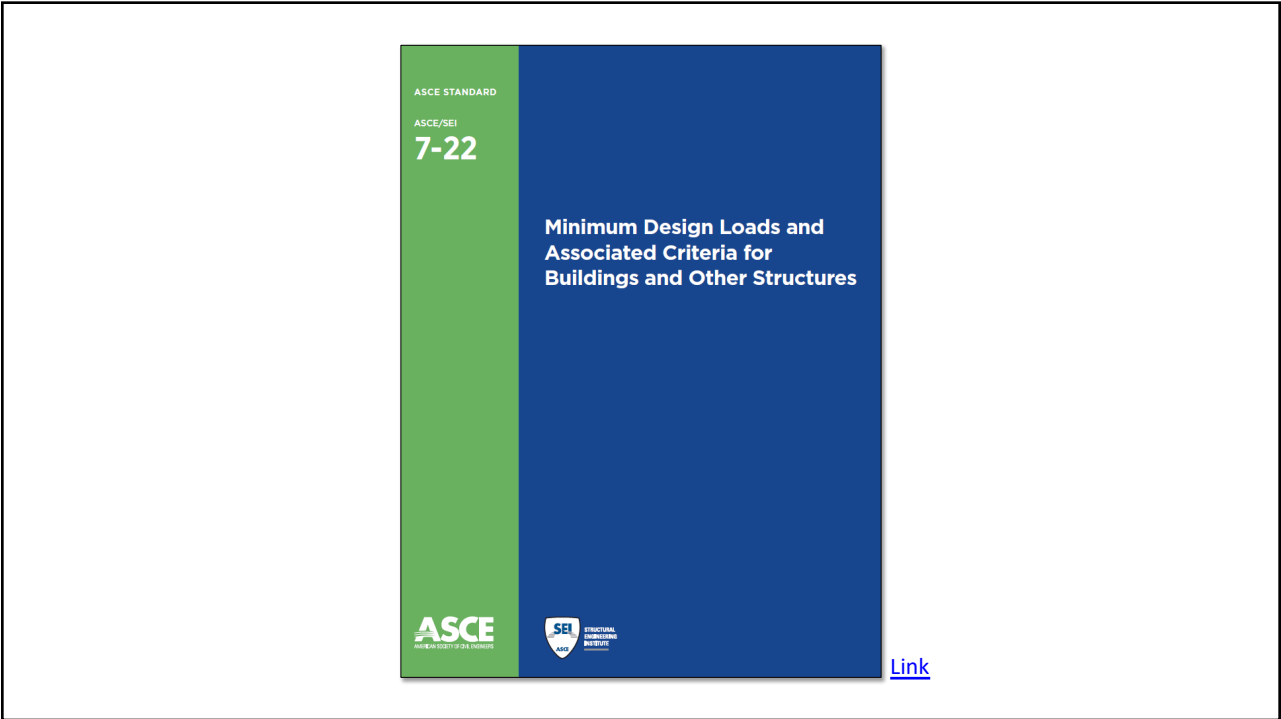
- Floor and roof dead and live loads.
- Ground snow load, p_s, and allowable stress design ground snow load, p_{allow}.
- Basic wind speed, V, mph (m/s), and allowable stress design wind speed, V_{allow}, as determined in accordance with Section 1609.3.1 and wind exposure.
- Seismic design category and site class.
- Flood design data, if located in flood hazard areas established in Section 1612.3.

