Low Slope Roofing Systems
The University of Wisconsin Madison
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Codes and standards

presented by

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

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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).

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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

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TECH TODAY

An ASTM primer

Establishing and maintaining standards for the roofing industry

by Mark S. Graham

ASTM International publishes more than 12,000 standards annually

A majority of the standards that apply within the roofing industry are developed by ASTM International. Although you most likely are aware of the "ASTM" designation, you may not be aware of how the organization operates and the different types of standards it develops and maintains.

Overview

ASTM International is a globally recognized leader in the development and delivery of voluntary consensus standards. ASTM International publishes more than 12,000 standards annually used around the world to establish product quality levels, enhance health and safety, facilitate market access and trade, and establish consumer confidence.

ASTM International has no technical research or testing facilities of its own. Instead, the organization relies on its members—more than 30,000 of the world's top technical experts and business professionals from more than 140 countries—and facilitates the process and provides venues for carrying out its mission.

ASTM International's standards development and maintenance activities are carried out by more than 140 ASTM technical committees. For example, its Committee D08 on Roofing and Waterproofing is responsible for a majority of ASTM's roofing-related standards. Committee C16 on Thermal Insulation, Committee E05 on Fire Standards and Committee E06 on Performance of Buildings address roofing-related thermal insulation, fire testing and performance issues, respectively.

Standards

ASTM International committees can develop four types of standards.

Test method standards define a specific method or series of methods for testing a material or product attribute. For example, ASTM D228, "Standard Test Methods for Sampling, Testing, and Analysis of Asphalt Roll Roofing, Cap Sheets, and Shingles Used in Roofing and Waterproofing," defines test methods for asphalt shingles, roll roofing and cap sheets.

Specification standards describe specific materials, products, systems or services and routinely include requirements for testing using ASTM international standard test methods. For example, ASTM D3462, "Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules," is the U.S. product standard defining fiberglass-reinforced asphalt shingles.

A standard practice is an accepted procedure for the performance of one or more operations or functions. In some cases, practices may include one or more test methods necessary for full use of the practice. For example, ASTM D7186, "Standard Practice for Quality Assurance Observation of Roof Construction and Repair," is the recognized consensus method for performing and reporting rooftop quality assurance observation during roof system application.

A standard guide is a compendium of information or series of options that does not recommend a specific course of action. Guides are intended to increase the awareness of information and approaches in a given subject area. Guides may propose a series of options or instructions that offer direction without recommending a definite course of action. A guide standard offers guidance based on a consensus of viewpoints but not to establish a standard practice to follow in all cases. For example, ASTM D7877, "Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes," provides commentary regarding electrical conductance testing of waterproofing membranes but does not provide specific practice or test method information.

ASTM International test methods, specifications and practice standards are appropriate to be referenced in project specifications, contracts and building codes. Because of their "information only" nature, ASTM International guide specifications are not.

Participation

A large number of NRCA member companies and, in some cases, individual company personnel are members of ASTM International, and many of them participate in various ASTM committees.

NRCA's Technical Services Section's staff members also are members of various ASTM technical committees. For example, I am a member of Committee C15 on Manufactured Masonry Units, C16, D08, E05 and E06. I also serve on the Executive Committee for Committee D08.

Additional information regarding ASTM International is available at www.astm.org. If you are not already an ASTM member, I encourage you to consider joining and participating in one or more of ASTM's technical committees.

MARK S. GRAHAM is NRCA's vice president of technical services.

12 www.professionalroofing.net NOVEMBER 2016

ASTM

Professional Roofing, Nov. 2016

Link

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Consider becoming an ASTM member…

www.astm.org

Most roofing-related standards are developed/maintained by Committee D08. Most roofing-related standards are contained in Vol. 4.04

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The purpose of the code

International Building Code, 2021 Edition

[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.

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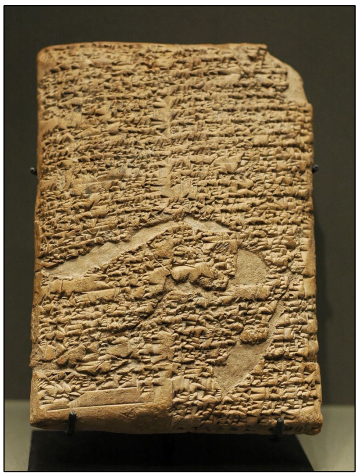
Code of Hammurabi

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



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Some background

Building code and standards in roofing

- The I-codes are "model codes" developed by the International Code Council (ICC)
- 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)
- Code enforcement occurs at the time of installation and occupancy/use
- The code can also provide a basis for construction claims-related litigation

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Code enforcement

- Code official
- Construction litigation

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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 & Siegel, PC

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Who is responsible?

- The building owner
- And, everyone else involved

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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.

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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…

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So, it pays to know...

or it can cost you if you don't know.

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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*
- International Conference of Building Officials
  - *Uniform Building Code*

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2021 I-codes

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I-code publication cycle

- 2000 edition
- 2003 edition
- 2006 edition
- 2009 edition
- 2012 edition
- 2015 edition
- 2018 edition
- 2021 edition
- 2024 edition (Development finalized; being published)

Three-year code development and publication cycle

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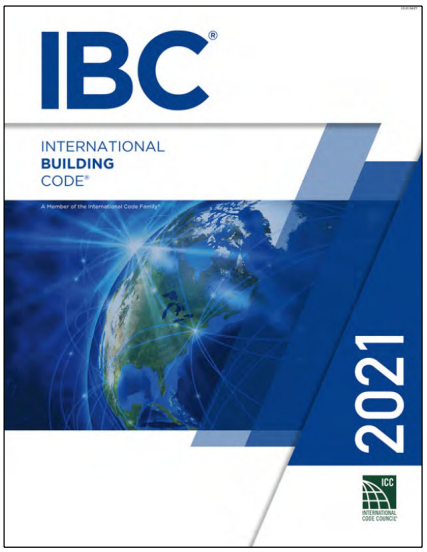
International Building Code, 2018 Edition



- Applicable to all buildings and structures, excepts those applicable to IRC 2021
- Roofing-related requirements:
  - Ch. 10-Means of egress
  - Ch. 12-Interior environment
  - Ch. 13-Energy efficiency
  - Ch. 15-Roof assemblies and rooftop structures
  - Ch. 16-Structural design
  - Ch. 20-Aluminum
  - Ch. 22-Steel
  - Ch. 24-Glass and glazing
  - Ch. 26-Plastic

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Significant roof requirements

International Building Code, 2021 Edition

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

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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], [BG] or [P] will be considered by one of the code development committees meeting during the 2021 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.*

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 Scuppers. Where *scuppers* are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the *scuppers* shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. *Scuppers* shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing *scuppers*.

