

Building Codes in Roofing

Based on the 2018 I-codes

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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.

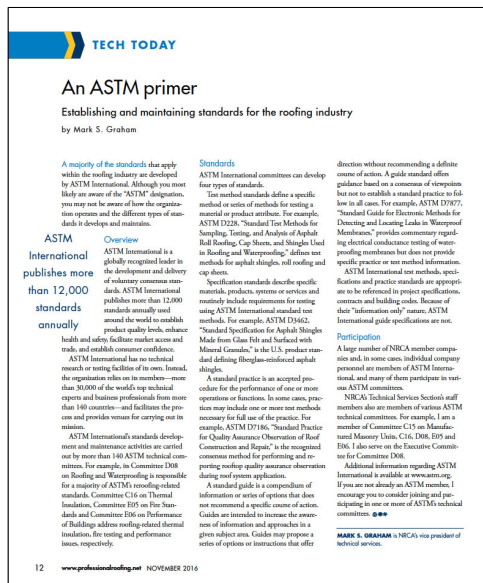
Code: 1) a body of laws, as a nation, city, etc., arranged systematically for easy reference; 2) any set of principles or rules of conduct (e.g., the moral code).

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

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4

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

5

The purpose of the code

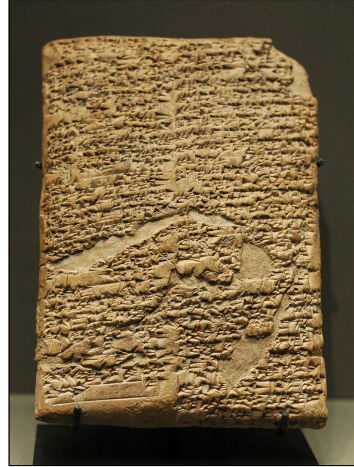
International Building Code, 2018

[A] 101.3 Intent. The purpose of this code is to establish the minimum requirements to provide a reasonable level of safety, public health and general welfare through structural strength, *means of egress* facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire, explosion and other hazards, 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
- “...an eye for an eye, a tooth for a tooth...”
- Specific provisions to construction and contracts



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

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

9



Code enforcement

- Code official
- Construction litigation



10

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

11

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, statutes, 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.

12

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13

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...

14

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15



16

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

17

International Building Code, 2018 Edition



- Applicable to all buildings and structures, excepts those applicable to IRC 2018
- 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