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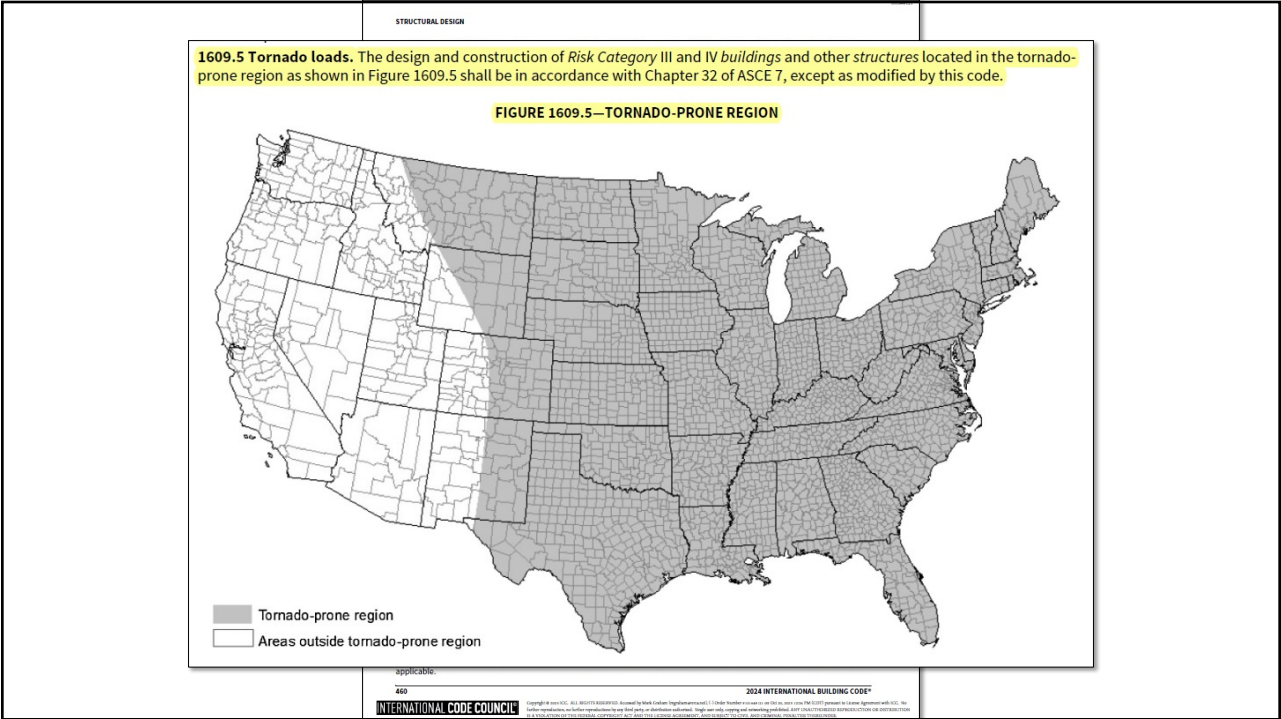
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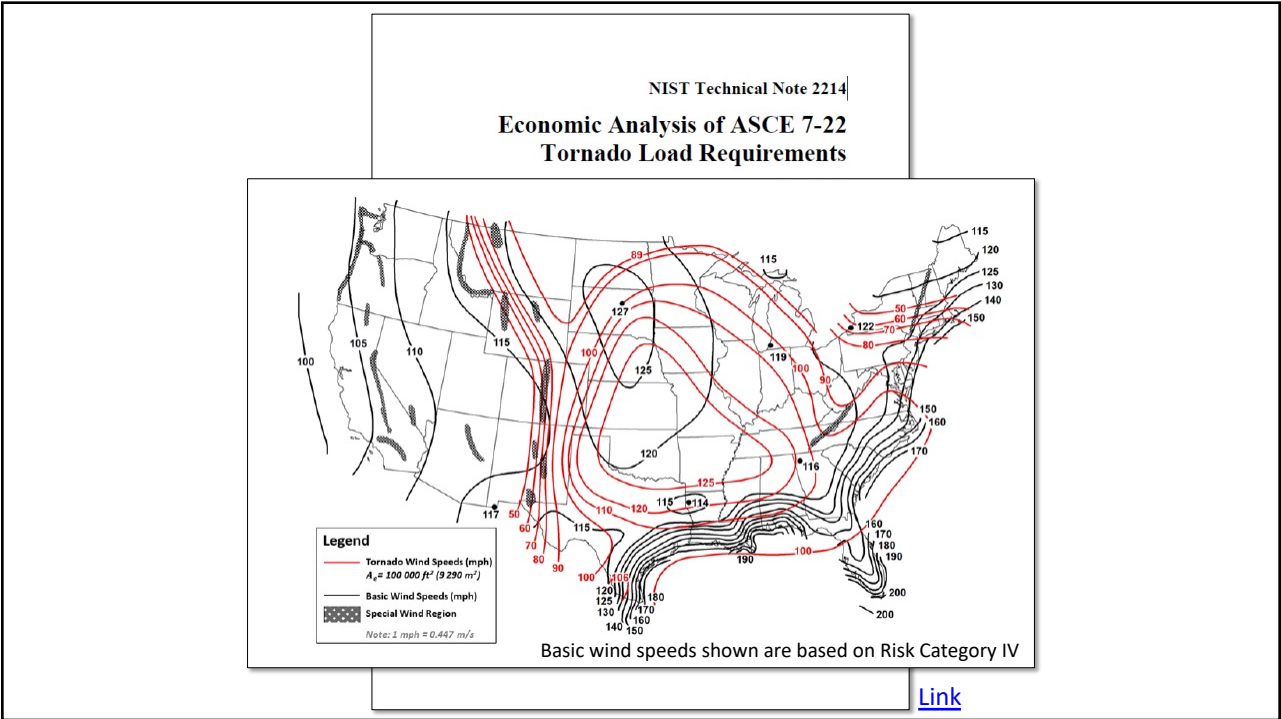
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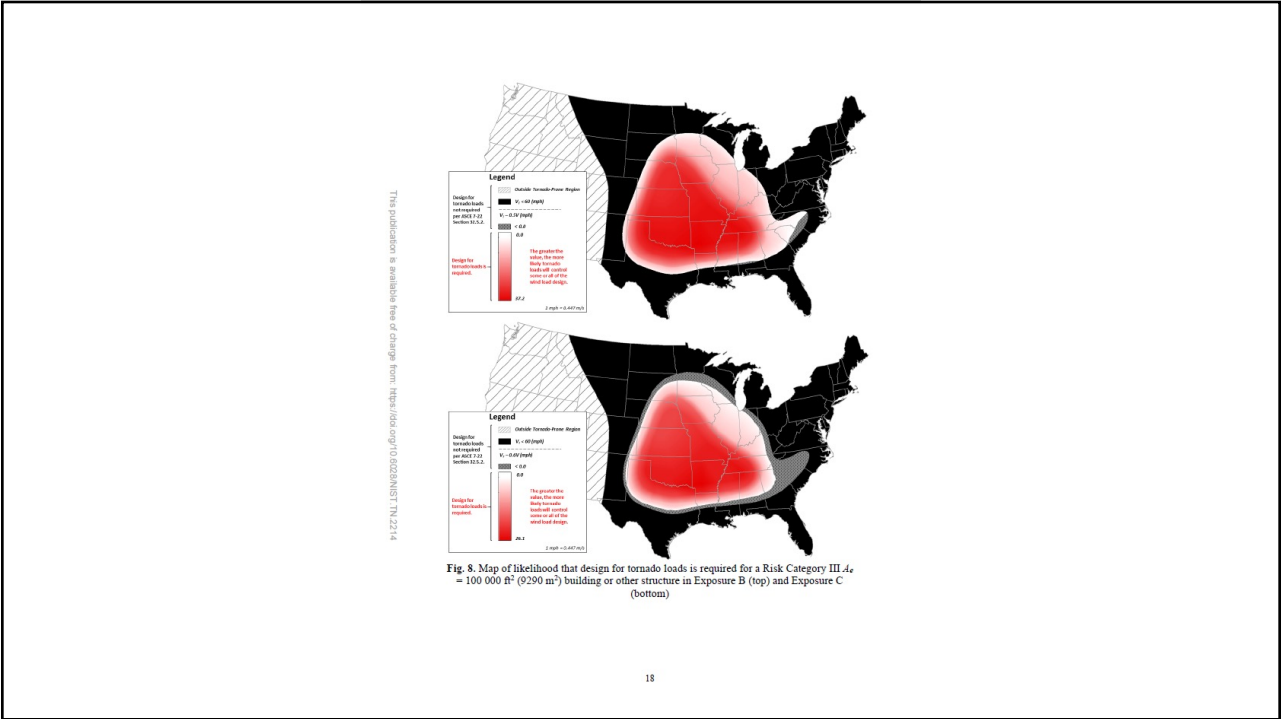
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	<div><div><div><div>CHAPTER</div><div>16</div></div><div>STRUCTURAL DESIGN</div></div><div><div>User notes</div><div>About this chapter:</div><div>Chapter 16 establishes minimum design requirements so that the structural components of buildings are proportioned to resist the loads that are likely to be encountered. In addition, this chapter assigns buildings and structures to risk categories that are indicative of their intended use. The loads specified herein along with the required load combinations have been established through research and service performance of buildings and structures. The application of these loads and adherence to the serviceability criteria enhance the protection of life and property.</div><div>Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.</div></div><div><div>SECTION 1601—GENERAL</div><div>1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof.</div><div>SECTION 1602—NOTATIONS</div><div>1602.1 Notations. The following notations are used in this chapter:</div><div><div>D = Dead load.</div><div>D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.</div><div>E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.</div><div>F = Load due to fluids with well-defined pressures and maximum heights.</div><div>F_r = Flood load in accordance with Chapter 5 of ASCE 7.</div><div>H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.</div><div>L = Live load.</div><div>L_r = Roof live load.</div><div>P_{allow} = Allowable stress design ground snow load.</div><div>P_s = Ground snow load determined from Figures 1608.2(1) through 1608.2(4) and Table 1608.2.</div><div>R = Rain load.</div><div>S = Snow load.</div><div>T = Cumulative effects of self-straining load forces and effects.</div><div>V_{asd} = Allowable stress design wind speed, mph (m/s) where applicable.</div><div>V = Basic wind speed, V, mph (m/s) determined from Figures 1609.3(1) through 1609.3(4) or ASCE 7.</div><div>V_t = Tornado speed, mph (m/s) determined from Chapter 32 of ASCE 7.</div><div>W = Load due to wind pressure.</div><div>W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.</div></div><div><div>SECTION 1603—CONSTRUCTION DOCUMENTS</div><div>1603.1 General. Construction documents shall show the material, size, section and connections of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the construction documents.</div><div>Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:</div><div><div>1. Floor and roof dead and live loads.</div><div>2. Ground snow load, p_g, and allowable stress design ground snow load, P_{allow}.</div><div>3. Basic wind speed, V, mph (m/s), and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1 and wind exposure.</div><div>4. Seismic design category and site class.</div><div>5. Flood design data, if located in flood hazard areas established in Section 1612.3.</div></div></div><div><div>2024 INTERNATIONAL BUILDING CODE®</div><div>433</div><div>INTERNATIONAL CODE COUNCIL</div></div></div></div>
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	<div><div>STRUCTURAL DESIGN</div><div>6. Design load-bearing values of soils.</div><div>7. Rain load data.</div><div>1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.13 shall be indicated for each type of live load used in the design.</div><div>1603.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas.</div><div>1603.1.3 Roof snow load data. The ground snow load, p_g, shall be indicated. In areas where the ground snow load, p_g, exceeds 15 pounds per square foot (psf) (0.72 kN/m²), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:</div><div><div>1. Flat-roof snow load, p_s.</div><div>2. Snow exposure factor, C_e.</div><div>3. Risk category.</div><div>4. Thermal factor, C_t.</div><div>5. Slope factor(s), C_d.</div><div>6. Drift surcharge load(s), p_d, where the sum of p_d and p_s exceeds 30 psf (1.44 kN/m²).</div><div>7. Width of snow drift(s), w.</div><div>8. Winter wind parameter for snow drift, W.</div></div><div>1603.1.4 Wind and tornado design data. The following information related to wind loads and, where required by Section 1609.5, tornado loads shall be shown, regardless of whether wind or tornado loads govern the design of the lateral force-resisting system of the structure:</div><div><div>1. Basic wind speed, V, mph (m/s), tornado speed, V_T, mph (m/s), and allowable stress design wind speed, V_{asd}, mph (m/s), as determined in accordance with Section 1609.3.1.</div><div>2. Risk category.</div><div>3. Effective plan area, A_g, for tornado design in accordance with Chapter 32 of ASCE 7.</div><div>4. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.</div><div>5. Applicable internal pressure coefficients, and applicable tornado internal pressure coefficients.</div><div>6. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m²). Where design for tornado loads is required, the design pressures shown shall be the maximum of wind or tornado pressures.</div></div><div>1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.4, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:</div><div><div>1. Flood design class assigned according to ASCE 24.</div><div>2. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation of the proposed lowest floor, including the basement.</div><div>3. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation to which any nonresidential building will be dry-floodproofed.</div><div>4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.</div></div></div> <div><div>434</div><div>2024 INTERNATIONAL BUILDING CODE®</div><div>INTERNATIONAL CODE COUNCIL</div></div>
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STRUCTURAL DESIGN

1603.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof, including but not limited to the loads of machinery or equipment, and that are greater than specified floor and roof loads shall be specified by their descriptions and locations.