1502.4 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

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 installed in accordance with the manufacturer's installation instructions. 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 705.11 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 705.11 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 shall be provided in accordance with Section 1202.2 and the vent product manufacturer's installation instructions.

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.

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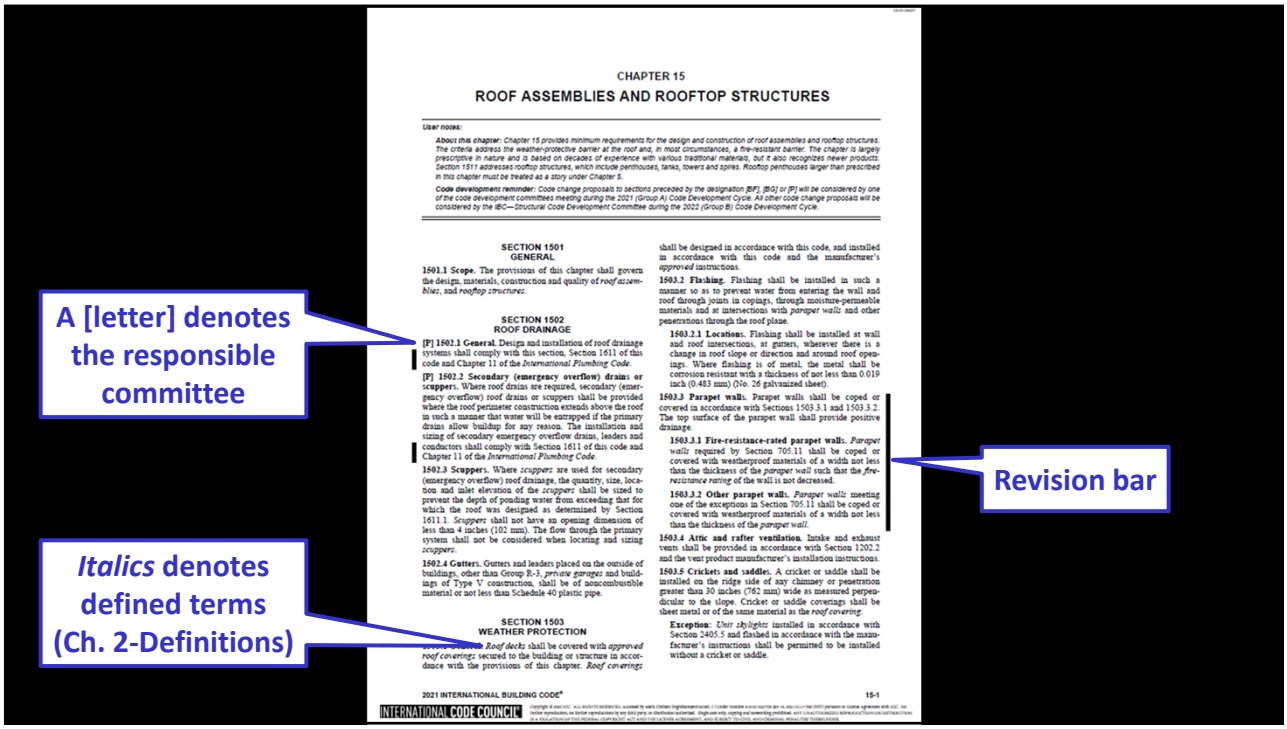
A [letter] denotes the responsible committee
Italics denotes defined terms (Ch. 2-Definitions)
Revision bar
CHAPTER 15
ROOF ASSEMBLIES AND ROOFTOP STRUCTURES
SECTION 1501
GENERAL
SECTION 1502
ROOF DRAINAGE
SECTION 1503
WEATHER PROTECTION
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INTERNATIONAL CODE COUNCIL

