

Building Codes in Roofing

Based on the 2024 I-codes

Mark S. Graham

Vice President, Technical Services
National Roofing Contractors Association



1

Definitions

Standard: something established for use as a rule or basis of comparison in measuring or judging capacity, quantity, content, extent, value or quality.

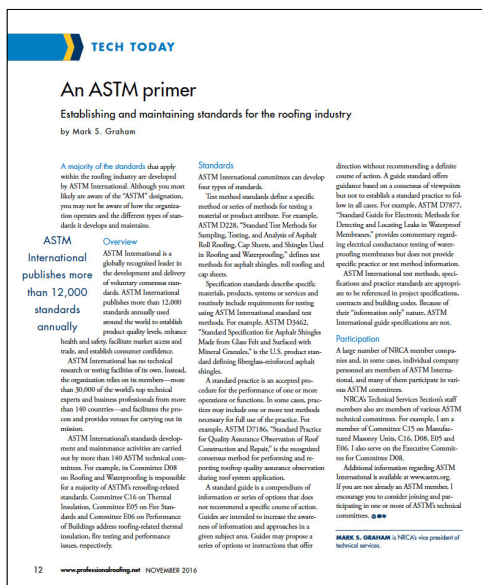
Code: 1) a body of laws, as a nation, city, etc., arranged systematically for easy reference; 2) any set of principles or rules of conduct (e.g., the moral code).

2

Roofing-related standards

- Promulgators: AAMA, ASCE, ASTM, CSA, CSSB, FM, SPRI, UL and WDMA
- Types of standards:
 - Test method (e.g., ASTM E108)
 - Specification/product standard (ASTM D6878)
 - Practice (ASTM D7186)
 - Guide (ASTM D6630) – Not enforceable

3




Professional Roofing,
November 2016

[Link](#)

4

Consider becoming an ASTM member...
<https://www.astm.org/member-student.html>

ASTM INTERNATIONAL
Helping our world work better

Products & Services Get Involved About NewsContact Cart (0) Sign In

Home / Get Involved / Students & Professors / For Students

- Technical Committees
- Membership
- Students & Professors
- For Students
- Publish With ASTM
- Consumer Participation

Become a Student Member

Join Your Future Peers - Today. Become an ASTM Student Member!

As a Student Member of ASTM International, you'll be part of a prestigious worldwide network of technical experts and business leaders who develop standards for quality and testing. An ASTM membership is more than an instant plus for your resume. It's a front row seat to the standardization process, enhancing your knowledge in the subject of standards before you start using them in the workplace.

Exciting Benefits for Student Member

- Receive Electronic editions of ASTM Magazines and Newsletters
- Free Attendance at ASTM Symposia
- Participation in Student Competition and Opportunities to Publish
- Reduced Membership Fees Upon Graduation

Apply Online

To become an ASTM Student Member, just fill out our easy [online application](#).

5

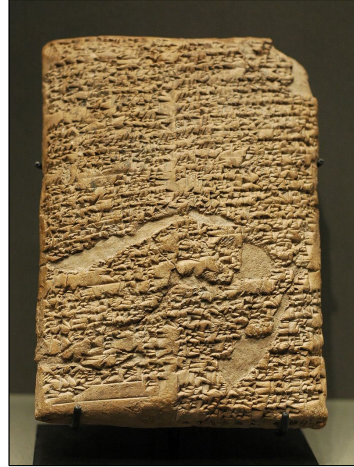
The purpose of the code
International Building Code, 2024

[A] 101.3 Purpose. The purpose of this code is to establish the minimum requirements to provide a reasonable level of safety, health and general welfare through structural strength, *means of egress*, stability, sanitation, light and *ventilation*, energy conservation, and for providing a reasonable level of life safety and property protection from the hazards of fire, *explosion* or *dangerous* conditions, and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

6

Code of Hammurabi

- Babylonian empire (1754 BC)
- 282 laws, scaled punishment
- Specific provisions to construction and contracts
- “...an eye for an eye, a tooth for a tooth...”



7

Legacy codes

Early 1900s up to 1999

- Building Officials and Code Administrators International (BOCA)
 - *The BOCA National Building Code*
- Southern Building Code Congress International (SBCCI)
 - *The Standard Building Code (SBC)*
- International Conference of Building Officials
 - *Uniform Building Code (UBC)*

8

Since 2000...

The “I-codes” are developed and published on a three-year cycle

*The most current edition of the I-codes is the
2024 Edition (i.e., the ninth edition)*


9

Some background

Building codes in roofing


- The I-codes are “model codes” developed by the International Code Council (ICC)
- The I-codes are updated and published on a three-year cycle
- Model codes serve as the technical basis for state or local code adoption
- The code provides the minimum legal requirements for building construction...and operation
- The code is enforced by the “authority having jurisdiction” (AHJ)
- The code can also provide a basis for construction claims-related litigation

10



Code enforcement

- Code official
- Construction litigation



11

Legal considerations

“In most states, a building code violation is considered to be evidence of negligence. In some situations, a building code violation may be considered *negligence per se*...”

--Stephen M. Phillips
Hendrick, Phillips, Salzman & Flatt

12

AIA General Conditions

AIA A201 – General Conditions of The Contract for Construction

Article 3 Contractor

3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statues, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by and made known to the Contractor as a request for information in such a form as the Architect may require.

13

AIA General Conditions

AIA A201 – General Conditions of The Contract for Construction

Article 3 Contractor

3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statues, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by and made known to the Contractor as a request for information in such a form as the Architect may require.

14

AIA General Conditions

AIA A201 – General Conditions of The Contract for Construction

3.2.4 ...If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay the costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages ...for nonconformities of the Contract Documents to... codes...

15

AIA General Conditions

AIA A201 – General Conditions of The Contract for Construction

3.2.4 ...If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay the costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages ...for nonconformities of the Contract Documents to... codes...