1603.1.8.1 Photovoltaic panel systems. The dead load of rooftop-mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1603.1.9 Roof rain load data. Design rainfall intensity, *i* (in/hr) (cm/hr), and roof drain, scupper and overflow locations shall be shown regardless of whether rain loads govern the design.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3.

TABLE 1604.3—DEFLECTION LIMITS^{a,c,d,f}

CONSTRUCTION	<i>L</i> or <i>L_s</i>	<i>S</i> ^b or <i>W</i> ^b	<i>D</i> = <i>L</i> ^{4,4}
Roof members ^a			
Supporting plaster or stucco ceiling	(/360)	(/240)	(/240)
Supporting nonplaster ceiling	(/240)	(/240)	(/180)
Not supporting ceiling	(/180)	(/180)	(/120)
Floor members	(/360)	—	(/240)
Exterior walls:			
With plaster or stucco finishes	—	(/360)	—
With other brittle finishes	—	(/240)	—
With flexible finishes	—	(/120)	—
Interior partitions ^a			
With plaster or stucco finishes	(/360)	—	—
With other brittle finishes	(/240)	—	—
With flexible finishes	(/120)	—	—
Farm buildings	—	—	(/180)
Greenhouses	—	—	(/120)

For *L* 1 foot = 120.8 mm.

a. For structural steeling and slating made of formed metal sheets, the total load deflection shall not exceed 1/80. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed 1/50. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed 1/80. For masonry, this exception only applies when the masonry has no load carrying.

b. Flexible, flexible and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1604.3b.

c. See Section 1603.1 for glass supports.

d. The deflection limit for the *L* or *L_s* load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For timber, structural glued laminated timber, prestressed wood joist and structural composite timber members that are dry at time of installation and used under dry conditions in accordance with the AIA/ASCE/ACI, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from 0.50. For timber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the AIA/ASCE/ACI, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from 0. The value of 0.50 shall not be used in combination with AIA/ASCE/ACI provisions for long-term loading.

e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 16.2 for details.

f. The wind load shall be permitted to be taken as 0.42 times the "component and cladding" loads or directly calculated using the 30-year mean return interval basic wind speed, *V*, for the purpose of determining deflection limits in Table 1604.3. Where racking members support glass, the deflection limit thereof shall not exceed that specified in Section 1604.3f.

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STRUCTURAL DESIGN

SECTION 1611—RAIN LOADS

1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater as per the requirements of Chapter 8 of ASCE 7. Rain loads shall be based on the summation of the static head, *d_s*, hydraulic head, *d_h*, and ponding head, *d_p*, using Equation 16-20. The hydraulic head shall be based on hydraulic test data or hydraulic calculations assuming a flow rate corresponding to a rainfall intensity equal to or greater than the 15-minute duration storm with return period given in Table 1611.1. Rainfall intensity shall be determined in inches per hour for 15-minute duration storms for the risk categories given in Table 1611.1. The ponding head shall be based on structural analysis as the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load.

Equation 16-20

$$R = 5.2(d_s + d_h + d_p)$$

For *S_t*: $R = 0.0098(d_s + d_h + d_p)$

where:

d_s = Hydraulic head equal to the depth of water on the undeflected roof above the inlet of the secondary drainage system for structural loading (SDSL) required to achieve the design flow, in inches (mm).

d_p = Ponding head equal to the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load, in inches (mm).

d_s = Static head equal to the depth of water on the undeflected roof up to the inlet of the secondary drainage system for structural loading (SDSL), in inches (mm).

R = Rain load, in pounds per square foot (kN/m²).

SDSL is the roof drainage system through which water is drained from the roof when the drainage systems listed in ASCE 7 Section 8.2 (a) through (d) are blocked or not working.

TABLE 1611.1—DESIGN STORM RETURN PERIOD BY RISK CATEGORY

RISK CATEGORY	DESIGN STORM RETURN PERIOD
I & II	100 years
III	200 years
IV	500 years

1611.2 Ponding instability. Ponding instability on roofs shall be evaluated in accordance with ASCE 7.

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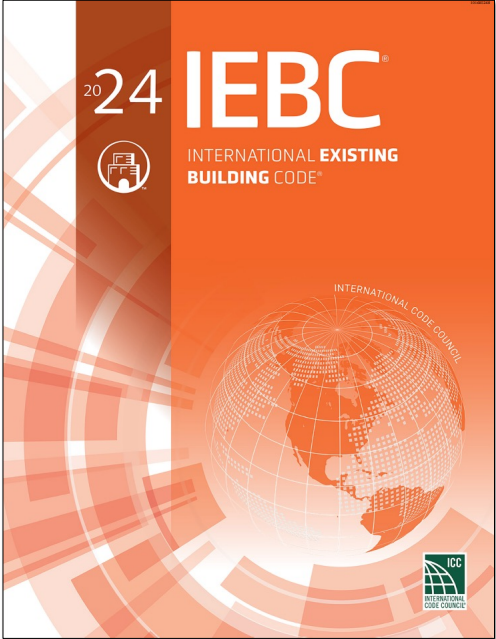
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North/East Roofing Contractors Association

March 18, 2025



IEBC 2024

- Ch. 7: Alterations-Level 1
 - Sec. 705-Reroofing
 - Sec. 705-Structural

[Link](#)

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CHAPTER
7

ALTERATIONS—LEVEL 1

User notes:

About this chapter: Chapter 7 provides the technical requirements for those existing buildings that undergo Level 1 alterations as described in Section 602, which includes replacement or covering of existing materials, elements, equipment or fixtures using new materials for the same purpose. This chapter, similar to other chapters of this code, covers all building-related subjects, such as structural, mechanical, plumbing, electrical and accessibility as well as the fire and life safety issues when the alterations are classified as Level 1. The purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system. This chapter is distinguished from Chapters 8 and 9 by involving only replacement of building components with new components. In contrast, Level 2 alterations involve more space reconfiguration, and Level 3 alterations involve more extensive space reconfiguration, exceeding 50 percent of the building area.

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SECTION 701—GENERAL

701.1 Scope. Level 1 alterations as described in Section 602 shall comply with the requirements of this chapter. Level 1 alterations to historic buildings shall comply with this chapter, except as modified in Chapter 12.

701.2 Conformance. An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Exception: Where the current level of safety or sanitation is proposed to be reduced, the portion altered shall conform to the requirements of the International Building Code.

[BS] 701.3 Flood hazard areas. In flood hazard areas, alterations that constitute substantial improvement shall require that the building comply with Section 1612 of the International Building Code, or Section R306 of the International Residential Code, as applicable.

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SECTION 702—BUILDING ELEMENTS AND MATERIALS

702.1 Interior finishes. Newly installed interior wall and ceiling finishes shall comply with Chapter 8 of the International Building Code.

702.2 Interior floor finish. New interior floor finish, including new carpeting used as an interior floor finish material, shall comply with Section 804 of the International Building Code.

702.3 Interior trim. Newly installed interior trim materials shall comply with Section 806 of the International Building Code.

702.4 Window fall prevention. In Group R-2 or R-3 buildings containing dwelling units and one- and two-family dwellings and townhouses regulated by the International Residential Code, window opening control devices or other window fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
 - 2.1. The window replacement includes replacement of the sash and frame.
 - 2.2. The window replacement includes the sash only where the existing frame remains.
3. One of the following applies:
 - 3.1. In Group R-2 or R-3 buildings containing dwelling units, the bottom of the clear opening of the window opening is at a height less than 36 inches (915 mm) above the finished floor.
 - 3.2. In one- and two-family dwellings and townhouses regulated by the International Residential Code, the bottom of the clear opening of the window opening is at a height less than 34 inches (863 mm) above the finished floor.
4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere when the window is in its largest opened position.
5. The vertical distance from the bottom of the clear opening of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

Exception: Operable windows where the bottom of the clear opening of the window opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F2090.