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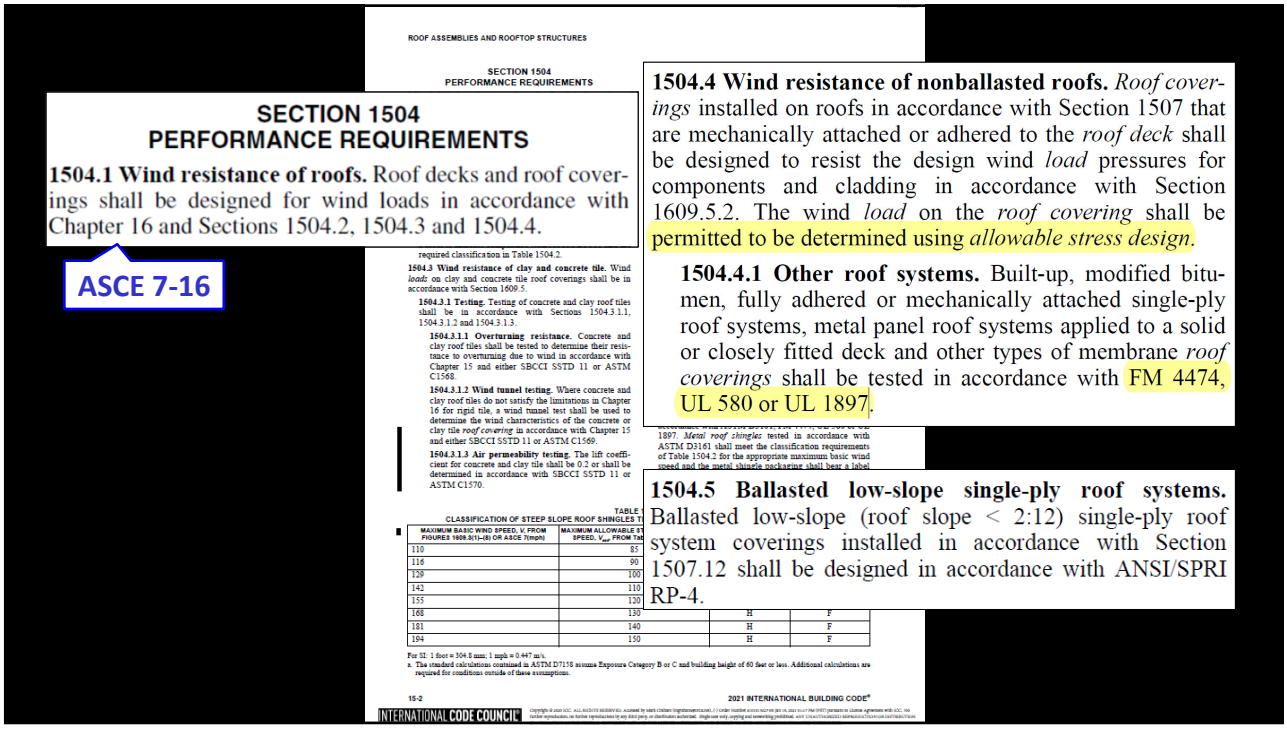
SECTION 1504
PERFORMANCE REQUIREMENTS
1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.
ASCE 7-16
1504.4 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance 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 1609.5.2. 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.
1504.5 Ballasted low-slope single-ply roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

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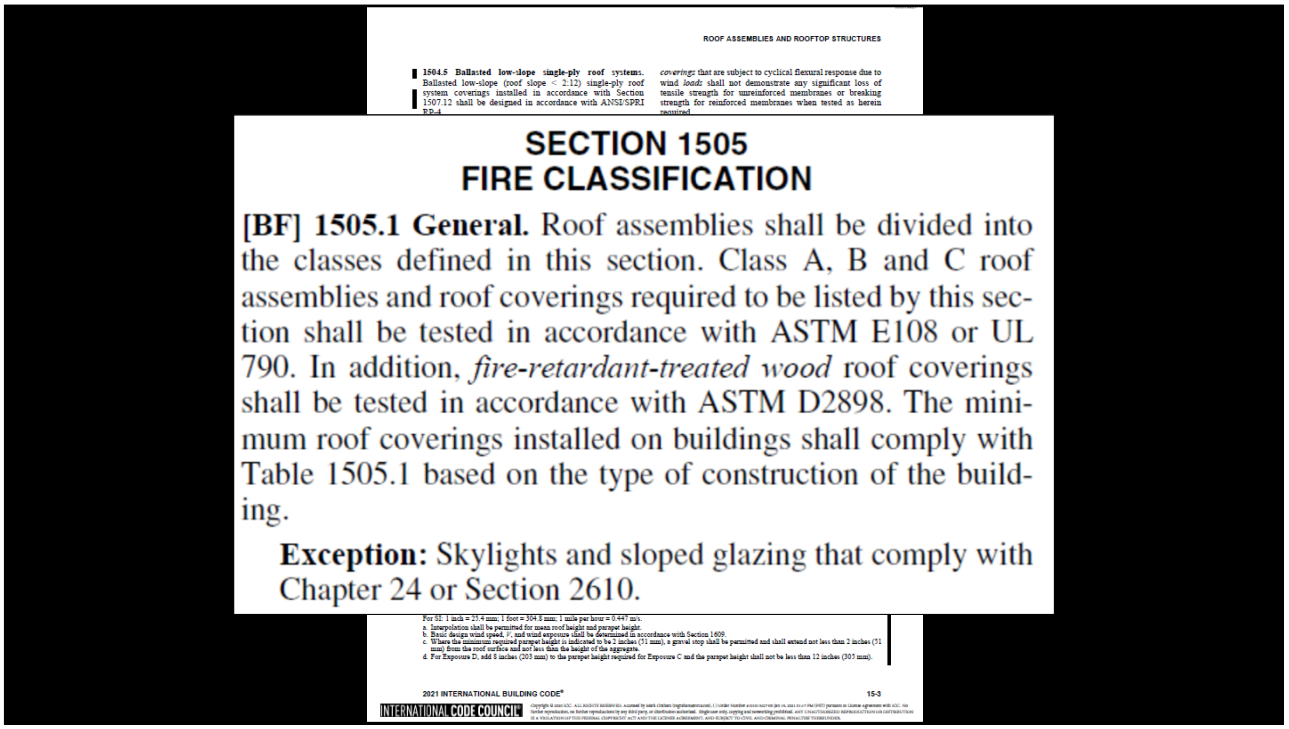
ROOF ASSEMBLIES AND ROOFTOP STRUCTURES
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coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.
SECTION 1505
FIRE CLASSIFICATION
[BF] 1505.1 General. Roof assemblies shall be divided into the classes defined in this section. 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. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.
Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.
For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.
a. Interpolation shall be permitted for mean roof height and parapet height.
b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.
c. 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.
d. For Exposure D, add 5 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).
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15-3
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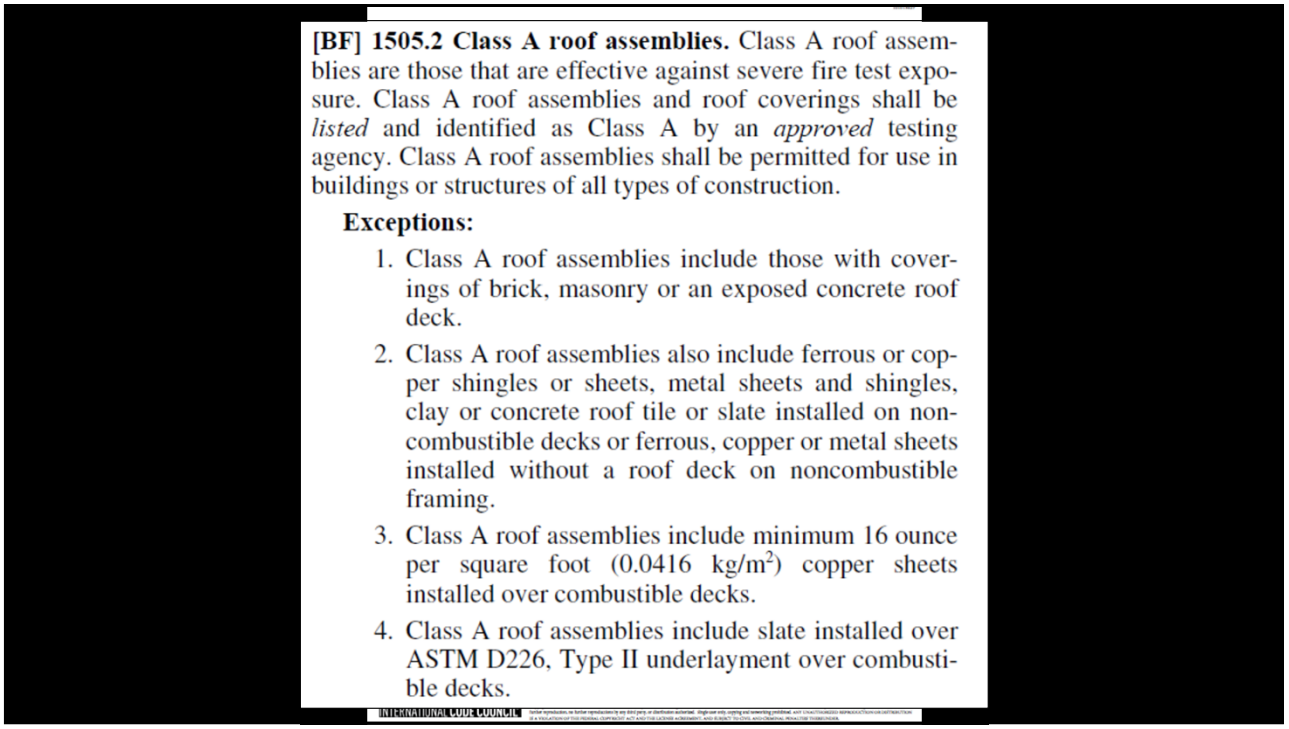
[BF] 1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings 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/m^2) copper sheets installed over combustible decks.
4. Class A roof assemblies include slate installed over ASTM D226, Type II underlayment over combustible decks.
INTERNATIONAL CODE COUNCIL