16

PERIODIC TABLE
INTERNATIONAL CODES®, STANDARDS & GUIDELINES

INTERNATIONAL CODES										STANDARDS										GUIDELINES	
IBC International Building Code®	IFGC International Fuel Gas Code®	IPMC International Property Maintenance Code®	ICC A117.1 Accessible and Usable Buildings and Facilities (ICC A117.1) Ref: ICC, IBC, IRC, IFGC, IFPC, ICC, ASICC, ICC	ICC 605 International Green Building Code® (In Development)	ASHRAE/ICC Standard 240 Evaluating Sustainable Goals, Goals and Value Proposition in Building Energy, Environment, and Resilience (In Development)	ICC 901/SRCC 100 Code Technical Building Standard (ICC 901) Ref: ICC, IBC, IFGC, IFPC, ICC, ASICC, ICC							ICC G1-2010 Guideline for Replicable Buildings								
IRC International Residential Code®	IECC International Energy Conservation Code®	IPSDC International Private Sewage Disposal Code®	ICC 300 Standard for Residential, Mobile and Recreational Vehicle and Motorhome (ICC 300) Ref: ICC, ASICC, IFPC	ICC 610 Standard for Residential Commercial Buildings with Detached Garages (ICC 610) (In Development)	CSA B805/ICC 805 Reservoir Containment Systems (CSA B805) Ref: IFC, ICC	ICC 902/PHTA 902/SRCC 400 Steel-Framed Cold-Formed Steel Buildings (ICC 902) Ref: ICC, ASICC	ICC 1150 Standard for 10-Story Residential Buildings (ICC 1150) (In Development)	ICC/MBI 1210 Standard for Residential, Commercial, and Industrial Plumbing Systems, Sewer, Stormwater, and Stormwater Collection in Off-Grid Communities (ICC/MBI 1210) (In Development)	RESNET/ACCA/ICC 310 Standard for Residential Foundation of Precast Concrete (RESNET/ACCA/ICC 310) (In Development)				ICC G2-2010 Guideline for Acoustics								
IFC International Fire Code®	ICCPC ICC Performance Code®	IZC International Zoning Code®	ICC 400 Standard for the Design and Construction of Green Buildings (ICC 400) Ref: ICC, ASICC	ICC 615 Standard for Residential Construction Buildings with "Sustainable Features" (In Development)	ICC 815 Sinks & Sill Drainage, Plumbing and Sewer Treatment (ICC 815) (In Development)	ICC 903/SRCC 500 Steel-Framed Cold-Formed Steel Buildings (ICC 903) (In Development)	ICC 1155 Standard for Low-Rise Residential Buildings (ICC 1155) (In Development)	ICC/THIA 1215 Standard for Residential, Commercial, and Industrial Plumbing Systems, Sewer, Stormwater, and Stormwater Collection in Off-Grid Communities (ICC/THIA 1215) (In Development)	RESNET/ICC 380 Standard for Building, Installation, and Evaluation of Heating and Cooling, Air Conditioning, Ventilation, and Air Filtration Systems, and Other Mechanical Systems of Residential Buildings (RESNET/ICC 380) Ref: ICC & ASICC				ICC G3-2011 Global Guideline for Practical Public Toilet Design								
IPC International Plumbing Code®	IWUIC International Wetland Urban Interface Code®	IgCC International Green Construction Code®	ICC/NSSA 500 Standard for the Design and Construction of Green Buildings (ICC/NSSA 500) Ref: ICC, ASICC, IFPC, ICC	ICC 700 National Green Building Standard (ICC 700) Ref: ICC & ASICC	ICC 825 Private Sewage Disposal System Standard (ICC 825) (In Development)	ICC 1100 Standard for Non-Residential, Non-Fabricated, Non-Panelized, Prefabricated Steel-Framed Buildings (ICC 1100) Ref: ICC	ICC/MBI 1200 Standard for 10-Story Residential Buildings (ICC/MBI 1200) Performance, Durability, and Quality (ICC/MBI 1200) (In Development)	ICC 1300 Standard for the Installation, Inspection, and Evaluation of Roofing, Siding, and Exterior Finishes of One and Two Family Buildings (ICC 1300) (In Development)	RESNET/ICC 850 Standard for the Calculation and Labeling of the Energy Performance of One and Two Family Buildings (RESNET/ICC 850) Ref: ICC & ASICC				ICC G4-2012 Guideline for Commissioning								
IMC International Mechanical Code®	IEBC International Existing Building Code®	ISPC International Swimming Pool and Spa Code®	ICC 600 Standard for Accessible and Usable Buildings and Facilities (ICC 600) Ref: ICC, ASICC, IFPC, ICC, ASICC, ICC	ASABE/ICC 802 Language Integrated Grammar (ASABE/ICC 802) Ref: IFC	ICC 900/SRCC 300 Steel-Framed Cold-Formed Steel Buildings (ICC 900) Ref: ICC, ASICC, IFPC, ICC, ASICC, ICC	ICC 1125 Standard for Non-Residential, Non-Fabricated, Non-Panelized, Prefabricated Steel-Framed Buildings (ICC 1125) (In Development)	ICC/MBI 1205 Standard for 10-Story Residential Buildings (ICC/MBI 1205) Performance, Durability, and Quality (ICC/MBI 1205) (In Development)	RESNET/ICC 301 Standard for the Calculation and Labeling of the Energy Performance of One and Two Family Buildings (RESNET/ICC 301) Ref: ICC & ASICC	RESNET/ICC 1450 Standard for the Calculation and Labeling of the Energy Performance of One and Two Family Buildings (RESNET/ICC 1450) (In Development)				ICC G5-2019 Guideline for the Safe Use of ISO Containers								
																				ICC G6-202X Guideline on Advanced Panelization (In Development)	
																				ICC G7-202X Existing Building Safety – Guideline for Inspection (In Development)	

Learn more about the Code Council's codes and standards development process, here: icc-sa.org/codes-standards

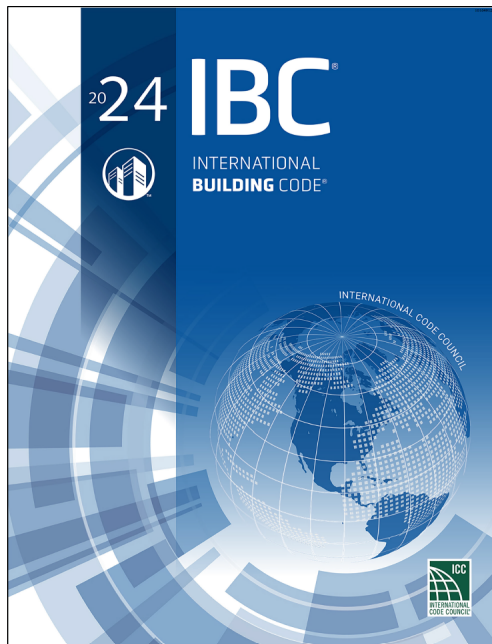
[Link](#)

17

I-codes commonly applicable to roofing

- IBC: International Building Code
- IRC: International Residential Code
- IEBC: International Existing Building Code
- IECC: International Energy Conservation Code
- IFC: International Fire Code
- IPC: International Plumbing Code

18



IBC 2024

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

19

Significant roof requirements

International Building Code, 2024 Edition, Chapter 15-Roof Assemblies and Rooftop Structures

- Wind resistance
- Fire classification
- Installation requirements
- Prescriptive requirements
- Reroofing

20

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 [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.