702.5 Replacement window for emergency escape and rescue openings. Where windows are required to provide emergency escape and rescue openings in Group R-2 and R-3 occupancies and one- and two-family dwellings and townhouses regulated by the International Residential Code, replacement windows shall be exempt from the requirements of Section 1031.3 of the International

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ALTERATIONS—LEVEL 1

Building Code and Section R310.2 of the International Residential Code, provided that the replacement window meets the following conditions:
1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. Where the replacement window is part of a change of occupancy it shall comply with Section 1011.5.6.
702.5.1 Control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be permitted for use on windows required to provide emergency escape and rescue openings. After operation to release the control device allowing the window to fully open, the control device shall not reduce the net clear opening area of the window unit. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.
702.6 Bars, grilles, covers or screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosure or window wells that serve such openings, provided all of the following conditions are met:
1. The minimum net clear opening size complies with the code that was in effect at the time of construction.
2. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.
3. Where such devices are installed, they shall not reduce the net clear opening of the emergency escape and rescue openings.
4. Smoke alarms shall be installed in accordance with Section 907.2.11 of the International Building Code.
702.7 Materials and methods. New work shall comply with the materials and methods requirements in the International Building Code, International Energy Conservation Code, International Mechanical Code and International Plumbing Code, as applicable, that specify material standards, detail of installation and connection, joints, penetrations and continuity of any element, component or system in the building.
[F6] 702.7.1 International Fuel Gas Code. The following sections of the International Fuel Gas Code shall constitute the fuel gas

IEBC 2024's Sec. 705-Reroofing matches
IBC 2024's Sec. 1512-Reroofing

703.1 General. Alterations shall be done in a manner that maintains the level of fire protection provided.

SECTION 705—REROOFING


[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the *International Building Code*.
Exceptions:
1. *Roof replacement or roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the *International Building Code* for roofs that provide positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2 of the *International Building Code*.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the *International Building Code*.

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ALTERATIONS—LEVEL 1

SECTION 706—STRUCTURAL


[BS] 706.1 General. Where *alteration* work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the provisions of this section shall apply.
[BS] 706.2 Addition or replacement of roofing or replacement of equipment. Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *International Building Code* for new structures.
Exceptions:
1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.
2. Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m²) or less over an existing single layer of roof covering.
[BS] 706.3 Additional requirements for reroof permits. The requirements of this section shall apply to *alteration* work requiring reroof permits.
[BS] 706.3.1 Bracing for unreinforced masonry bearing wall parapets. Where a permit is issued for *reroofing* for more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of parapet bracing.
[BS] 706.3.2 Roof diaphragms resisting wind loads in high-wind regions. Where roofing materials are removed from more than 50 percent of the roof diaphragm or section of a building located where the basic wind speed, V , is greater than 130 mph (58 m/s), in accordance with Figure 1609.3(2) of the *International Building Code*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the *International Building Code*.
Exception: Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7—88 or later editions.

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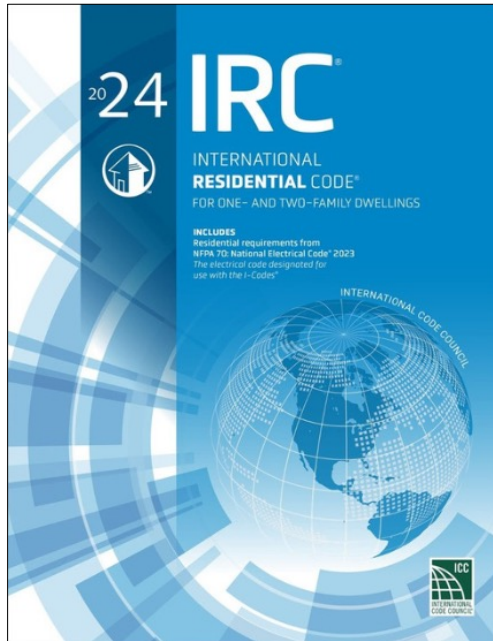


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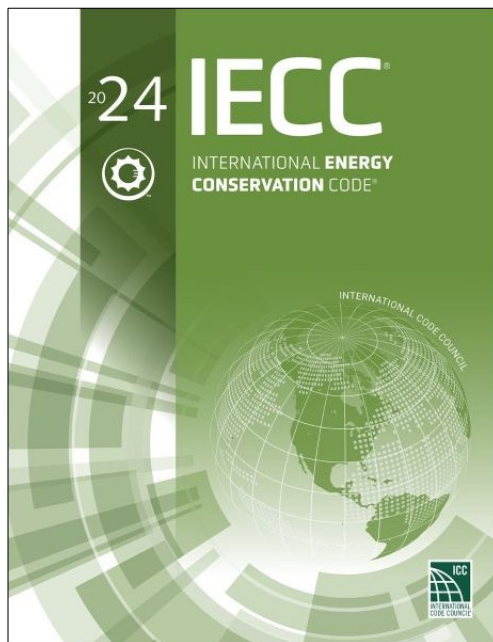
March 18, 2025



IRC 2024

- Ch. 9: Roofing
 - Requirements closely match those of IBC Ch. 15
 - IRC tends to be more prescriptive than IBC

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IECC 2024

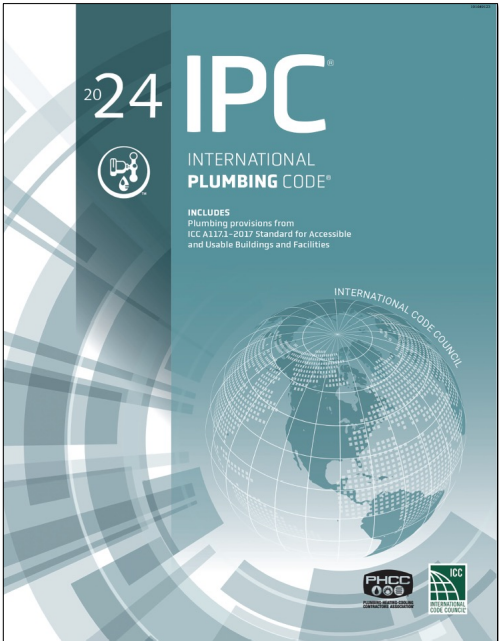
C- and R-provisions:

- Commercial: Similar R-values and reflectivity, and more complex air barrier requirements
- Residential: Some lower R-values and more complex air barrier requirements

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<p>EXISTING BUILDINGS</p> <p>C503.2.5 Floor alterations. Where an alteration to a floor or floor overhang exposes cavities or surfaces to which insulation can be applied, and the floor or floor overhang is part of the <i>building thermal envelope</i>, the floor or floor overhang shall be brought into compliance with Section C402.1 or an approved design that minimizes deviation from the insulation requirements. This requirement applies to floor alterations where the floor cavities or surfaces are exposed and unobstructed prior to construction.</p> <p>C503.2.6 Below-grade wall alterations. Where unconditioned below-grade space is changed to conditioned space, walls enclosing such conditioned space shall be insulated where required in accordance with Section C402.1. Where the below-grade space is <i>conditioned space</i> and where walls enclosing such space are altered, they shall be insulated where required in accordance with Section C402.1.</p> <p>C503.2.7 Air barrier. Altered <i>building thermal envelope</i> assemblies shall be provided with an <i>air barrier</i> in accordance with Section C402.6.1. Such <i>air barrier</i> need not be continuous with unaltered portions of the <i>building thermal envelope</i>. Testing requirements of Section C402.6.1.2 shall not be required.</p> <p>C503.3 Heating and cooling systems. New heating, cooling and <i>duct systems</i> that are part of the alteration shall comply with section C403.</p> <p>C503.3.1 Economizers. New cooling systems that are part of <i>alteration</i> shall comply with Section C403.5.</p> <p>C503.3.2 Mechanical system acceptance testing. Where an alteration requires compliance with Section C403 or any of its subsections, mechanical systems that serve the alteration shall comply with Sections C406.2.2, C408.2.3 and C408.2.5.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> Buildings with less than 10,000 square feet (929 m²) and a combined heating, cooling and service water heating capacity of less than 960,000 Btu/h (281 kW). Systems included in Section C403.5 that serve individual dwelling units and sleeping units. <p>C503.3.3 Duct testing. Ducts and plenums designed to operate at static pressures not less than 3 inches water gauge (747 Pa) that serve an alteration shall be tested in accordance with this section where the alteration includes any of the following:</p> <ol style="list-style-type: none"> Twenty-five percent or more of the total length of the ducts in the system are relocated. The total length of all ducts in the system is increased by 25 percent or more. 											
<p>C503.3.6 Replacement or added roof-mounted mechanical equipment. For roofs with insulation entirely above the roof deck and where existing roof-mounted mechanical equipment is replaced or new equipment is added, and the existing roof does not comply with the insulation requirements for new construction in accordance with Sections C402.1 and C402.2.1, curbs for added or replaced equipment shall be of a height necessary to accommodate the future addition of above-deck roof insulation to be installed in accordance with Section C503.2.1, Item 2. Alternatively, the curb height shall comply with Table C503.3.6. Curb height shall be the distance measured from the top of the curb to the top of the roof deck.</p>											
<p>TABLE C503.3.6—ROOF-MOUNTED MECHANICAL EQUIPMENT CURB HEIGHTS</p> <table> <tr> <th>CLIMATE ZONE</th><th>CURB HEIGHT, MINIMUM</th></tr> <tr> <td>0, 1, 2 and 3</td><td>16 inches</td></tr> <tr> <td>4, 5 and 6</td><td>17 inches</td></tr> <tr> <td>7 and 8</td><td>18 inches</td></tr> <tr> <td colspan="2">For SI: 1 inch = 25.4 mm.</td></tr> </table>		CLIMATE ZONE	CURB HEIGHT, MINIMUM	0, 1, 2 and 3	16 inches	4, 5 and 6	17 inches	7 and 8	18 inches	For SI: 1 inch = 25.4 mm.	
CLIMATE ZONE	CURB HEIGHT, MINIMUM										
0, 1, 2 and 3	16 inches										
4, 5 and 6	17 inches										
7 and 8	18 inches										
For SI: 1 inch = 25.4 mm.											