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TABLE 1505.1[a, b]
MINIMUM ROOF COVERING CLASSIFICATION FOR TYPES OF CONSTRUCTION

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 m^2.

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 R-3 and 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.

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TABLE 1505.1
MINIMUM ROOF COVERING
CLASSIFICATION FOR TYPES OF CONSTRUCTION[a, b]

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[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/m^2) copper sheets installed over combustible decks.
4. Class A *roof assemblies* include slate installed over ASTM D226, Type II *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 AWPA C1. Each bundle shall be marked to identify the manufactured 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 application requirements of Section 1507.8 or 1507.9. In addition, an *underlayment* of $^{1}/_{4}$-inch (15.9 mm) Type X water-resistant gypsum backing board or *gypsum sheathing* shall be placed under minimum nominal $^{1}/_{2}$-inch-thick (12.7 mm) *wood structural panel* solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

[BF] 1505.8 Building-integrated photovoltaic (BIPV) products. *BIPV products* 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 roofs. Landscaped roofs shall comply with Sections 1505.1 and 1507.15 and shall be installed in accordance with ANSI/SPRI VF-1.

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.

SECTION 1507
REQUIREMENTS FOR ROOF COVERINGS

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 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 *photovoltaic*

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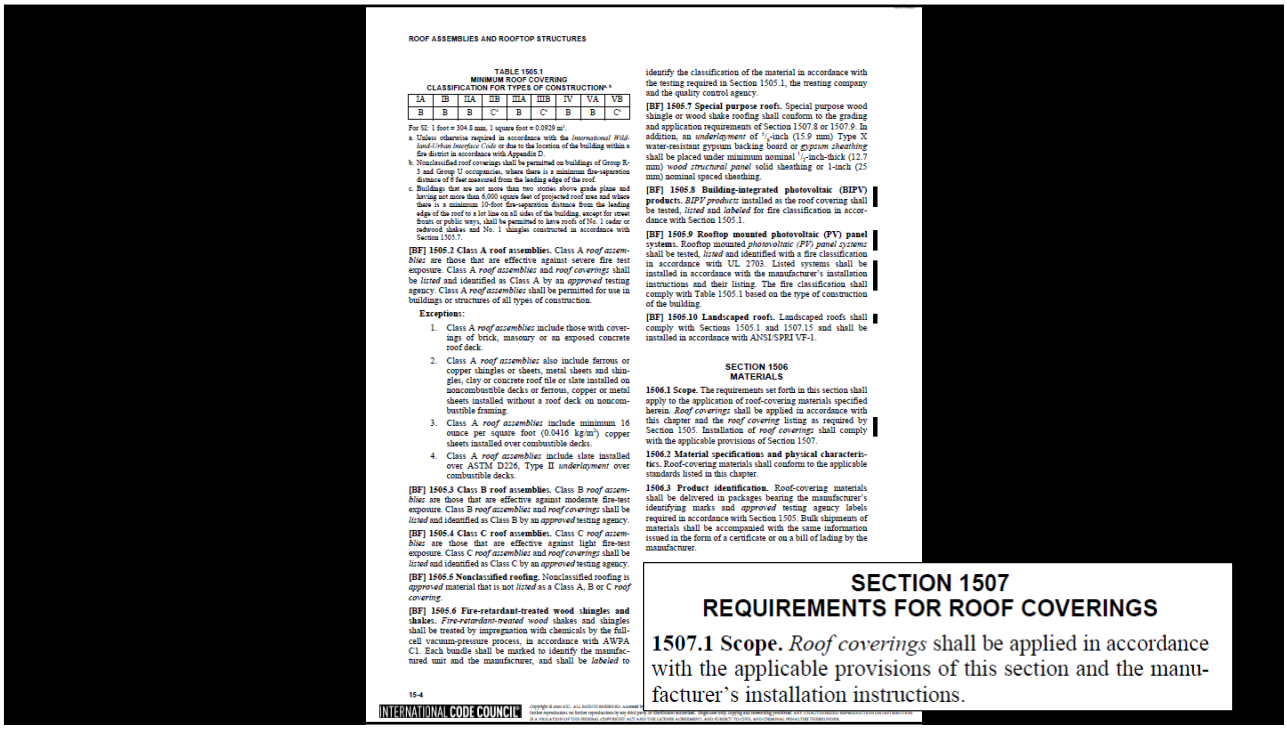