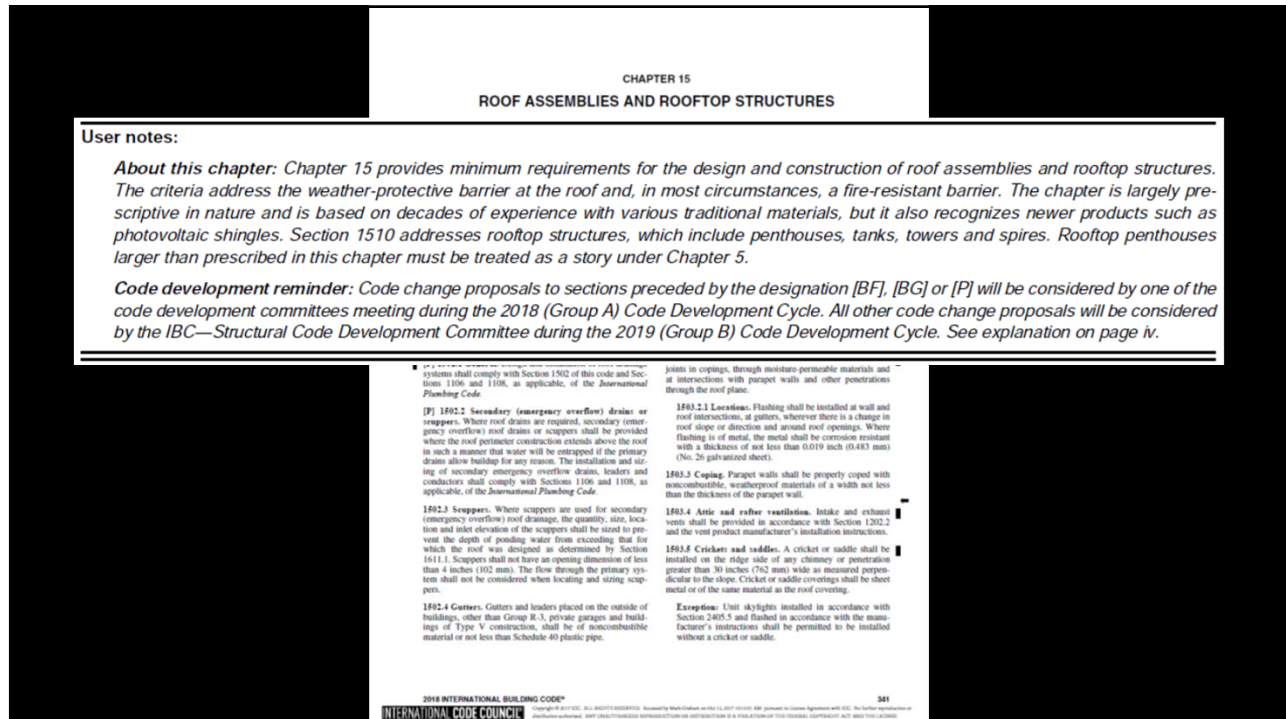
18

Significant roof requirements

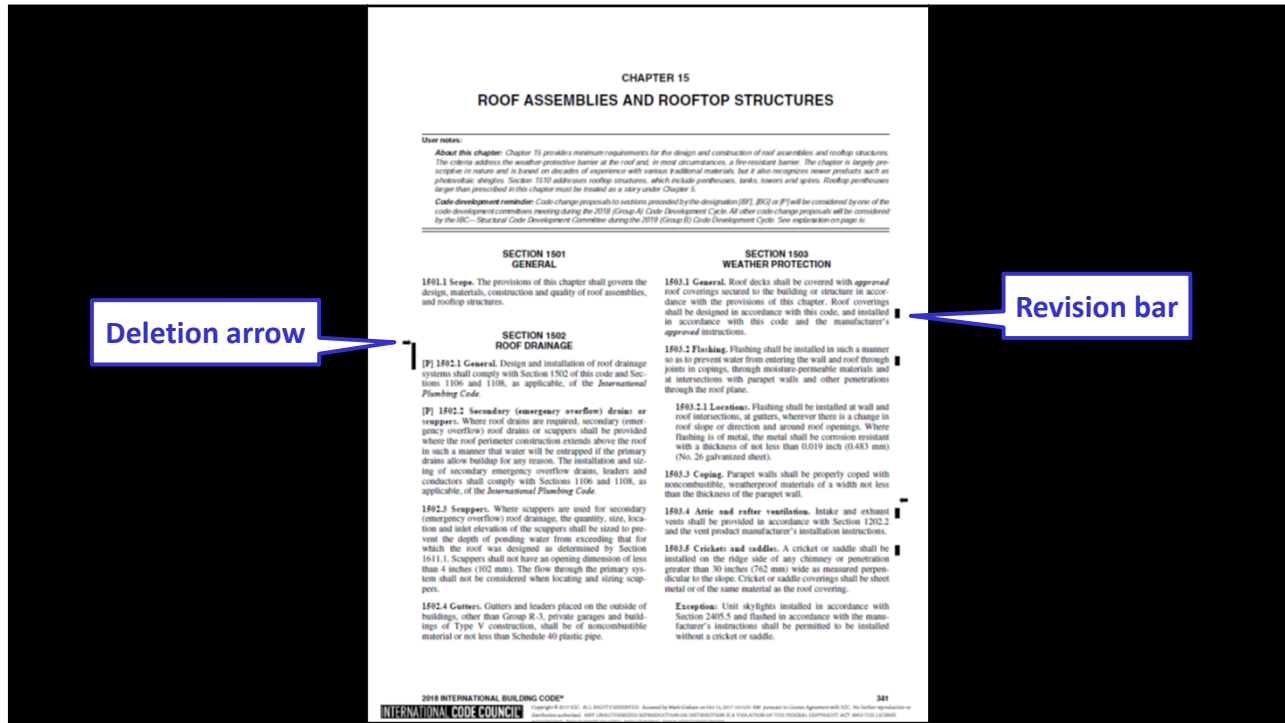
International Building Code, 2018 Edition, Chapter 15-Roof Assemblies and Rooftop Structures