1503.2.1 **Weather-protective barrier.** 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.

1503.2.2 **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.

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.

1503.5 **Crickets and saddles.** A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Unit skylights installed in accordance with Section 2405.5 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

410 2024 INTERNATIONAL BUILDING CODE®

INTERNATIONAL CODE COUNCIL

SECTION 1504—PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed in accordance with Section 1504.

1504.2 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table 1504.2 for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table 1504.2.

Exception: Asphalt shingles not included in the scope of ASTM D7158 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 1504.2—CLASSIFICATION OF STEEP SLOPE ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161 OR D7158

MAXIMUM BASIC WIND SPEED, V , FROM FIGURES 1609.3(1)–(4) OR ASCE 7 (mph)	MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V_{asdp} FROM Table 1609.3.1 (mph)	ASTM D7158 ^a CLASSIFICATION	ASTM D3161 or UL 7103 CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, 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

For SI: 1 foot = 304.8 mm, 1 mph = 0.447 m/s.

a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.


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.

1504.2 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table 1504.2 for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table 1504.2.

Exception: Asphalt shingles not included in the scope of ASTM D7158 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.



Scan for Changes
0768c61

MAXIMUM BASIC WIND SPEED, V, FROM FIGURES 1609.3(1)-(4) OR ASCE 7 (mph)	MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V _W , FROM TABLE 1609.3.1 (mph)	ASTM D7158 ^a	ASTM D3161 ^a
		CLASSIFICATION	UL 1703 CLASSIFICATION
110	85	G or H	A, D or F
116	90	G or H	A, D or F
129	100	G or H	A, 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. The standard calculations contained in ASTM D7158 assume Exposure Category 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 either SBCCI 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 either SBCCI SSTD 11 or ASTM C1569.

1504.3.1.3 Air permeability testing. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined in accordance with SBCCI 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.

2024 INTERNATIONAL BUILDING CODE®

23

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 R-1, R-2 and R-3 of ANSI/SPRI E-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 Roof 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)	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	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	34	17	19	22	24	27	32	37	42	47
	50	12	12	14	16	18	21	25	30	35	37	39	22	25	28	30	36	41	47	
ASTM D1863 (No. 6)	15	2	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	50	12	12	14	16	18	21	25	30	35	37	39	22	25	28	30	36	41	47	

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.



Scan for Changes
0768c61

2024 INTERNATIONAL BUILDING CODE®

24

[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:

1. Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
2. 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.
3. Class A roof assemblies include minimum 16 ounce per square foot (0.0416 kg/m²) copper sheets installed over combustible decks.
4. Class A roof assemblies include slate installed over ASTM D226, Type II or ASTM D4869, Type IV underlayment over combustible decks.

25

[BF] 1505.8 Building-integrated photovoltaic (BIPV) systems. Building-integrated photovoltaic (BIPV) systems installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section 1505.1.

[BF] 1505.9 Rooftop mounted photovoltaic (PV) panel systems. Rooftop mounted photovoltaic (PV) panel systems shall be tested, listed and identified with a fire classification in accordance with UL 2703. Listed systems shall be installed in accordance with the manufacturer's installation instructions and their listing. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

[BF] 1505.10 Landscaped and vegetative roofs. Landscaped and vegetative roofs shall comply with Sections 1505.1 and 1507.15. Vegetative roofs shall be installed in accordance with ANSI/SPRI VF-1.

26

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[BF] TABLE 1505.1—MINIMUM ROOF ASSEMBLY CLASSIFICATION FOR TYPES OF CONSTRUCTION^{1,2}

IA	IB	IIA	IIIB	IIIA	IIIB	IV	VA	VB
B	B	C	B	C	B	B	B	C

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

1. Unless otherwise required in accordance with the International Building Code or due to the location of the building within a fire district in accordance with Appendix D.

2. 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.

3. Buildings that are no 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 rubber or reinforced shales 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.

[BF] 1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

[BF] 1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

[BF] 1505.5 Nonclassified roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

[BF] 1505.6 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum pressure process, in accordance with NFPA C1. Each bundle shall be marked to identify the manufacturer unit and the manufacturer, and shall be labeled to identify the classification of the material in accordance with the testing required in Section 1505.1, the treating company and the quality control agency.

[BF] 1505.7 Special purpose roofs. Special purpose wood shingle or wood shake roofing shall conform to the grading and applica-

SECTION 1506—MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. *Roof coverings* shall be applied in accordance with this chapter and the *roof covering* listing as required by Section 1505. Installation of *roof coverings* shall comply with the applicable provisions of Section 1507.

1506.2 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards 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.


2024 INTERNATIONAL BUILDING CODE® 413
INTERNATIONAL CODE COUNCIL

27

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1507—REQUIREMENTS FOR ROOF COVERINGS

Scan for Changes



d079973

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*.

TABLE 1507.1.1(1)—UNDERLAYMENT TYPES

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
		ASTM D226 Type II	

414 2024 INTERNATIONAL BUILDING CODE®
INTERNATIONAL CODE COUNCIL

28

Roof system types addressed by the Code

Prescriptive requirement in Section 1507

- Asphalt shingles
- Clay and concrete tile
- Metal panels
- Metal shingles
- Mineral-surfaced roll roofing
- Slate shingles
- Wood shingles
- Wood shakes
- Built-up roofs
- Modified bitumen roofing
- Thermoset single-ply roofing
- Thermoplastic single-ply roofing
- Spray polyurethane foam
- Liquid-applied roofing
- Vegetative roofs, roof gardens and landscaped roofs
- Photovoltaic shingles
- Building-integrated photovoltaic roof panels

29

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES
 TABLE 1507.4.3—METAL ROOF COVERINGS—continued

1507.7 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

1507.7.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck slope. Slate shingles shall only be used on slopes of 4 units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. *Underlayment* shall comply with Section 1507.1.1.

1507.7.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.7.5 Material standards. Slate shingles shall comply with ASTM C406.