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

TABLE 1505.1
MINIMUM ROOF COVERING
CLASSIFICATION FOR TYPES OF CONSTRUCTION[a, b]

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

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b. Nonclassified roof coverings shall be permitted on buildings of Group R-3 and 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 *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 AWPA C1. Each bundle shall be marked to identify the manufactured 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 application requirements of Section 1507.8 or 1507.9. In addition, an *underlayment* of ⁵/₈-inch (15.9 mm) Type X water-resistant gypsum backing board or *gypsum sheathing* shall be placed under minimum nominal ½-inch-thick (12.7 mm) *wood structural panel* solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

[BF] 1505.8 Building-integrated photovoltaic (BIPV) products. *BIPV products* 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 roofs. Landscaped roofs shall comply with Sections 1505.1 and 1507.15 and shall be installed in accordance with ANSI/SPRI VF-1.

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.

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SECTION 1507
REQUIREMENTS FOR ROOF COVERINGS

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

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Roof system types

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
- Single-ply roofing
- Spray polyurethane foam
- Liquid-applied roofing
- Vegetative roofs, roof gardens and landscaped roofs
- Photovoltaic shingles
- Building-integrated photovoltaic roof panels

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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 $^1/_4$ unit vertical in 12 units horizontal (2-percent slope) for drainage.

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 (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.5. Stone used as *ballast* shall comply with ASTM D448 or ASTM D7655.

Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

1507.13.4 Foam plastics. Foam plastic materials and installation shall comply with Chapter 26.

1507.14 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.14.1 Slope. Liquid-applied roofing shall have a design slope of not less than $^1/_4$ unit vertical in 12 units horizontal (2-percent slope).

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.14.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, ASTM C957 or ASTM D3468.

1507.15 Vegetative roofs and landscaped roofs. *Vegetative roofs* and landscaped roofs shall comply with the requirements of this chapter, Section 1607.14.2.2 and the *International Fire Code*.

[BF] 1507.15.1 Structural fire resistance. The structural frame and roof construction supporting the load imposed on the roof by the *vegetative roof* or landscaped roofs shall comply with the requirements of Table 601.

1507.16 Photovoltaic shingles. The installation of *photovoltaic shingles* shall comply with the provisions of this section.

1507.16.1 Deck requirements. *Photovoltaic shingles* shall be applied to a solid or closely fitted deck, except where the shingles are specifically designed to be applied over spaced sheathing.

1507.16.2 Deck slope. *Photovoltaic shingles* shall be installed on roof slopes of not less than 2 units vertical in 12 units horizontal (2:12).

1507.16.3 Underlayment. *Underlayment* shall comply with Section 1507.1.1.

1507.16.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.16.5 Fasteners. Fasteners for *photovoltaic shingles* shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gage [0.105 inch (2.67 mm)] shank with a minimum $^3/_8$-inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and not less than $^3/_4$ inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than $^3/_4$ inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F1667.

1507.16.6 Material standards. *Photovoltaic shingles* shall be *listed* and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.16.7 Attachment. *Photovoltaic shingles* shall be attached in accordance with the manufacturer's installation instructions.

1507.16.8 Wind resistance. *Photovoltaic shingles* shall comply with the classification requirements of Table 1504.2 for the appropriate maximum nominal design wind speed.

1507.17 Building-integrated photovoltaic roof panels. The installation of building-integrated photovoltaic (*BIPV*) roof panels shall comply with the provisions of this section.

1507.17.1 Deck requirements. *BIPV* roof panels shall be applied to a solid or closely fitted deck, except where the *roof covering* is specifically designed to be applied over spaced sheathing.

1507.17.2 Deck slope. BIPV roof panels shall be used only on roof slopes of 2 units vertical in 12 units horizontal (2:12) or greater.

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.17.3 Underlayment. *Underlayment* shall comply with ASTM D226, ASTM D4869 or ASTM D6757.

1507.17.4 Underlayment application. *Underlayment* shall be applied *shingle fashion*, parallel to and starting from the eave, lapped 2 inches (51 mm) and fastened sufficiently to hold in place.

1507.17.4.1 High-wind attachment. *Underlayment* applied in areas subject to high winds [V_{asd} greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied in accordance with the manufacturer's instructions. Fasteners shall be applied along the overlap at not more than 36 inches (914 mm) on center. *Underlayment* installed where V_{asd} is not less than 120 mph (54 m/s) shall comply with ASTM D226, Type III, ASTM D4869, Type IV or ASTM D6757. The *underlayment* shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. The *underlayment* shall be applied in accordance with Section 1507.1.1 except all laps shall be not less than 4 inches (102 mm). *Underlayment* shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (0.89 mm). The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Staple gage shall be not less than 21 gage [0.0.2 inch (0.81 mm)]. Cap nail shank and cap staple legs shall have a length sufficient to penetrate through-the-roof sheathing or not less than $^3/_4$ inch (19.1 mm) into the roof sheathing.