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INCLUDES
Plumbing provisions from
ICC A117.1-2017 Standard for Accessible
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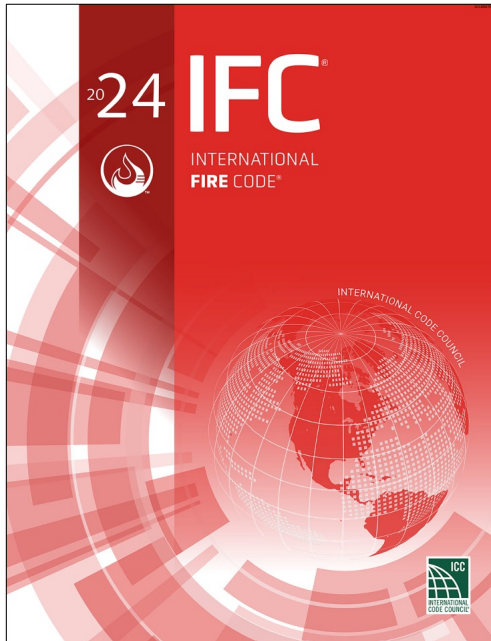
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- Ch. 11: Storm Drainage
 - Roof drains, scuppers and gutters
 - Maps based on a 100-yr. hourly rainfall rate
- No substantive roofing-related changes

[Link](#)

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**IFC 2024**

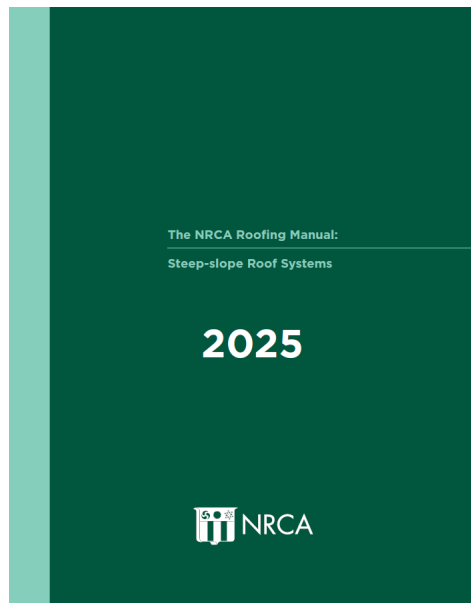
- Sec. 303-Asphalt Kettles
- Sec. 317-Vegetative and Landscaped Roofs
- Sec. 701.2-Fire-resistance-rated construction
- Sec. 3305.10-Safeguarding Roofing Operations
- No substantive roofing-related changes

[Link](#)

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Technical issues...

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2025 NRCA Manual
Steep-slope Roof Systems

*The Manual represents
“best practice” guidelines*

[Link](#)

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Significant revisions

The NRCA Roofing Manual: Steep-slope Roof Systems-2025

- OSB roof decks are no longer recommended
- Nailbase and vented nailbase insulation should be installed in two layers with staggered and offset joints
- Joints in vented nailbase insulation should be taped
- Updated code references to 2024 I-codes
- New appendix addressing IBHS' Fortified program

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Maintenance Roof Systems
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The NRCA Roofing Manual
Maintenance Roof Systems
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The NRCA Roofing Manual
Metal Roofs and RSM Roof Systems
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The NRCA Roofing Manual
Energy-Use Roof Systems
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Roof Wind Designer

www.roofwinddesigner.com



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ROOF WIND DESIGNER

ASCE 7-05, ASCE 7-10, ASCE 7-16 AND ASCE 7-22




Tornado design has been added to Roof Wind Designer

Roof Wind Designer is intended to provide users with an easy-to-use means for determining roof systems' design wind loads for many commonly encountered building types that are subject to building code compliance.

Design-wind loads are derived using the American Society of Civil Engineers (ASCE) Standard ASCE 7, "Minimum Design Loads for Buildings and Other Structures." This standard is a widely recognized consensus standard and is referenced in and serves as the technical basis for wind load determination in the International Building Code and NFPA 5000: Building Construction and Safety Code. Roof Wind Designer allows users to choose between ASCE 7's 2005, 2010, 2016, and 2022 editions. Roof Wind Designer uses ASCE 7-05's Method 1—Simplified Method, ASCE 7-10's Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, ASCE 7-16's Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, and Part 4: Buildings with $60\text{ft} < h \leq 160\text{ft}$ (Simplified), and ASCE 7-22's Part 1: Low-rise Buildings, Part 2: Buildings with $h > 60\text{ft}$ [$h > 18.3\text{m}$], and Part 4: Building appurtenances, rooftop structures and equipment. [A more detailed explanation of ASCE 7's four editions.](#)

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RESEARCH+TECH

Plywood or OSB?
Moisture-related concerns exist with wood structural panels
by Mark S. Graham

NBCA technical services staff continues to hear from roofing contractors experiencing moisture-related dimensional stability problems with plywood and oriented strand board structural panel sheathing used with steep-slope roof systems. Following is a brief discussion of moisture mechanics, linear expansion and thickness swell testing, and NBCTA recommendations for plywood and OSB structural panel sheathing roof decks.

Moisture mechanics
Plywood and OSB sheathing, similar to all wood products, are hygroscopic, meaning they tend to absorb and release moisture from their surroundings. When not exposed to direct wetting, structural panel sheathing's moisture content is a function of its environment's relative humidity and temperature. During construction and its service life, panels may be exposed to direct moisture. When exposed to direct wetting, structural panel sheathing's moisture content is influenced by wetting time and panel variables that affect capillarity, such as veneer species of plywood and wax additives in OSB.

24 professionalroofing.net, APRIL 2021

Professional Roofing
April 2021

[Link](#)

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Standards for wood structural panels

International Residential Code, 2024 Edition

Plywood:

- U.S. Department of Commerce PS-1, “Structural Plywood”
- CSA Group O325, “Construction Sheathing”

Oriented-strand board (OSB):

- U.S. Department of Commerce PS-2, “Performance Standard for Wood-based Structural-use Panels”
- CSA Group O437, “Standards for OSB and Waferboard”

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Common, but not referenced in the Code

Plywood and OSB:

- APA-The Engineered Wood Association Standard PRP-108, “Performance Standards and Policies for Structural-Use Panels”

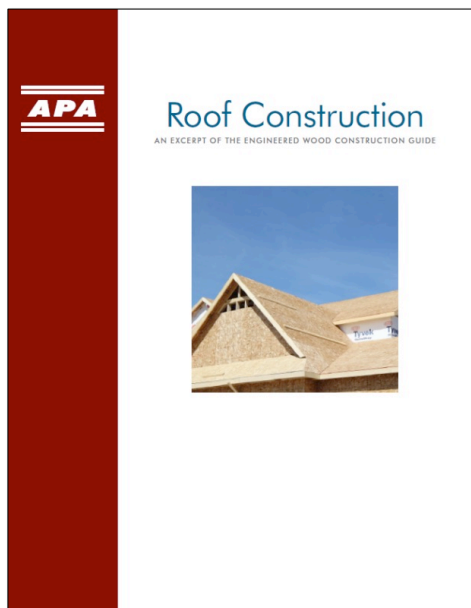
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Attachment of Wood Panels: The *International Residential Code, 2024 Edition's* Table R602.3(1)-Fastening Schedule provides minimum fastener and fastener spacing requirements for wood structural panels into roof framing shown in Figure 6.1.