1507.7.6 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.6. Slate shingles shall be secured to the roof with two fasteners per slate.

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope ≥ 20:12	2
For Sl: 1 inch = 25.4 mm.	

1507.7.7 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be not less than 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc-coated G90. Chimneys, stucco or brick walls shall have not fewer than two plies of felt for a cap flashing consisting of a 4-inch-wide (102 mm) strip of felt set in plastic cement and extending 1 inch (25 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing 2 inches (51 mm).

2024 INTERNATIONAL BUILDING CODE® 421
 INTERNATIONAL CODE COUNCIL

30

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.9.9 Flashing. At the juncture of the roof and vertical surfaces, 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 papi) 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 up 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) underlap of either one layer of Type I underlayment running the full length of the valley or a self-adhesive polymer-modified bitumen sheet having a label indicating

1507.12 Single-ply roofing. The installation of single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope. Single-ply membrane roofs shall have a design slope of not less than $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) for drainage.

11-percent slope.
1507.10.2 Material standards. Built-up roof covering materials shall comply with the standards in Table 1507.10.2 or UL 55A.

1507.12.2 Material standards. Single-ply *roof coverings* shall comply with the material standards in Table 1507.12.2.

TABLE 1507.12.2—SINGLE-PLY ROOFING MATERIAL STANDARDS	
MATERIAL	MATERIAL STANDARD
Chlorosulfonated polyethylene (CSPE) or polyisobutylene (PIB)	ASTM D5019
Ethylene propylene diene monomer (EPDM)	ASTM D4637
Ketone Ethylene Ester (KEE)	ASTM D6754
Polyvinyl Chloride (PVC) or (PVC/KEE)	ASTM D4434
Thermoplastic polyolefin (TPO)	ASTM D6878

1507.12.3 Ballasted low-slope roofs. Ballasted *low-slope* roofs shall be installed in accordance with this section and Section 1504.5. Stone used as *ballast* shall comply with ASTM D448 or ASTM D7655.

1507.12.1 Slope. Single-ply membrane roofs shall have a design slope of not less than $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) for drainage.

2024 INTERNATIONAL BUILDING CODE®
INTERNATIONAL CODE COUNCIL 425

31

SECTION 1508—ROOF INSULATION

[BF] 1508.1 General. The use of above-deck thermal insulation shall be permitted provided that such insulation is covered with an *approved roof covering* and passes the tests of NFPA 276 or UL 1256 when tested as an assembly.

Exceptions:

1. Foam plastic roof insulation shall conform to the material and installation requirements of Chapter 26.
2. Where a concrete or composite metal and concrete *roof deck* is used and the above-deck thermal insulation is covered with an *approved roof covering*.

[BF] 1508.2 Material standards. Above-deck thermal insulation board shall comply with the standards in Table 1508.2.

Scan for Changes

 d17a230

[BF] TABLE 1508.2—MATERIAL STANDARDS FOR ROOF INSULATION	
MATERIAL	STANDARD
Cellular glass board	ASTM C552 or ASTM C1902
Composite boards	ASTM C1289, Type III, IV, V or VII
Expanded polystyrene	ASTM C578

[BF] TABLE 1508.2—MATERIAL STANDARDS FOR ROOF INSULATION—continued	
MATERIAL	STANDARD
Extruded polystyrene	ASTM C578
Fiber-reinforced gypsum board	ASTM C1278
Glass-faced gypsum board	ASTM C1177
High-density polyisocyanurate board	ASTM C1289, Type II, Class 4
Mineral fiber insulation board	ASTM C726
Perlite board	ASTM C728
Polyisocyanurate board	ASTM C1289, Type I or II
Wood fiberboard	ASTM C208, Type II

32

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[B] TABLE 1509.2—MATERIAL STANDARDS FOR ROOF INSULATION—continued

MATERIAL	STANDARD
Extruded polystyrene	ASTM C578
Fiber-reinforced gypsum board	ASTM C1378
Glass-faced gypsum board	ASTM C1377
High-density polyisocyanurate board	ASTM C1288, Type II, Class 4
Mineral-fiber insulation board	ASTM C552
Perlite board	ASTM C720
Polyisocyanurate board	ASTM C1288, Type I or II
Wood fiberboard	ASTM C208, Type II

SECTION 1509—ROOF COATINGS


1509.1 General. The installation of a roof coating on a roof covering shall comply with the requirements of Section 1506 and this section.

1509.2 Material standards. Roof coating materials shall comply with the standards in Table 1509.2.

TABLE 1509.2—ROOF COATING MATERIAL STANDARDS

SECTION 1511—ROOFTOP STRUCTURES

Scan for Changes



9d7afe3

[BG] 1511.1 General. The provisions of this section shall govern the construction of *rooftop structures*.

1511.1.1 Area limitation. The aggregate area of *penthouses* and other enclosed *rooftop structures* shall not exceed one-third the area of the supporting *roof deck*. Such *penthouses* and other enclosed *rooftop structures* shall not be required to be included in determining the *building height*, number of *stories* or *building area* as regulated by Section 503.1. The area of such *penthouses* shall not be included in determining the *fire area* specified in Section 901.7.

[BG] 1511.2 Penthouses. *Penthouses* in compliance with Sections 1511.2.1 through 1511.2.4 shall be considered as a portion of the *story* directly below the *roof deck* on which such *penthouses* are located. Other *penthouses* shall be considered as an additional *story* of the *building*.

[BG] 1511.2.1 Height above roof deck. *Penthouses* constructed on *buildings* of other than Type I construction shall not exceed 18 feet (5486 mm) in height above the *roof deck* as measured to the average height of the roof of the *penthouse*. *Penthouses* located on the roof of *buildings* of Type I construction shall not be limited in height.

Exception: Where used to enclose tanks or elevators that travel to the roof level, *penthouses* shall be permitted to have a maximum height of 28 feet (8534 mm) above the *roof deck*.

428 2024 INTERNATIONAL BUILDING CODE®
INTERNATIONAL CODE COUNCIL

33

Types of roof structures

IBC 2024, Section 1511-Roof Structures

- Penthouses
- Tanks
- Cooling towers
- Towers, spires, domes and cupolas
- Mechanical equipment screens
- Photovoltaic panels and modules
- Other rooftop structures (e.g., aerial supports, dormers, fences, flagpoles)
- Lightning protection systems
- Raised deck systems

34

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1512—REROOFING

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.