Exception: As an alternative, adhered *underlayment* complying with ASTM D1970 shall be permitted.

1507.17.4.2 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a back-up of water, an ice barrier consisting of not fewer than two layers of *underlayment* cemented together or of a self-adhering polymer modified bitumen sheet shall be used instead of normal *underlayment* and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the *exterior wall* line of the building.

Exception: Detached accessory structures that do not contain conditioned floor area.

1507.17.5 Material standards. BIPV roof panels shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.17.6 Attachment. *BIPV* roof panels shall be attached in accordance with the manufacturer's installation instructions.

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.

[BF] TABLE 1508.2
MATERIAL STANDARDS FOR ROOF INSULATION

Cellular glass board	ASTM C552
Composite boards	ASTM C1289, Type III, IV, V or VII
Expanded polystyrene	ASTM C578
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

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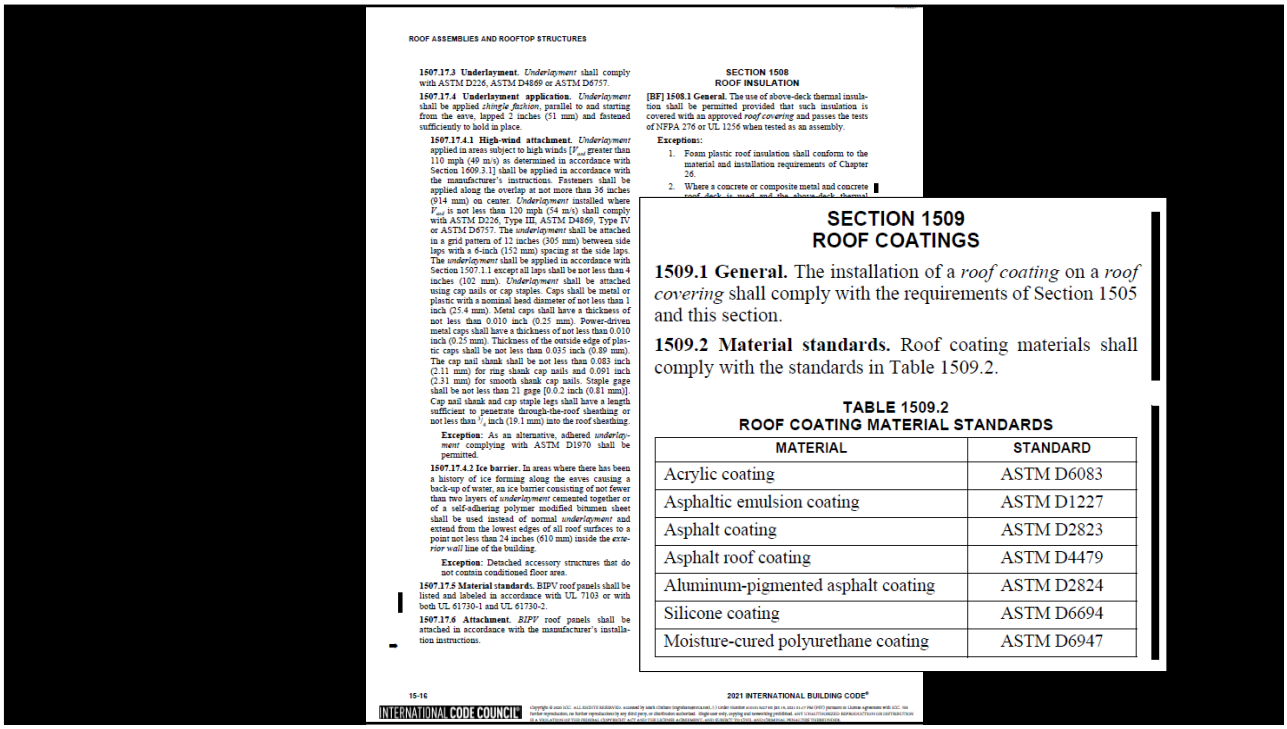

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.17.3 Underlayment. *Underlayment* shall comply with ASTM D226, ASTM D4869 or ASTM D6757.

1507.17.4 Underlayment application. *Underlayment* shall be applied *shingle fashion*, parallel to and starting from the eave, lapped 2 inches (51 mm) and fastened sufficiently to hold in place.

1507.17.4.1 High-wind attachment. *Underlayment* applied in areas subject to high winds [V_{asd} greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied in accordance with the manufacturer's instructions. Fasteners shall be applied along the overlap at not more than 36 inches (914 mm) on center. *Underlayment* installed where V_{asd} is not less than 120 mph (54 m/s) shall comply with ASTM D226, Type III, ASTM D4869, Type IV or ASTM D6757. The *underlayment* shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. The *underlayment* shall be applied in accordance with Section 1507.1.1 except all laps shall be not less than 4 inches (102 mm). *Underlayment* shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (0.89 mm). The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Staple gage shall be not less than 21 gage [0.0.2 inch (0.81 mm)]. Cap nail shank and cap staple legs shall have a length sufficient to penetrate through-the-roof sheathing or not less than $^{3}/_{4}$ inch (19.1 mm) into the roof sheathing.

Exception: As an alternative, adhered *underlayment* complying with ASTM D1970 shall be permitted.

1507.17.4.2 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a back-up of water, an ice barrier consisting of not fewer than two layers of *underlayment* cemented together or of a self-adhering polymer modified bitumen sheet shall be used instead of normal *underlayment* and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the *exterior wall* line of the building.

Exception: Detached accessory structures that do not contain conditioned floor area.