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

19



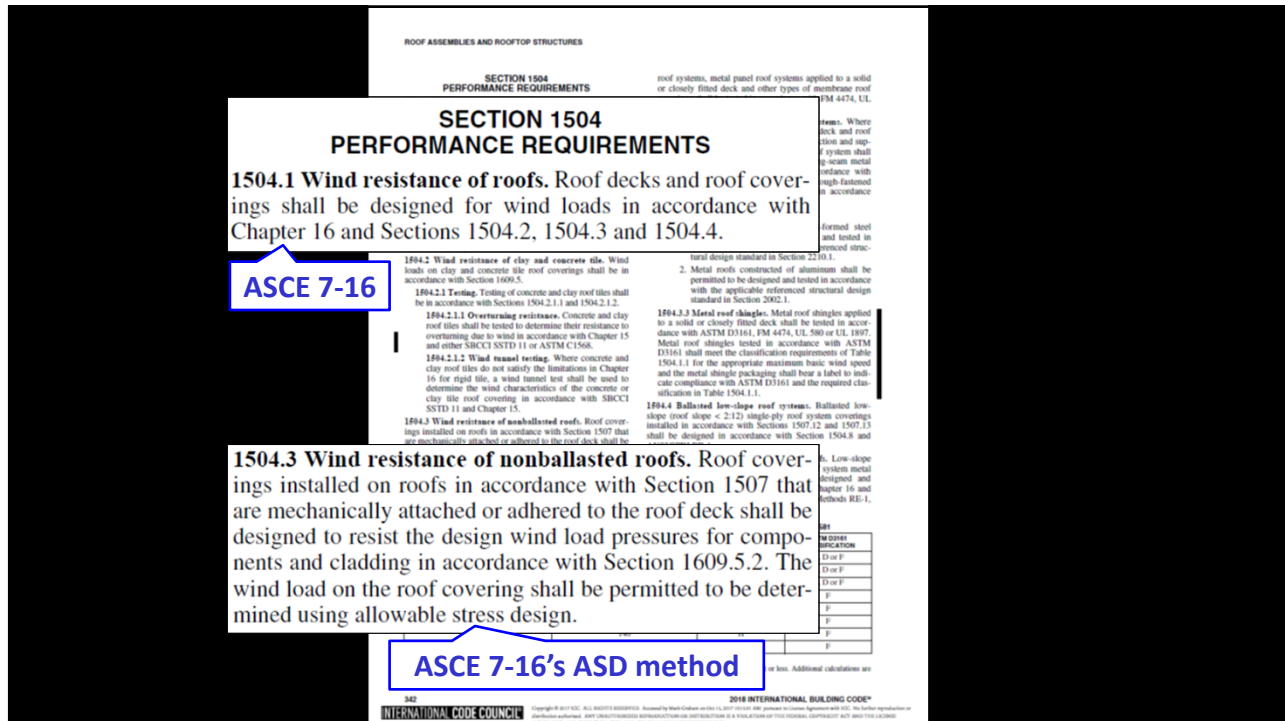
20



Deletion arrow

Revision bar

21



ASCE 7-16

ASCE 7-16's ASD method

22

1504.1.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table 1504.1.1 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 1504.1.1.

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 1504.1.1.

TABLE 1504.1.1
CLASSIFICATION OF STEEP SLOPE ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161 OR D7158¹

| MAXIMUM BASIC WIND SPEED, V, FROM FIGURES 1609.3(1)-(8) OR ASCE 7 (mph) | MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V _{MSD} , FROM TABLE 1609.3.1 (mph) | ASTM D7158 ² CLASSIFICATION | ASTM D3161 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.

23

RE-2 and RE-3 of ANSIS/SPRI ES-1, except basic design wind speed, F, shall be determined from Figure 1609.3(1).

SECTION 1505
FIRE CLASSIFICATION

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.

value of F_{MSD} shall be used, or direct interpolation is permitted.
c. NP = gravel and stone are permitted for any roof height.
d. F_{MSD} shall be determined in accordance with Section 1609.3.1.

Note: In a minimum, 100-foot fire-resistance duration from the leading edge of the roof to a fire line on all sides of the building, except for stairs, ramps or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shingles and No. 1 shingles constructed in accordance with Section 1505.7.

24

[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 non-combustible 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.

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25

**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 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 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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26

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design wind speed, V_f shall be determined from Figures 1609.3(1) through 1609.3(8) as applicable.

1604.6 Physical properties. Roof coverings installed on low-slope roofs (roof slope $\leq 2:12$) in accordance with Section 1507 shall demonstrate physical integrity over the working life of the roof based on 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G152, ASTM G154 or ASTM G155. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for membrane membranes or breaking strength for reinforced membranes when tested as herein required.

1604.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope $< 2:12$) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272 or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470.

1604.8 Surfacing and ballast materials in hurricane-prone regions. For a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site, the following materials shall not be used on the roof:

1. Aggregate used as surfacing for roof coverings.
2. Aggregate, gravel or stone used as ballast.

**TABLE 1604.8
MAXIMUM ALLOWABLE MEAN ROOF HEIGHT
PERMITTED FOR BUILDINGS WITH AGGREGATE ON THE
ROOF IN AREAS OUTSIDE A HURRICANE-PRONE REGION**

| NORMAL DESIGN WIND SPEED, V_w (mph) ^a | Exposure category | |
|--|-------------------|-----|
| | 1 | 2 |
| 65 | 100 | 105 |
| 90 | 110 | 115 |
| 95 | 115 | 120 |
| 100 | 120 | 125 |
| 110 | 130 | 135 |
| 115 | 135 | 140 |
| 120 | 140 | 145 |
| Greater than 120 | 145 | 150 |

For SF: 1 foot = 304.8 mm, 1 inch = 25.4 mm
 a. Mean roof height as defined in Section 202.
 b. For intermediate values of V_w , the value of H_m shall be interpolated.
 c. V_w is a ground-surface mean wind speed.
 d. V_w shall be determined in accordance with Section 1609.3.

**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 D2098. 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 2910.

[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.

Exception:

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 on noncombustible decks.
4. Class A roof assemblies include slate installed over ASTM D226, Type II underlayment over combustible framing.

[BF] 1505.9 Rooftop mounted photovoltaic panel systems. Rooftop rack-mounted *photovoltaic panel systems* shall be tested, listed and identified with a fire classification in accordance with UL 1703 and UL 2703. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

[BF] 1505.10 Roof gardens and landscaped roofs. Roof gardens and landscaped roofs shall comply with Section 1505.1 and 1507.16 and shall be installed in accordance with ANSI/SPRI VF-1.

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27

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[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 shingle and shake. *Fire-retardant-treated wood* shingles and shakes shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPACI. Each bundle shall be marked to identify the manufacturer 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 1/2-inch (12.7 mm) Type X water-resistant gypsum backing board or gypsum sheathing shall be placed under minimum nominal 7/8-inch-thick (12.7 mm) wood structural panel solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