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 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.

1512.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of *roof assembly* materials down to the *roof deck*.

Exceptions:

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.



Scan for Changes
a4df0bb

2024 INTERNATIONAL BUILDING CODE® 431
INTERNATIONAL CODE COUNCIL

35

1512.3 Roof recover. The installation of a new *roof covering* over an existing *roof covering* shall be permitted where any of the following conditions occur:

1. Where the new *roof covering* is installed in accordance with the *roof covering* manufacturer's approved instructions.
2. 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*.
3. 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.
4. 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*.

Exception: A roof recover shall not be permitted where any of the following conditions occur:

1. 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.
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*.

36

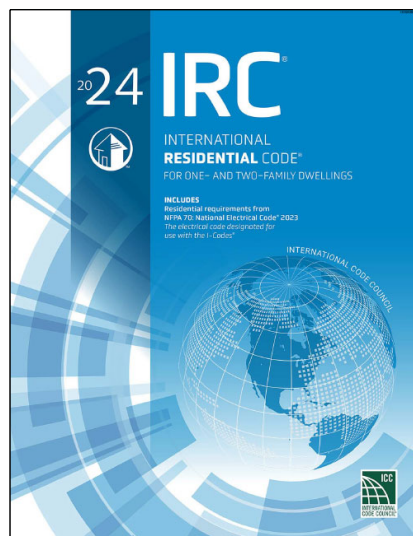
1512.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of *roof assembly* materials down to the *roof deck*.

Exceptions:

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.
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:
 - 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.

37

International Residential Code, 2024 Edition



- Applicable to one- and two-family dwellings and townhouses no more than three stories in height
- Roofing-related requirements:
 - Ch. 8-Roof/ceiling construction
 - Ch. 9-Roof assemblies

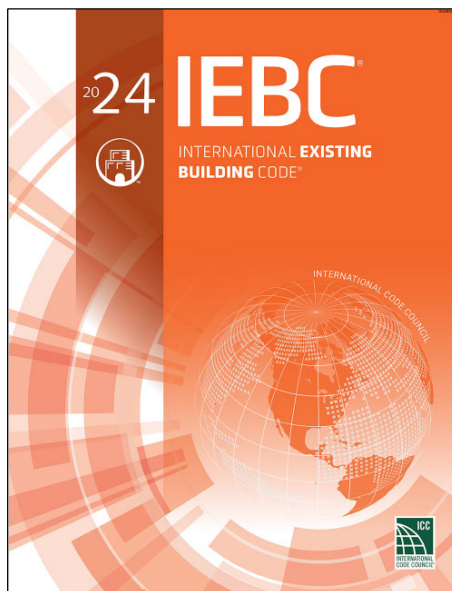
38

Ch. 9-Roof assemblies

International Residential Code, 2024 Edition

- Ch. 9 closely mirrors IBC Ch. 15's requirements
- Except IRC only requires fire classified roof assemblies where:
 - Required by local ordinance
 - Roof edge is less than 3 ft. from the lot line

39



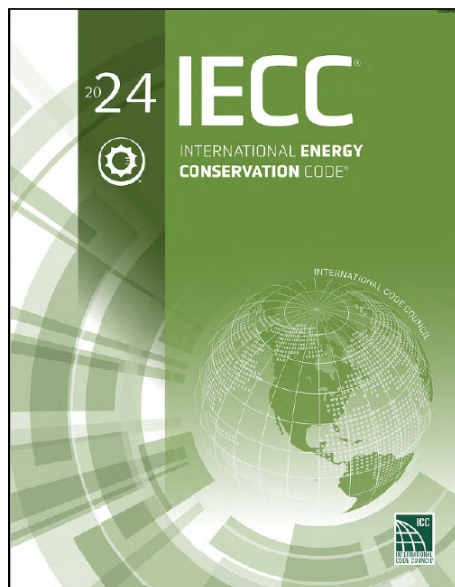
***International Existing
Building Code, 2024 Edition***

40

IEBC 2024

- Building alterations are classified as Level I, Level II or Level III
- Reroofing (without other major building alterations) is a Level I alteration
- Reroofing is addressed in Chapter 7-Alterations-Level I, Section 705-Reroofing.
- IEBC Section 705-Reroofing is identical to IBC Section 1512-Reroofing
- IEBC Section 706-Structural provides some additional structural requirements for reroofing when a permit is required for reroofing projects.

41



IECC 2024:

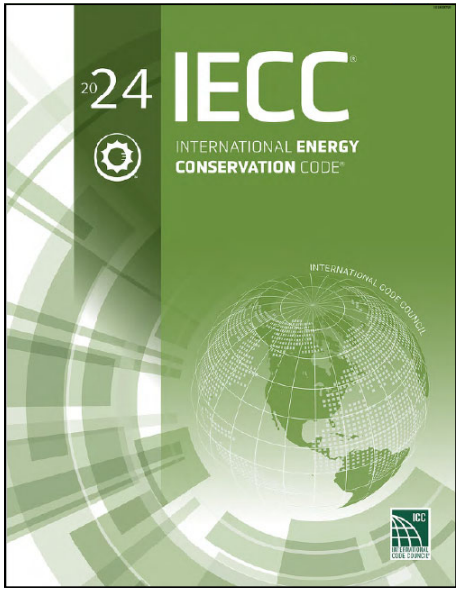
Commercial buildings:

- All except “Residential Buildings”

Residential buildings:

- One- and two-family dwellings, multiple single-family dwellings and Group R-2, R-3 and R-4 buildings three stories or less