Item	Description of building elements	Number and type of fasteners	Spacing of fasteners	
			Edges (inches)	Intermediate supports (inches)
Wood structural panels, roof sheathing to framing and particle board wall sheathing to framing				
31	3/8- to ½-inch-thick	6d common or deformed nail (2" x 0.113" x 0.281" head)	6	6
		8d common nail (2½" x 0.131" x 0.281" head), or RSRS-01 nail (2⅜" x 0.113" x 0.281" head)	6	6
32	19/32- to ¾-inch thick	8d common nail (2½" x 0.131" x 0.281" head), or RSRS-01 nail (2⅜" x 0.113" x 0.281" head)	6	6
33	7/8- to 1¼-inch thick	10d common nail (3" x 0.148" x 0.281" head), or 2½" x 0.131" x 0.281" head deformed nail	6	12

Figure 6-1. Roof sheathing-specific excerpt from *International Residential Code, 2024 Edition's* Table R602.3(1)-Fastening Schedule

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**APA Form E30, "Roof Construction"**

--Roofing-specific excerpts from
*APA's Engineered Wood Construction
Guide* (102 pages)

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Considerations

Lumber, plywood and OSB roof decks

- Be extra cautious of plywood and OSB roof decks
- Limit your deck acceptance responsibilities
- Consider more proactive plywood and OSB deck replacement
- Consider pull tests for plywood and OSB roof decks when using mechanically-attached membrane systems

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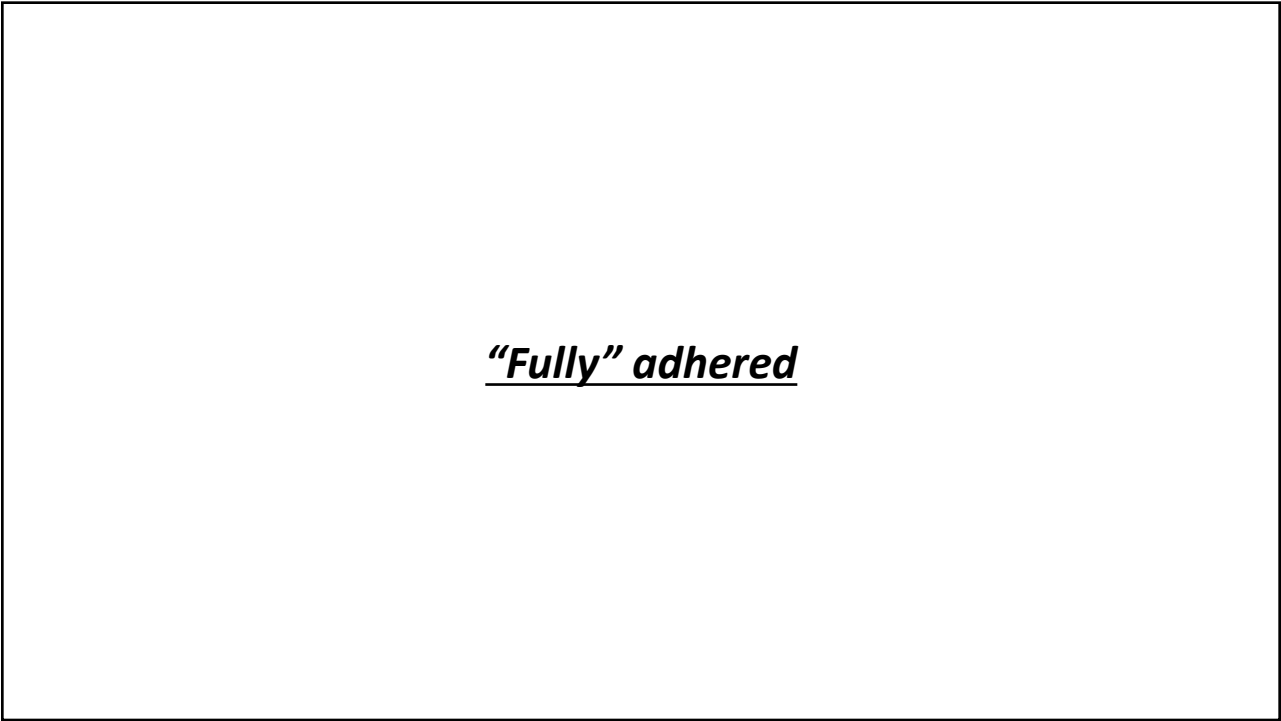
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Nailbase insulation considerations

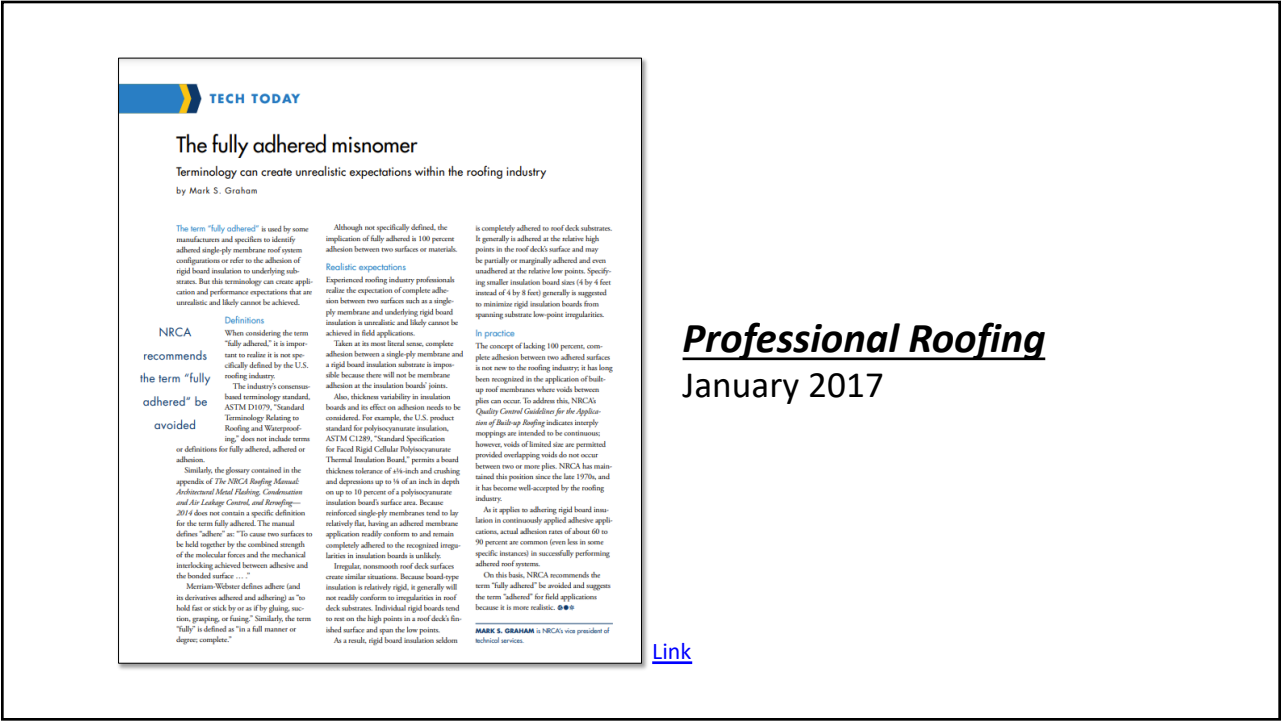
- Double layer design and application
- Taped joints can control vapor leaks/underlayment wrinkling at board joints
- Pressure-tested and FRT nailbase are not good ideas for nailbase