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

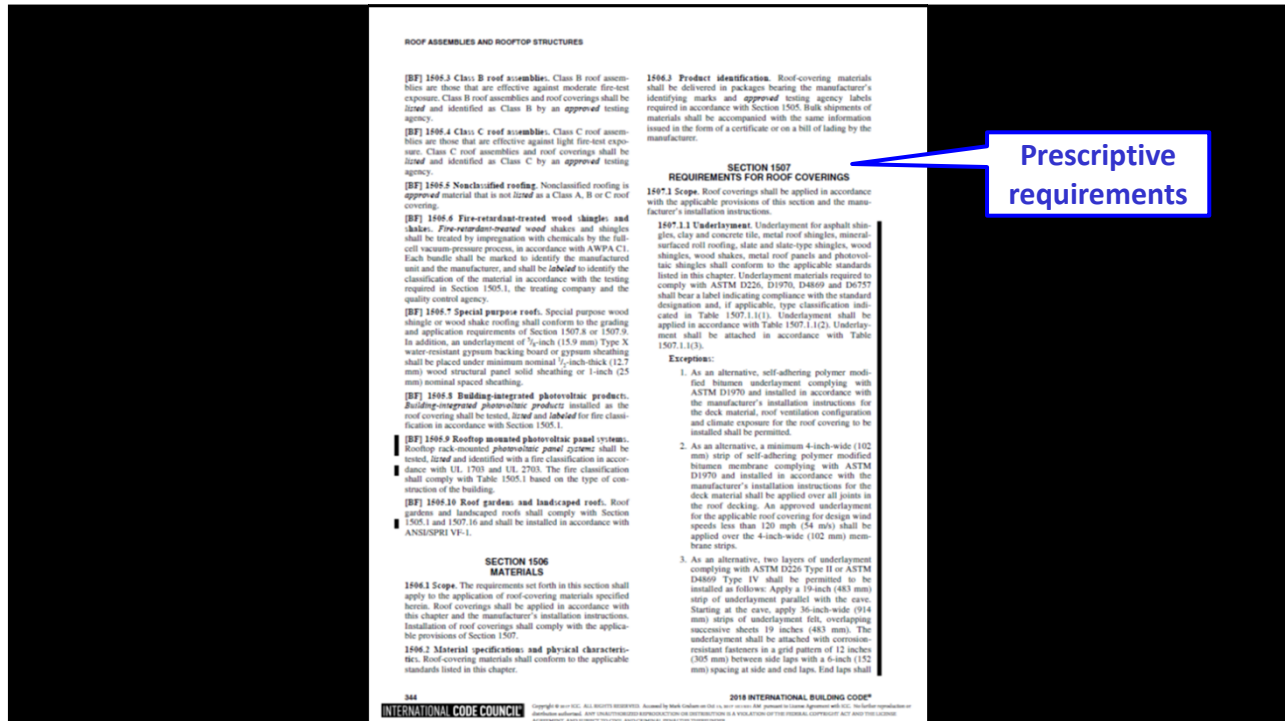
1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

**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 manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

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28



29

Roof system types

Prescriptive requirement in Section 1507

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

30

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[RF] 1509.3 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.

[RF] 1509.4 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.

[RF] 1509.5 Nonclassified roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

[RF] 1509.6 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shingles and shakes 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 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.

[RF] 1509.7 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 1/8-inch (3.2 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.

[RF] 1509.8 Building-integrated photovoltaic products. Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section 1505.1.

[RF] 1509.9 Roofing-mounted photovoltaic panel systems. Roofing rack-mounted photovoltaic panel systems shall be tested, listed and identified with a fire classification in accordance with UL 1703 and UL 2703. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

[RF] 1509.10 Roof gardens and landscaped roofs. Roof gardens and landscaped roofs shall comply with Section 1505.1 and 1507.10 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 manufacturer's installation instructions. 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.

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1507.13 Thermoplastic single-ply roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of this section.

1507.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a design slope of not less than one-fourth unit vertical in 12 units horizontal (2-percent slope).

1507.13.2 Material standards. Thermoplastic single-ply roof coverings shall comply with ASTM D4434, ASTM D6754 or ASTM D6878.

1507.13.3 Ballasted thermoplastic low-slope roofs. Ballasted thermoplastic low-slope roofs (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.4. Stone used as ballast shall comply with ASTM D448 or ASTM D7655.

1507.13.3.1 single-ply membrane roofing shall be installed in accordance with the manufacturer's instructions. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment felt, overlapping successive strips 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall

31

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[RF] 1509.3 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.

[RF] 1509.4 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.

[RF] 1509.5 Nonclassified roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

[RF] 1509.6 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shingles and shakes 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 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.

[RF] 1509.7 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 1/8-inch (3.2 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.

[RF] 1509.8 Building-integrated photovoltaic products. Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section 1505.1.

[RF] 1509.9 Roofing-mounted photovoltaic panel systems. Roofing rack-mounted photovoltaic panel systems shall be tested, listed and identified with a fire classification in accordance with UL 1703 and UL 2703. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

[RF] 1509.10 Roof gardens and landscaped roofs. Roof gardens and landscaped roofs shall comply with Section 1505.1 and 1507.10 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 manufacturer's installation instructions. 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.

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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 four 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.