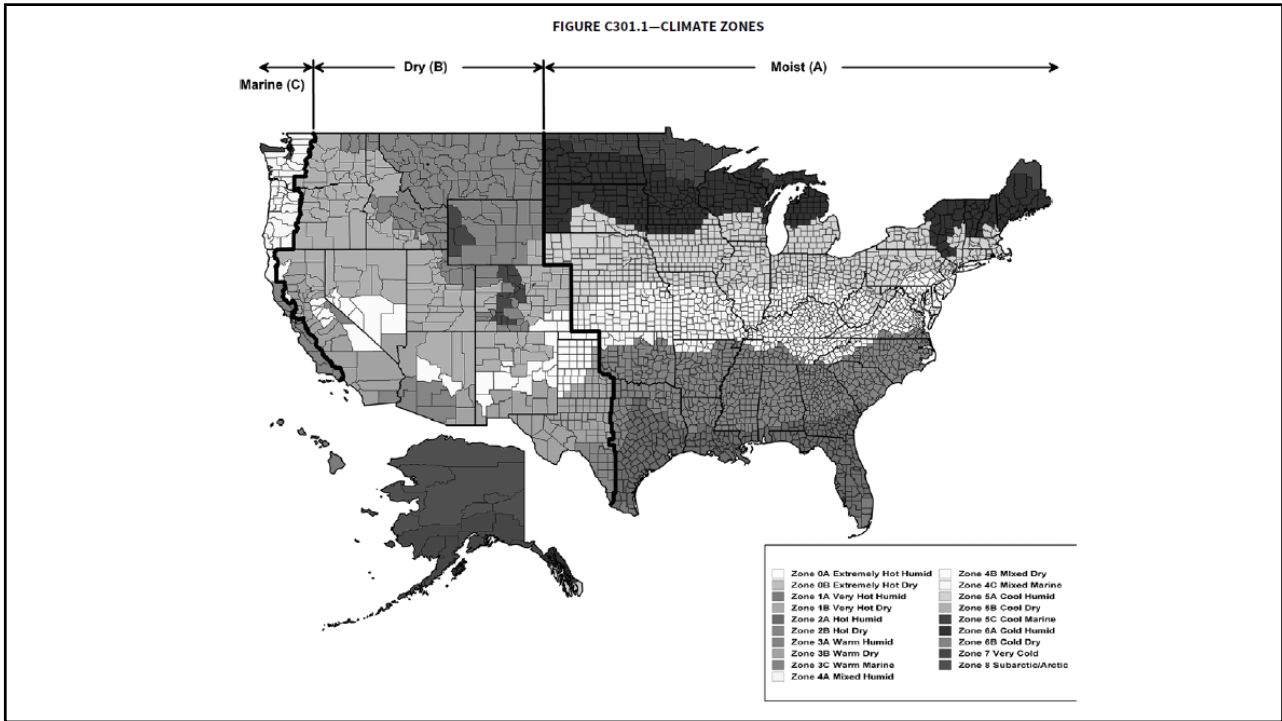
42



Roof requirements:

- R-value
- Roof reflectivity
- Air retarder

43



44

COMMERCIAL ENERGY EFFICIENCY

TABLE C402.1.3—OPAQUE BUILDING THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^a

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings ^b	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS	
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60

2024 INTERNATIONAL ENERGY CONSERVATION CODE®

45

Roofing-specific adaptation of Table C402.1.3

International Energy Conservation Code, 2024 Edition

Opaque Thermal Envelope Assembly Requirements			
Climate zone	Roof assembly configuration		
	Insulation entirely above deck	Metal buildings (with R-5 thermal blocks)	Attic and other
1	R-20ci	R-19 + R-11 LS	R-38
2	R-25ci		
3			
4			
5	R-30ci	R-25 + R-11 LS	R-49
6			
7	R-35ci	R-30 + R-11 LS	
8			

ci = Continuous insulation
 LS = Liner system (a continuous membrane installed below the purlins and uninterrupted by framing members; uncompressed, faced insulation rests on top of the membrane between the purlins)

46

Comparison of IECC's various editions

Commercial Buildings (Insulation component R-value-based method)

Climate Zone	IECC 2003	IECC 2006	IECC 2009	IECC 2012*	IECC 2015*	IECC 2018*	IECC 2021*	IECC 2024*
1	R-12 ci	R-15 ci	R-15 ci	R-20 ci	R-20 ci	R-20 ci	R-20ci	R-20ci
2	R-14 ci		R-20ci		R-25 ci	R-25 ci	R-25 ci	R-25ci
3	R-10 ci				R-25 ci	R-25 ci	R-25 ci	R-25ci
4	R-12 ci	R-20 ci	R-20ci	R-25 ci	R-30 ci	R-30 ci	R-30ci	R-30ci
5	R-15 ci							
6	R-11 ci							
7	R-15 ci	R-25 ci	R-25 ci	R-30 ci	R-35 ci	R-35 ci	R-35ci	R-35ci
8								

* Applies to roof replacement projects
ci = continuous insulation

47

C402.4 Roof solar reflectance and thermal emittance. *Low slope roofs* directly above cooled *conditioned spaces* in Climate Zones 0 through 3 shall comply with one or more of the options in Table C402.4.

Exceptions: The following roofs and portions of roofs are exempt from the requirements of Table C402.4:

1. Portions of the roof that include or are covered by the following:
 - 1.1. Photovoltaic systems or components.
 - 1.2. Solar air or water-heating systems or components.
 - 1.3. *Vegetative roofs* or landscaped roofs.
 - 1.4. Above-roof decks or walkways.
 - 1.5. Skylights.
 - 1.6. HVAC systems and components, and other opaque objects mounted above the roof.
2. Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the *building* or by permanent features of adjacent buildings.
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m²) or 23 psf (117 kg/m²) pavers.
4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.

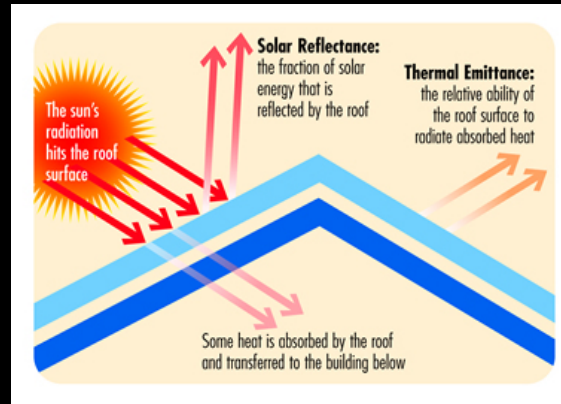
TABLE C402.4—MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS^a

Three-year-aged solar reflectance^b of 0.55 and 3-year aged thermal emittance^c of 0.75

Three-year-aged solar reflectance index^d of 64

- a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with Section C402.4.1 and a 3-year-aged thermal emittance of 0.90.
- b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
- c. Aged thermal emittance tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
- d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft² × °F (12 W/m² × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

48



Courtesy of the Cool Roofs Rating Council

49

Definitions

Solar reflectance: The fraction of solar flux reflected by a surface expressed within the range of 0.00 and 1.00.

Thermal emittance: The ratio of radiant heat flux emitted by a surface to that emitted by a black body radiator at the same temperature expressed within a range of 0.00 to 1.00.

50

Definitions – cont.