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“Fully” adhered



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“Moisture” meter concerns



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*These meters do not read moisture...
...they are reading relative conductivity, which can be
correlated to specific materials in specific conditions
when properly calibrated.*

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Considerations

"Moisture" meters

- Read/understand the instruction manual
- Understand device sensitivity
- Understand proper operating conditions
- Proper calibration/recalibration is critical
- Don't overstate the meter's capability
- Verify job-specific results with gravimetric analysis

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IR thermometers



The same concerns apply:

- Not really measuring temperature
- Emissivity
- Reflectivity
- Devices are sensitive to temperature and humidity changes

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Facer sheet adhesion (with the Chicago Roofing Contractors Association)

HP	AP	GP	EP
HP31	AP11	GP21	EP41
HP32	AP12	GP22	EP42
HP33	AP13	GP23	EP43
HP34	AP14	GP24	EP44
HP21	AP21	GP31	EP21
HP22	AP22	GP32	EP22
HP23	AP23	GP33	EP23
HP24	AP24	GP34	EP24
HP11	AP31	GP41	EP11
HP12	AP32	GP42	EP12
HP13	AP33	GP43	EP13
HP14	AP34	GP44	EP14

March 18, 2025

LTTR – ASTM C1303 and ASTM C518

- A 15-year time-weighted average R-value
- The predicted R-value after 5-years (under controlled laboratory conditions)

R-value – ASTM C518

- R-value at the time of the test

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- LTTR and R-value is typically tested and reported at 75 F.
- NRCA tests at 75 F, but we also test at 40 F and 110 F.

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Test results		
Physical properties		
Manufacturer	Apparent density (lb/ft³)	Thickness (inches)
1c	2.726	2.578
1p	2.002	2.594
2c	3.254	2.576
2p	2.024	2.585
3p	2.218	2.500
4p	2.057	2.735

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Test results	
R-value	
Manufacturer	R-value (75 F)
1c	14.4
1p	13.9
2c	13.6
2p	15.6
3p	13.2
4p	15.3

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More test results

R-value

Manufacturer	R-value (40 F)	R-value (75 F)	R-value (110 F)
1c	10.8	14.4	12.8
1p	8.9	13.9	12.0
2c	14.5	13.6	12.1
2p	15.4	15.6	13.4
3p	12.6	13.2	11.6
4p	16.9	15.3	13.1

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- ### Preliminary conclusions

 - Tested R-values vary
 - Some tested R-values are already lower than LTTR
 - Some samples are exhibiting different characteristics

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Preliminary recommendations


- Specify, purchase and sell polyisocyanurate insulation (and all insulation products) based on their thicknesses, not its R-values

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Polyiso facer sheet adhesion

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This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

 Designation: C1289 – 23a

Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board¹

This standard is issued under the fixed designation C1289; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript epsilon (ε) indicates an editorial change since the last revision or approval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers the general requirements for faced thermal insulation boards composed of rigid cellular polyisocyanurate surfaced with other materials. The insulation boards are intended for use at temperatures between –40 and 200°F (–40 and 93°C). This specification does not cover cryogenic applications. Consult the manufacturer for specific recommendations and properties in cryogenic conditions. For specific applications, the actual temperature limits shall be agreed upon by the manufacturer and the purchaser.

1.2 This standard is intended to apply to rigid cellular polyurethane-modified polyisocyanurate thermal insulation board products that are commercially acceptable as non-structural panels useful in building construction. The term polyisocyanurate encompasses the term polyurethane. For engineering and design purposes, users should follow specific product information provided by board manufacturers regarding physical properties, system design considerations and installation recommendations.

Notes 1—See Appendix X1 for guidance on determining wind pressure resistance of joints when required for wall cladding applications.

1.3 The use of thermal insulation materials covered by this specification is typically regulated by building codes, or other agencies that address fire performance. Where required, the fire performance of the material shall be addressed through standard fire test methods established by the appropriate governing documents.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

Notes 2—For conversion to metric units other than those contained in this standard, refer to IEEE/ASTM SI 10.

¹ This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C30.22 on Organic and Nonthermosetting Resin Thermal Insulations. Current edition approved Sept. 1, 2023. Published October 2023. Originally approved in 1996. Last previous edition approved in 2021 as C1289 – 21. DOI: 10.1533/C1289-23a.

1.5 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.6 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 The following documents, of the issue in effect on the date of material purchase, form a part of this specification to the extent specified herein:

2.2 *ASTM Standards:*²

C168 Terminology Relating to Thermal Insulation
C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
C303 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
C208 Specification for Cellulosic Fiber Insulating Board
C209 Test Methods for Cellulosic Fiber Insulating Board
C303 Test Method for Dimensions and Density of Pre-formed Block and Board-Type Thermal Insulation
C390 Practice for Sampling and Acceptance of Thermal Insulation Lots
C318 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
C550 Test Method for Measuring Tensile and Squaresness of Rigid Block and Board Thermal Insulation
C728 Specification for Perlite Thermal Insulation Board
C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

ASTM C1289-23a

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11.6 Tensile Strength Perpendicular to Board Surface— Tensile strength perpendicular to the major board surfaces of the faced board product shall be tested in accordance with Test Method **C209**, Tensile Strength Perpendicular to Surface, or Test Method **D1623** (Type C), utilizing a 250°F (121°C) hot melt adhesive system for sample preparation. Molten adhesive shall be uniformly applied over each faced sample surface and allowed to cool in 73°F (23°C) laboratory air for 24 h before testing.

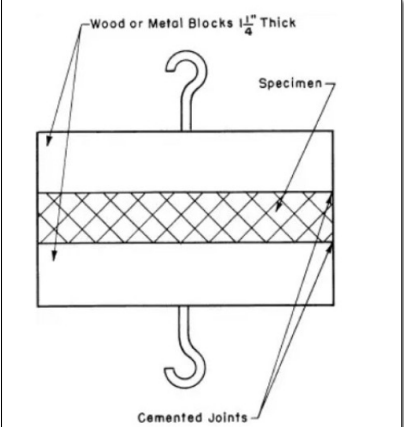


FIG. 2 Apparatus for Determination of Tensile Strength Perpendicular to Surface

Tensile strength, psf (kPa), min Perpendicular to board surface	500 (24)	500 (24)	500 (24)	500 (24)	500 (24)	2000 (95)
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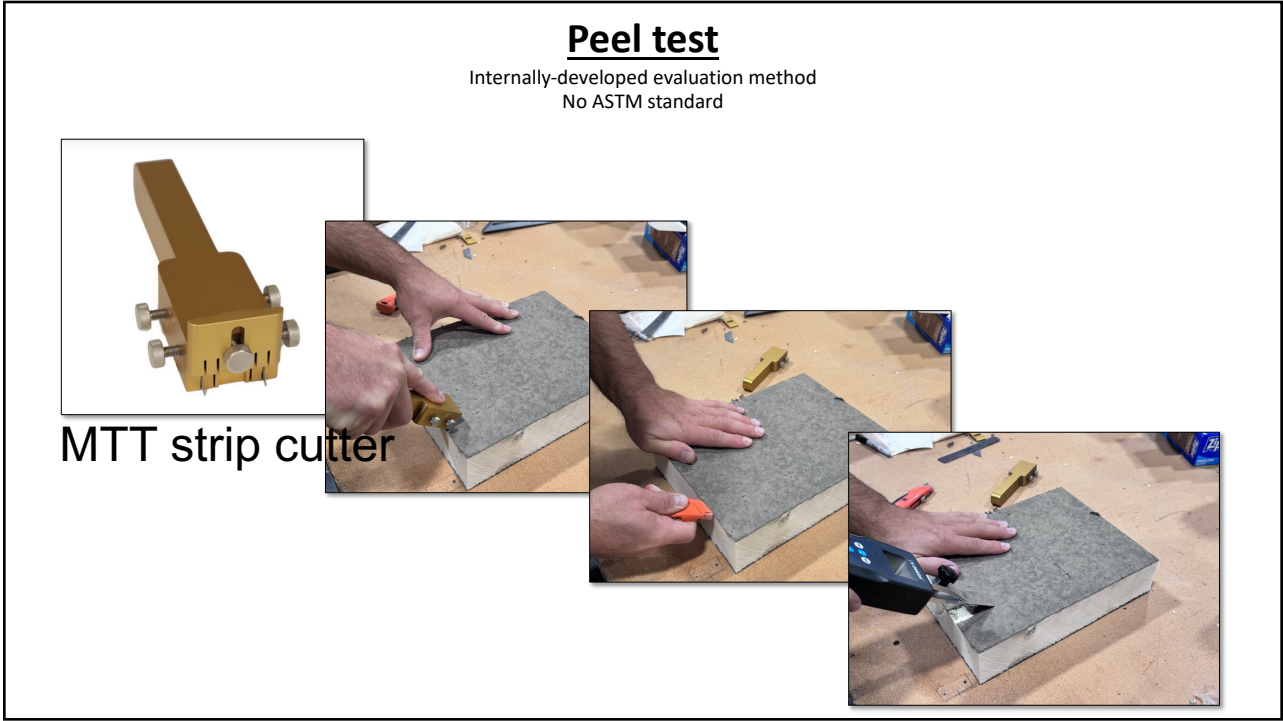
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Test results