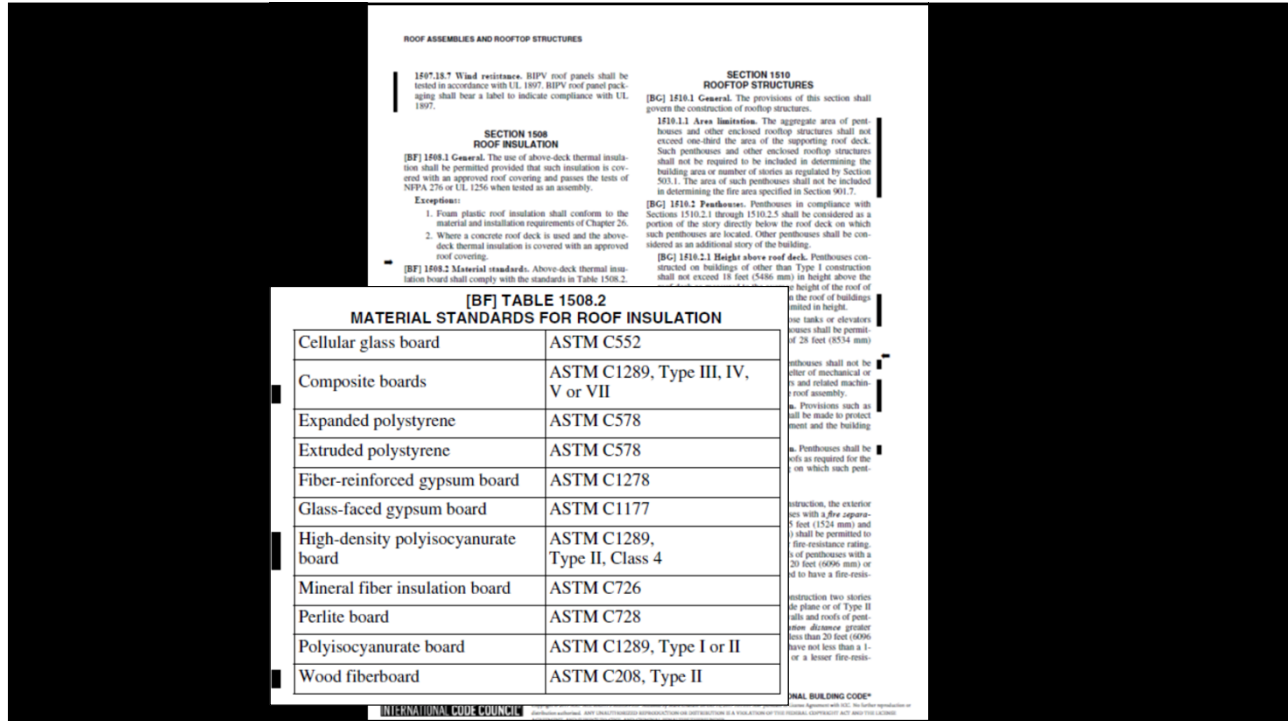
TABLE 1507.7.6 SLATE SHINGLE HEADLAP

| SLOPE | HEADLAP (Inches) |
|----------------------|------------------|
| 4:12 < slope < 8:12 | 4 |
| 8:12 < slope < 20:12 | 3 |
| slope ≥ 20:12 | 2 |

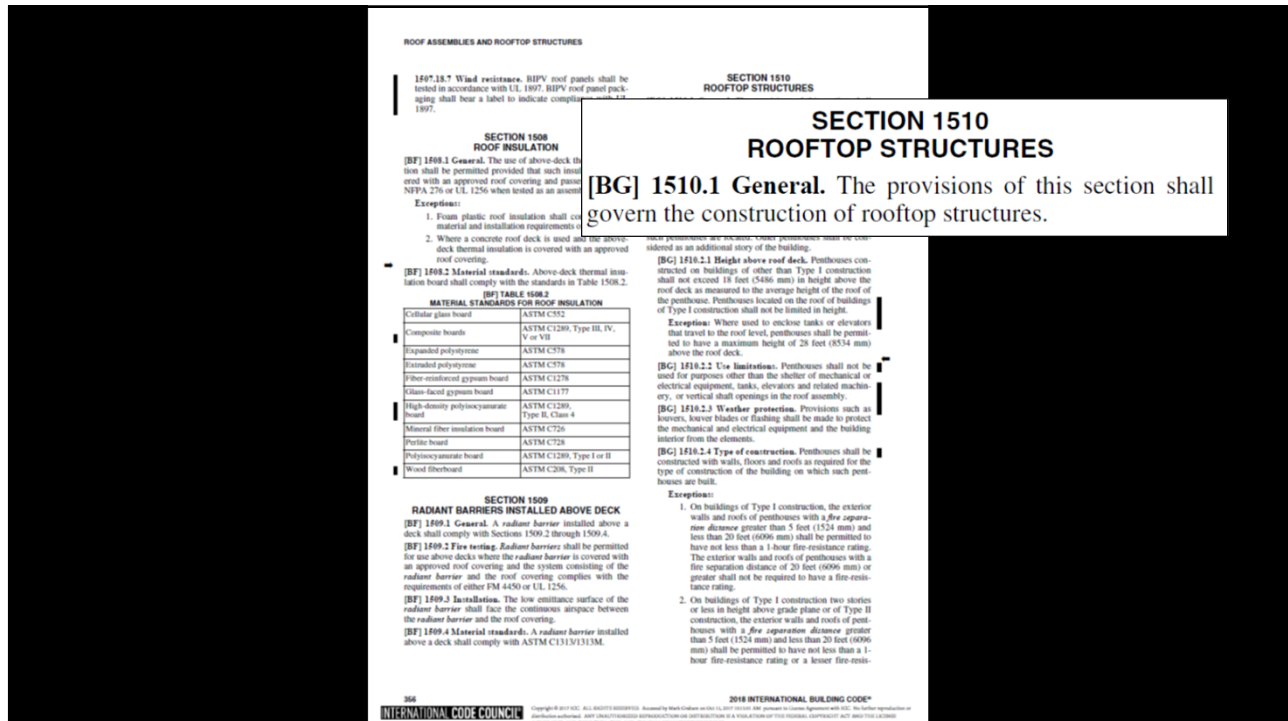
For SI: 1 inch = 25.4 mm.

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).