Solar reflectance index (SRI): The relative steady-state surface temperature of a surface with respect to the standard white (SRI = 100) and standard black (SRI = 0) under standard solar and ambient conditions.

--ASTM E 1980

51

COMMERCIAL ENERGY EFFICIENCY

C402.6.1.2 Air barrier construction. The continuous air barrier shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that compromise the building thermal envelope and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure differentials such as those from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure. Sealing of concealed fire sprinklers, where required,

C402.6.2 Air leakage compliance. Air leakage of the building thermal envelope shall be tested by an approved third party in accordance with Section C402.6.2.1. The measured air leakage shall not be greater than 0.35 cubic feet per minute per square foot (1.8 L/s x m²) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa) with the calculated building thermal envelope surface area being the sum of the above- and below-grade building thermal envelope.

Exceptions:

1. Where the measured air leakage rate is greater than 0.35 cfm/ft² (1.8 L/s x m²) but is not greater than 0.45 cfm/ft² (2.3 L/s x m²), the approved third party shall perform a diagnostic evaluation using a smoke tracer or infrared imaging. The evaluation shall be conducted while the building is pressurized or depressurized along with a visual inspection of the air barrier in accordance with ASTM E1186. All identified leaks shall be sealed where such sealing can be made without damaging existing building components. A report specifying the corrective actions taken to seal leaks shall be deemed to establish compliance with the requirements of this section where submitted to the code official and the building owner. Where the measured air leakage rate is greater than 0.45 cfm/ft² (2.3 L/s x m²), corrective actions must be made to the building and an additional test completed for which the results are 0.45 cfm/ft² (2.3 L/s x m²) or less.
2. Buildings in Climate Zone 2B.
3. Buildings larger than 25,000 square feet (2323 m²) floor area in Climate Zones 0 through 4, other than Group I and R occupancies, that comply with Section C402.6.2.3.
4. As an alternative, buildings or portions of buildings containing Group I-1 and R-2 occupancies shall be permitted to be tested by an approved third party in accordance with Section C402.6.2.2. The reported air leakage of the building thermal envelope shall not be greater than 0.27 cfm/ft² (1.4 L/s x m²) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa).

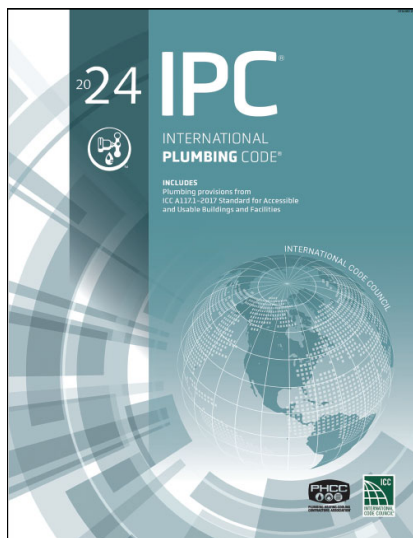
52

C402.6.2.3.1 Materials. Materials with an air permeability not greater than 0.004 cfm/ft²(0.02 L/s × m²) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as *air barriers* in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than $\frac{3}{8}$ inch (10 mm).
2. Oriented strand board having a thickness of not less than $\frac{3}{8}$ inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m³) and having a thickness of not less than $1\frac{1}{2}$ inches (38 mm).
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m³) and having a thickness of not less than 4.5 inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
8. Cement board having a thickness of not less than $\frac{1}{2}$ inch (12.7 mm).
9. Built-up roofing membrane.
10. Modified bituminous roof membrane.
11. Single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $\frac{5}{8}$ inch (15.9 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.
16. Solid or hollow masonry constructed of clay or shale masonry units.