1507.17.5 Material standards. BIPV roof panels shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.17.6 Attachment. *BIPV* roof panels shall be attached in accordance with the manufacturer's installation instructions.

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

SECTION 1509
ROOF COATINGS

1509.1 General. The installation of a *roof coating* on a *roof covering* shall comply with the requirements of Section 1505 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

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Asphaltic emulsion coating	ASTM D1227
Asphalt coating	ASTM D2823
Asphalt roof coating	ASTM D4479
Aluminum-pigmented asphalt coating	ASTM D2824
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

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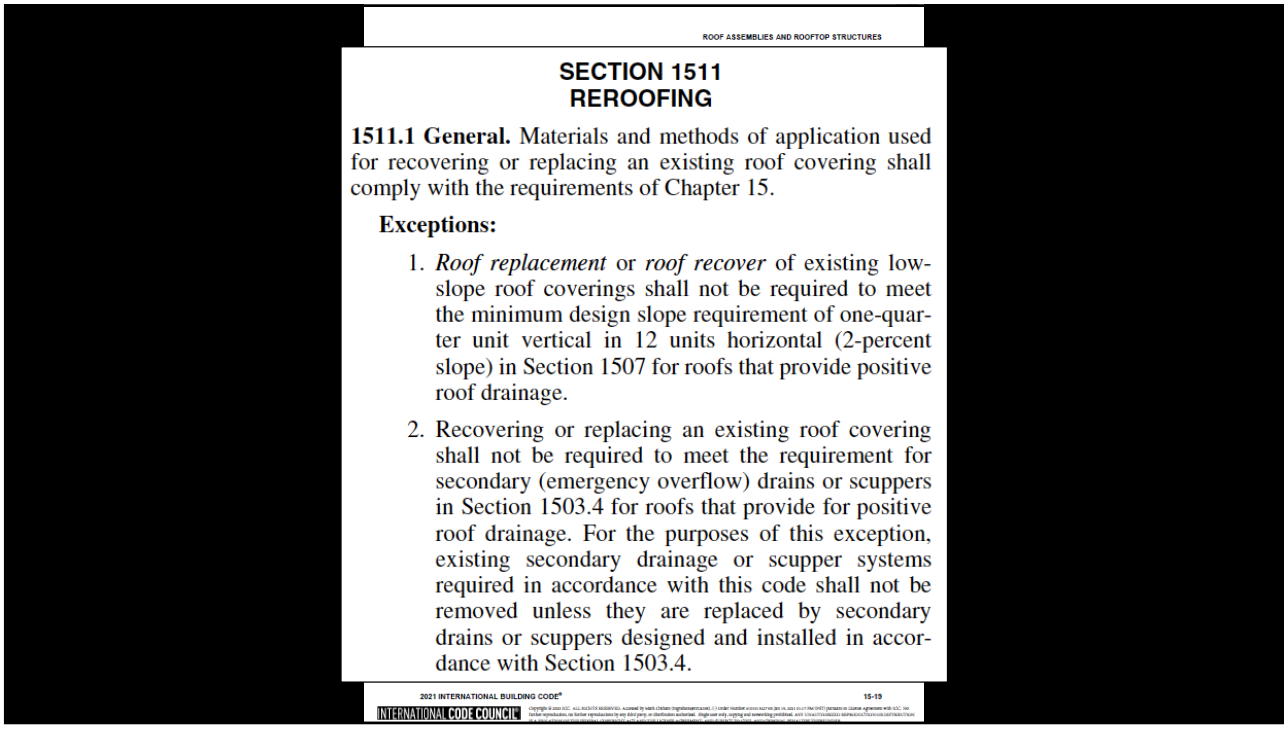

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1511
REROOFING

1511.1 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 one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
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 1503.4 for roofs that provide for positive roof drainage. 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 1503.4.

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1511.3 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, 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.

1511.3.1 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 1511.4.

Continued…

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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.

1511.3.1.1 Exceptions. A *roof recover* shall not be permitted where any of the following conditions occur:

1. Where 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. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

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Wisconsin has some notable modifications in their adoption of the I-codes

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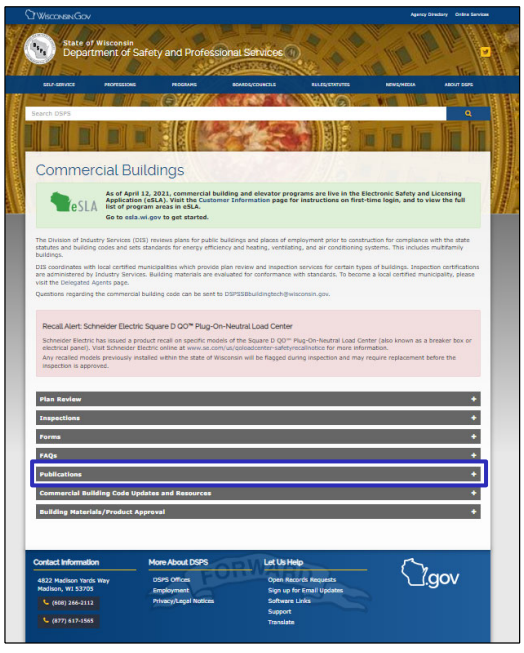

State of Wisconsin
Dept. of Safety and Professional Service
dsps.wi.gov

Link

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Insert pages for May 1, 2018 Wisconsin Commercial Building Code, SPS 361 – SPS 366, into the International Building Code, 2015 Edition

Wisconsin Department of Safety and Professional Services- Division of Industry Services

IBC Chapter 15, Insert 15D, Page 1 of 1

Insert between pages 336 and 337

SPS 362.1507 Roof slope.
(1) This is a department exception to the requirements in IBC section 1507.12.1: Thermo- set single–ply membrane roofs may have a design slope of less than 2 percent, if permitted by the manufacturer's literature or listing criteria.
(2) This is a department exception to the requirements in IBC section 1507.13.1: Thermoplastic single–ply membrane roofs may have a design slope of less than 2 percent, if permitted by the manufacturer's literature or listing criteria.
(3) This is a department exception to the requirements in IBC section 1507.14.1: Sprayed polyurethane foam roofs may have a design slope of less than 2 percent, if permitted by the manufacturer's literature or listing criteria.
(4) This is a department exception to the requirements in IBC section 1507.15.1: Liquid–applied roofs may have a design slope of less than 2 percent, if permitted by the manufacturer's literature or listing criteria.