32



33



34

Types of roof structures

IBC 2018, Section 1510-Roof Structures

- Penthouses
- Tanks
- Cooling towers
- Towers, spires, domes and cupolas
- Mechanical equipment screens
- Photovoltaic panels and modules
- Other rooftop structures:
 - Aerial supports
 - Dormers
 - Fences
 - Flagpoles

35

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.

358
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36

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...

368 INTERNATIONAL CODE COUNCIL 2018 INTERNATIONAL BUILDING CODE®

37

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

wood complying with Section 2303.2 for exterior installation.

3. Where exterior wall covering panels are wood, the panels shall have a flame spread index of 25 or less when tested in the minimum and maximum thickness.

[BG] 1510.8.1 Aerial supports. Aerial supports shall be constructed of noncombustible materials.

Exception: Aerial supports not greater than 12 feet (3.66 m) in height as measured from the roof deck to the highest point on the aerial supports shall be permitted.

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.

rip-mounted photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's instructions.

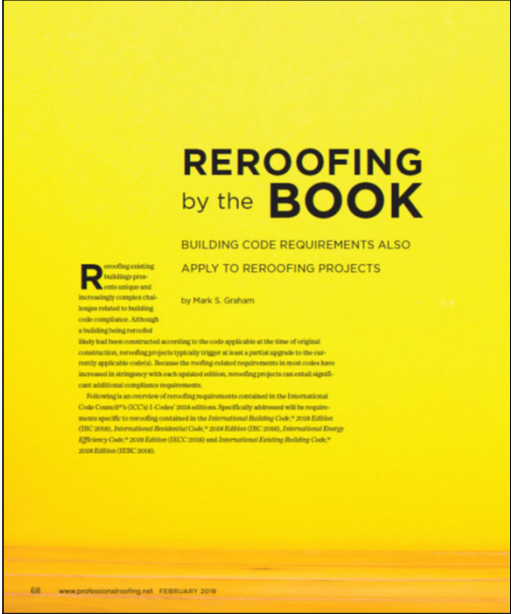
[BG] 1510.8 Other rooftop structures. Rooftop structures not regulated by Sections 1510.2 through 1510.7 shall comply with Sections 1510.8.1 through 1510.8.5, as applicable.

removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

1511.2 Structural and construction loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

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38



REROOFING
by the **BOOK**

BUILDING CODE REQUIREMENTS ALSO
APPLY TO REROOFING PROJECTS

by Mark S. Graham

Reroofing-related building projects often trigger at least a partial upgrade to the current applicable code. Because the roofing-related requirements in most codes have increased in stringency with each updated edition, reroofing projects can still adhere to additional compliance requirements.

Reroofing is an extension of roofing requirements contained in the International Code Council's (ICC) 2018 Code family. Specifically addressed will be requirements specific to reroofing contained in the International Building Code® 2018 Edition (IBC 2018), International Residential Code® 2018 Edition (IRC 2018), International Energy Efficiency Code® 2018 Edition (IECC 2018) and International Existing Building Code® 2018 Edition (IEBC 2018).


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39

International Residential Code, 2018 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

40

Ch. 9-Roof assemblies

International Residential Code, 2018 Edition

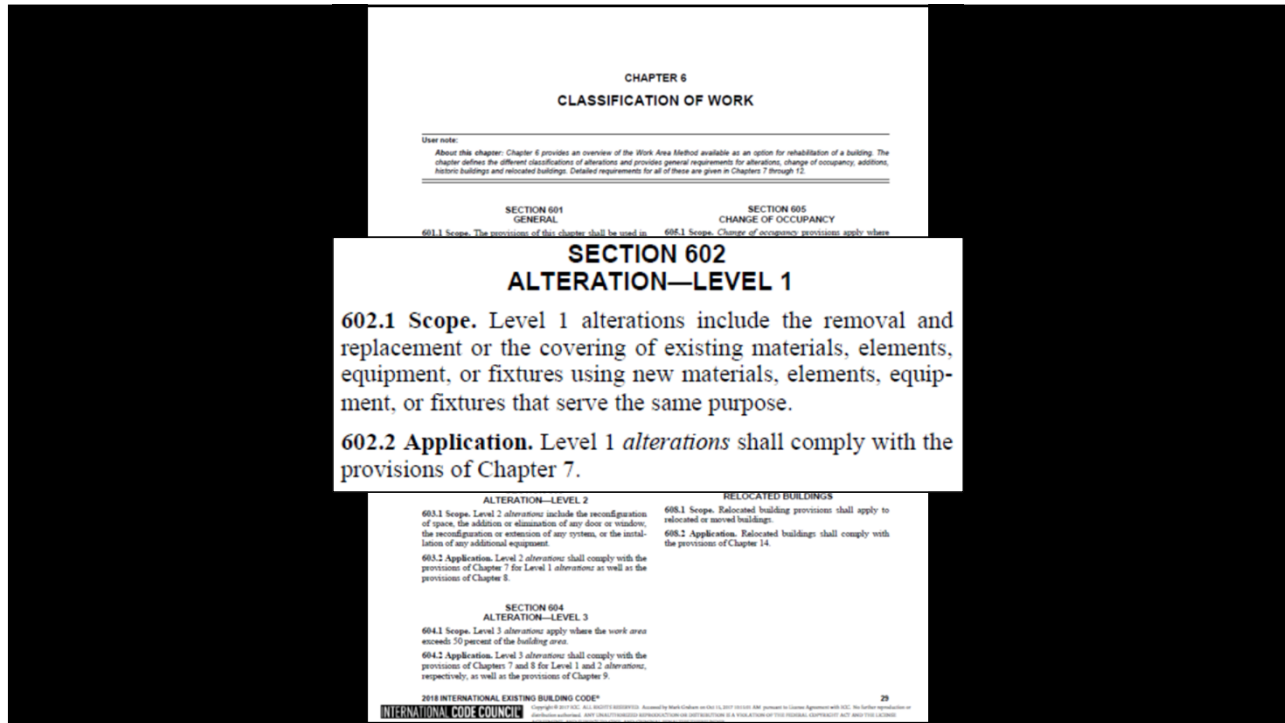
- Ch. 9 closely mirrors IBC Ch. 15's requirements
- Except IRC only requires fire classified roof assemblies where:
 - Required by local ordinance
 - Roof edge is less than 3 ft. from the lot line