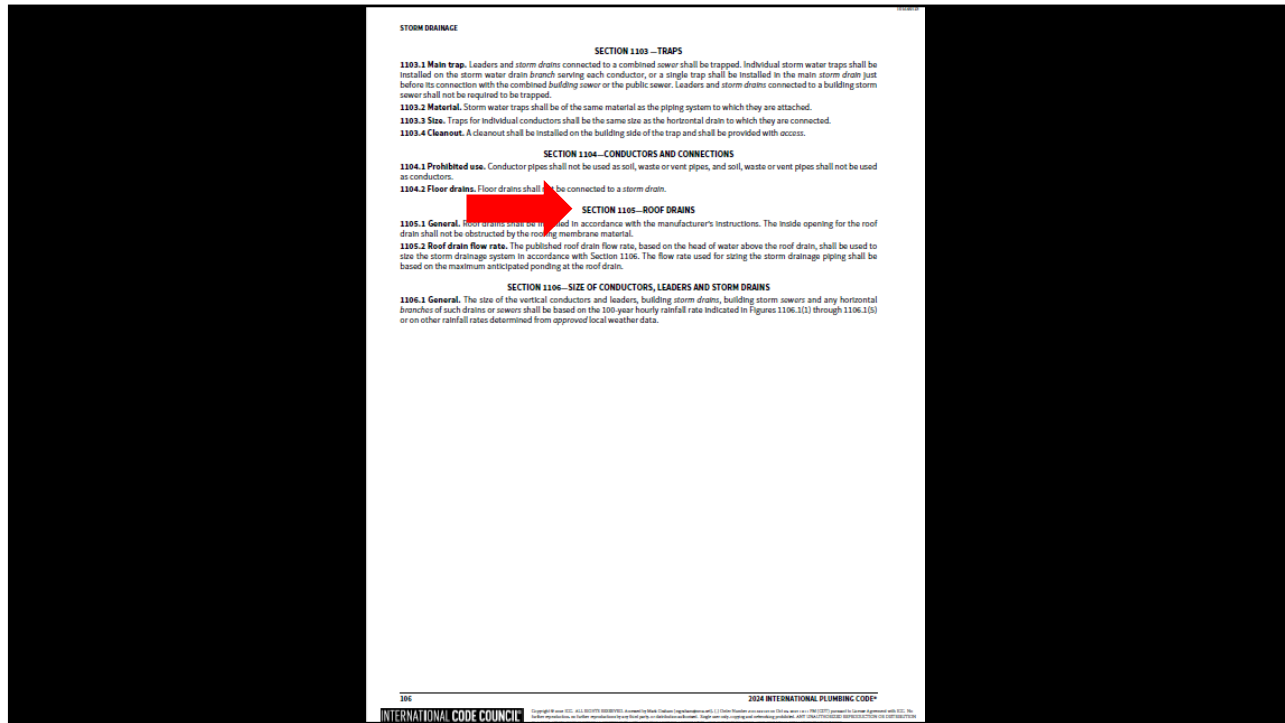
53

International Plumbing Code, 2024 Edition



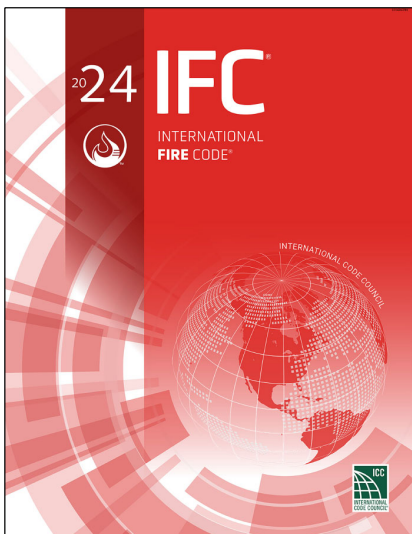
- Applicable to all plumbing systems, except those applicable to IRC 2024
- Roofing-related requirements:
 - Ch. 11-Storm drainage

54



55

International Fire Code, 2024 Edition



Applicability:

- Structures, facilities and conditions
- Existing conditions and operations

56

Roofing-related provisions

International Fire Code, 2024 Edition

- Sec. 303-Asphalt kettles
- Sec. 317-Rooftop gardens
- Sec. 1204-Solar photovoltaic systems
- Sec. 3317-Safeguarding roofing operations

57

*How should we deal with alternatives other than
what is specifically permitted by the Code?*

58

Alternative materials, design and methods of construction and equipment

- IBC 2024, Sec. 104.11
- IRC 2024, Sec. R104.11
- IECC 2024, Sec. C102 and Sec. R102
- IEBC 2024, Sec. 104.11
- IFC 2024, Sec. 104.9
- IPC 2024, Sec. 105.2

59

RESEARCH+TECH



Consider alternatives
Code interpretations, modifications and alternatives provide some code compliance flexibility
by Mark S. Graham

Building codes by their nature tend to be relatively restrictive; they limit design, materials and construction methods to those specifically prescribed in codes and meeting the code's performance requirements. However, most codes also contain provisions that allow code officials to accept, project specific modifications and alternatives to code requirements.

You should be aware of a code's interpretation, modification and alternative acceptance provisions because these may provide a basis for acceptance of roof system designs and roofing products that do not specifically comply with a code's requirements.

Alternative acceptance
In Chapter 1, Scope and Administration of the International Building Code, 2018 Edition, Section 104.10 and Powers of Building Official grants a code official the authority to enforce the code, under interpretations and adopt procedures to clarify the code's provisions. Such interpretations and procedures are not intended to waive code requirements.

Section 104.10-Modifications give a code official authority to

22 www.professionalroofing.net APRIL 2019

Professional Roofing
April 2019

[Link](#)

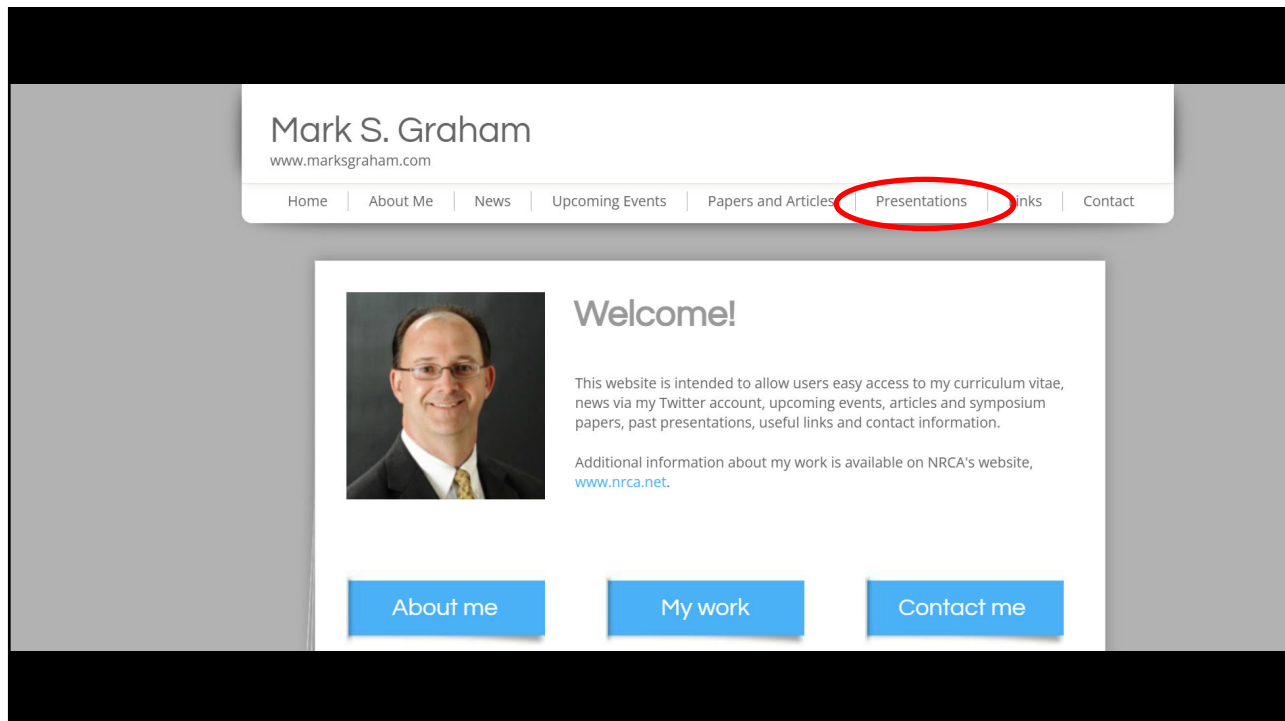
60

Accessing the I-codes

codes.iccsafe.org



61



62

Questions?



Mark S. Graham

Vice President, Technical Services
National Roofing Contractors Association
10255 West Higgins Road, 600
Rosemont, Illinois 60018-5607

(847) 299-9070
mgraham@nrca.net
www.nrca.net

Personal website: www.MarkGrahamNRCA.com
LinkedIn: [linkedin.com/in/MarkGrahamNRCA](https://www.linkedin.com/in/MarkGrahamNRCA)