Link to IBC insert pages
Wisc. Commercial Building Code

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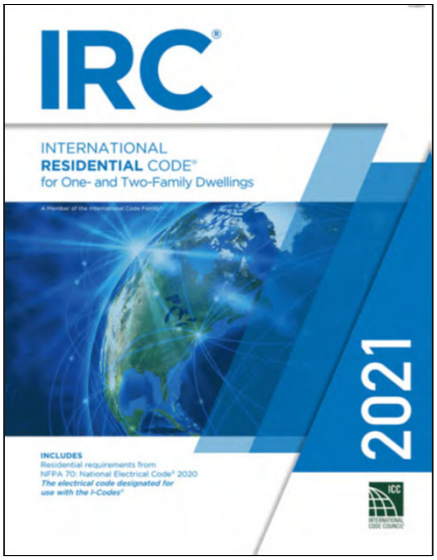
International Residential Code, 2021 Edition



- 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

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Ch. 9-Roof assemblies

International Residential Code, 2021 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

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Roof requirements:

Ch. 11: Storm drainage

- Roof drains
- Overflow drains
- Gutters and downspouts

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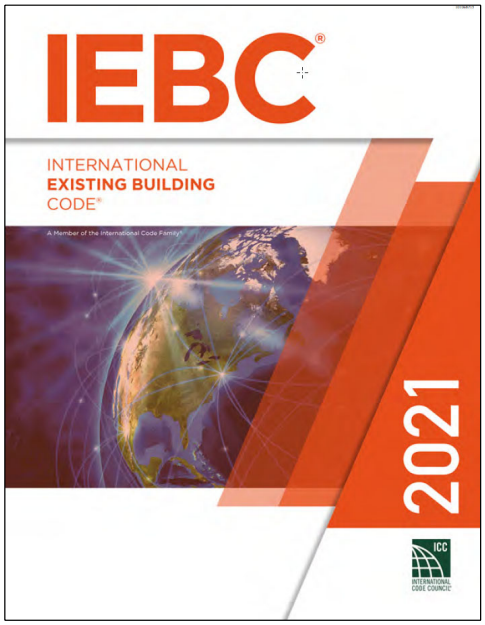

Roof requirements:

Ch. 7-Alterations-Level 1

- Sec. 705-Reroofing (IBC 2021)
- Sec. 706-Structural
  - Increased dead, live or snow loads
  - Unreinforced masonry parapets
  - Roof diaphragms

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Roof requirements:

- Sec. 303-Asphalt kettles
- Sec. 317-Landscape roofs
- Sec. 1205-Solar PV power systems
- Sec. 3318-Roofing operations

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How should I deal with alternatives to what is permitted by the Code?

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Alternative materials, design and methods of construction and equipment

- IBC 2021, Sec. 104.11
- IRC 2021, Sec. R104.11
- IECC 2021, Sec. C102 and Sec. R102
- IPC 2021, Sec. 105.2
- IEBC 2021, Sec. 104.11
- IFC 2021, Sec. 104.10

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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 designs, materials and construction methods to those specifically prescribed in codes and meeting the codes' performance requirements. However, most codes also contain provisions that allow code officials to accept limited, project-specific modifications and alternatives to code requirements.

You should be aware of a code's interpretation, modification and alternative acceptance provisions because those 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-Duties and Powers of Building Official grants a code official the authority to enforce the code, render 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 gives a code official authority to

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Code compliance is becoming increasingly challenging and presents significant liability risks

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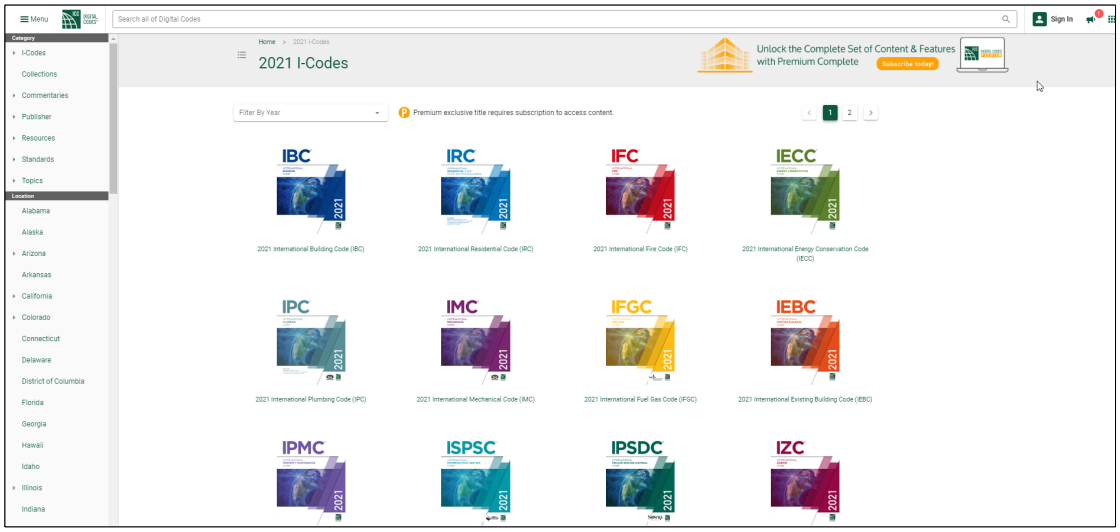
Added content

Viewing the codes

codes.iccsafe.org



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Questions

Codes and standards

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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

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