41

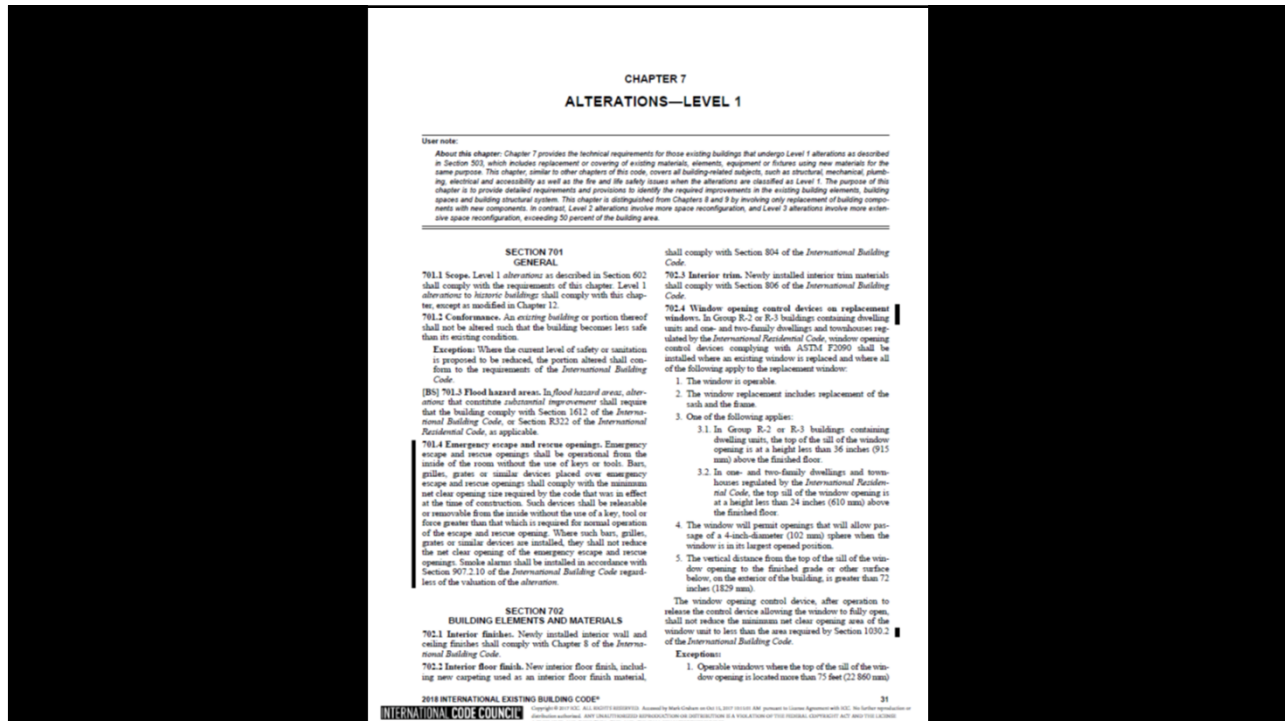


***International Existing
Building Code, 2018 Edition***

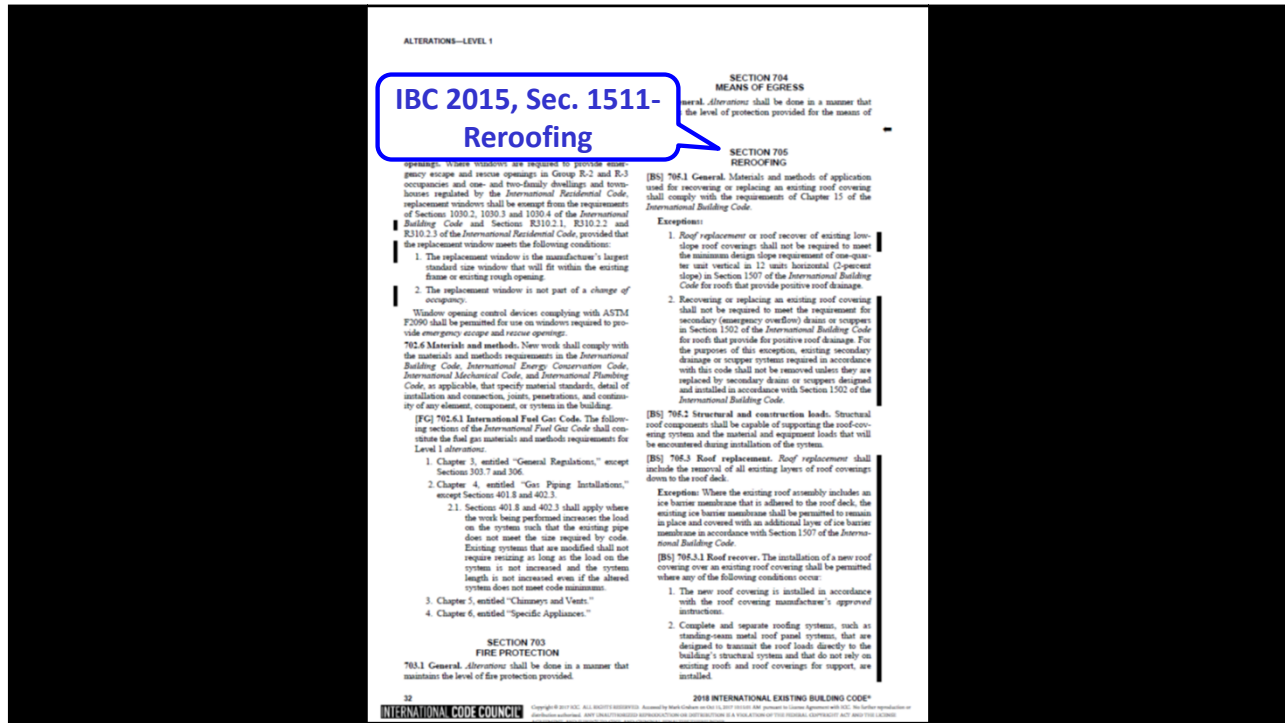
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