ASTM C209 tensile strength

Manufacturer	Tensile strength Average (psf)	Standard deviation (psf)
1c	1,888	556
1p	2,041	909
2c	1,874	730
2p	1,301	409
3p	1,029	495
4p	1,185	327

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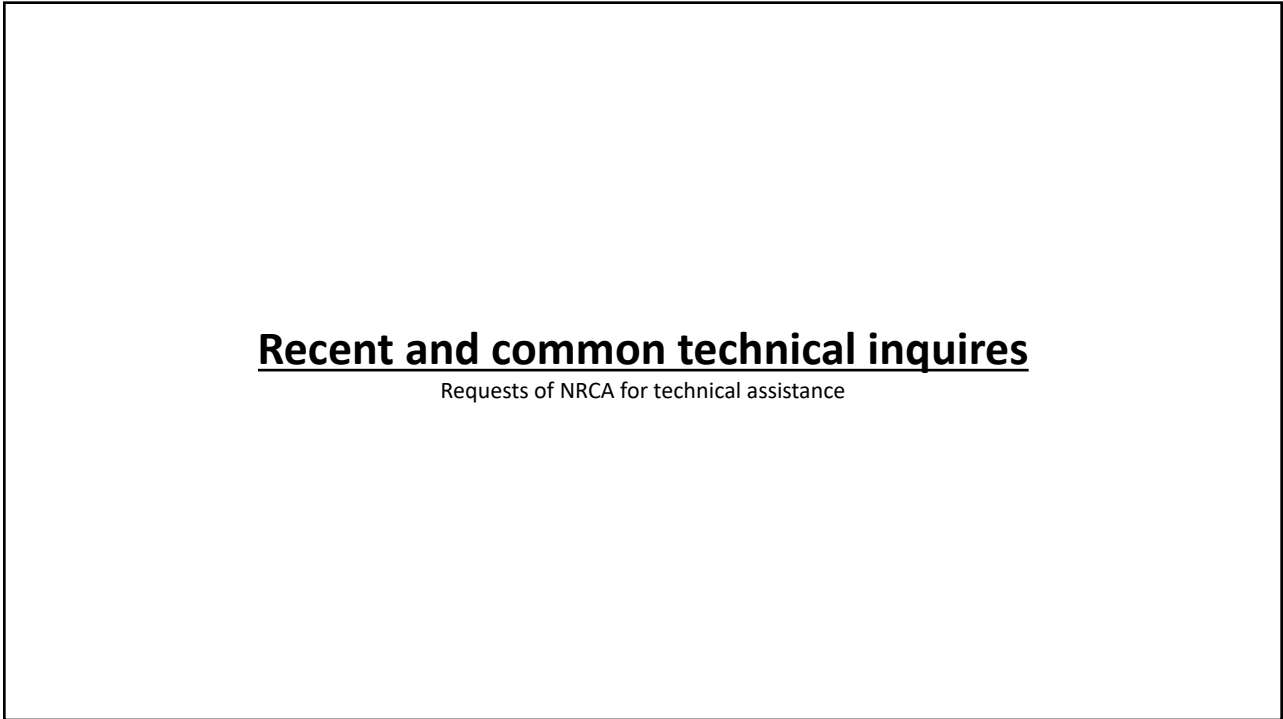
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Test results		
Manufacturer	Peel strength Average (psi)	Standard deviation (psi)
1c	2.78 MD 3.03 XMD	0.62 MD 0.44 XMD
1p	2.52 MD 2.89 XMD	0.78 MD 0.94 XMD
2c	2.30 MD 2.30 XMD	0.31 MD 0.28 XMD
2p	2.52 MD 2.36 XMD	0.61 MD 0.53 XMD
3p	2.83 MD 2.97 XMD	0.59 MD 0.57 XMD
4p	2.61 MD 2.19 XMD	0.56 MD 0.76 XMD
Average	2.59 MD 2.62 XMD	

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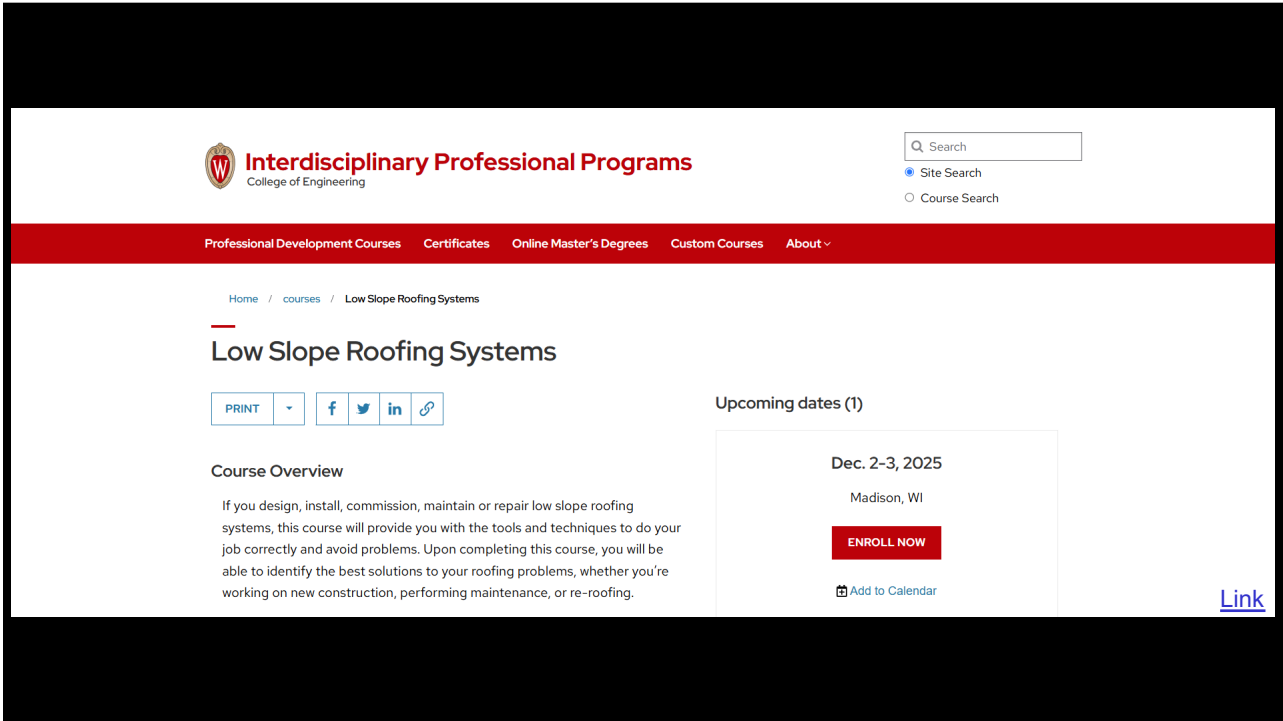
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|--|
| <p><u>Preliminary conclusions</u></p> <ul style="list-style-type: none">• Our peel test method seems viable<ul style="list-style-type: none">– More refinement of the test method may be needed• Peel values are only about 10% of tensile values• Peel values seem low• More testing is planned:<ul style="list-style-type: none">– More polyiso. specimens (production lots, plants)– Board top vs. board bottom– Impact of knit lines– Other faced insulation boards |
|--|

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Recent and common technical inquires
Requests of NRCA for technical assistance

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[We're moving! NRCA's new office address as of April 7, 2025...](#)



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