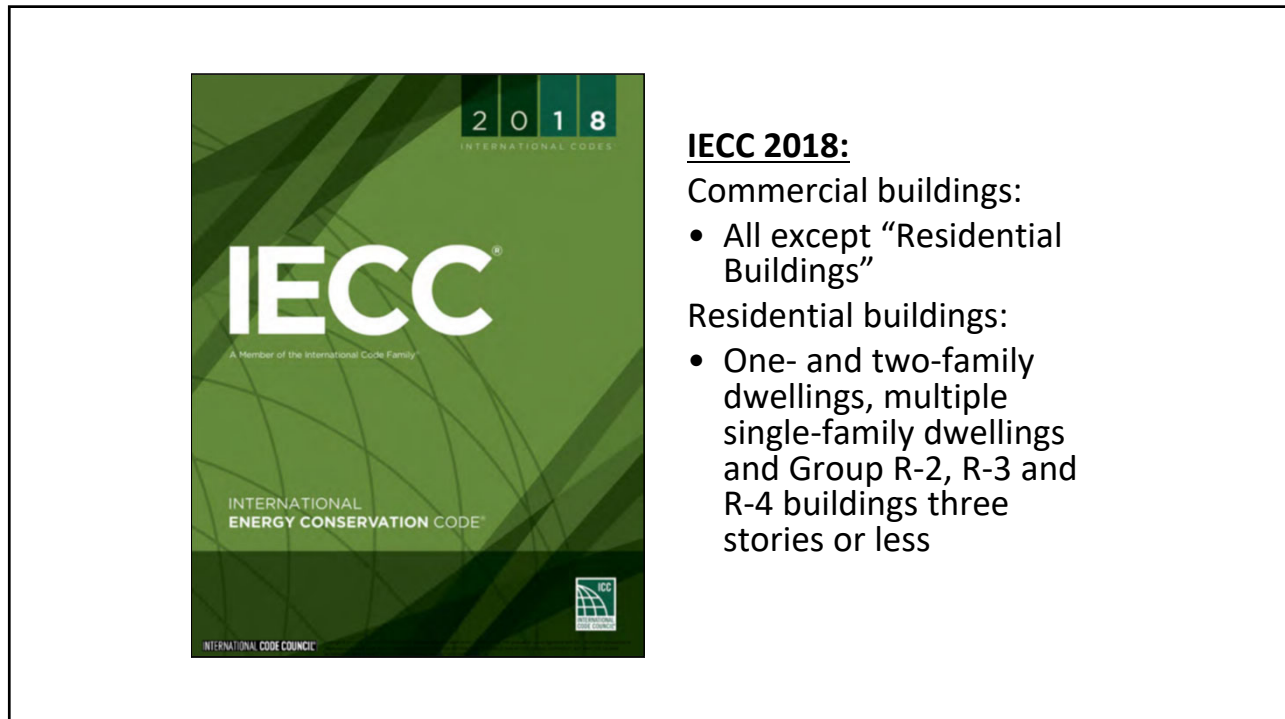
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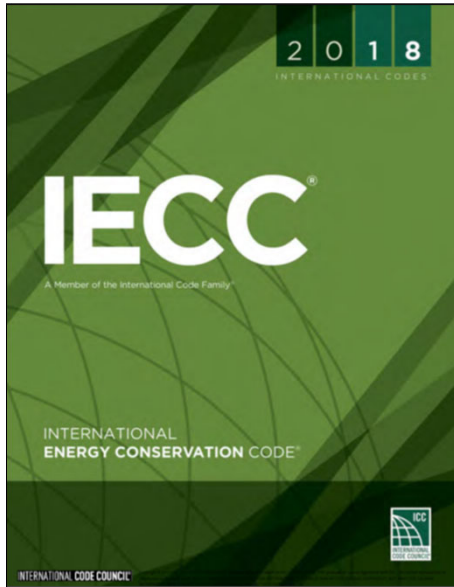
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46



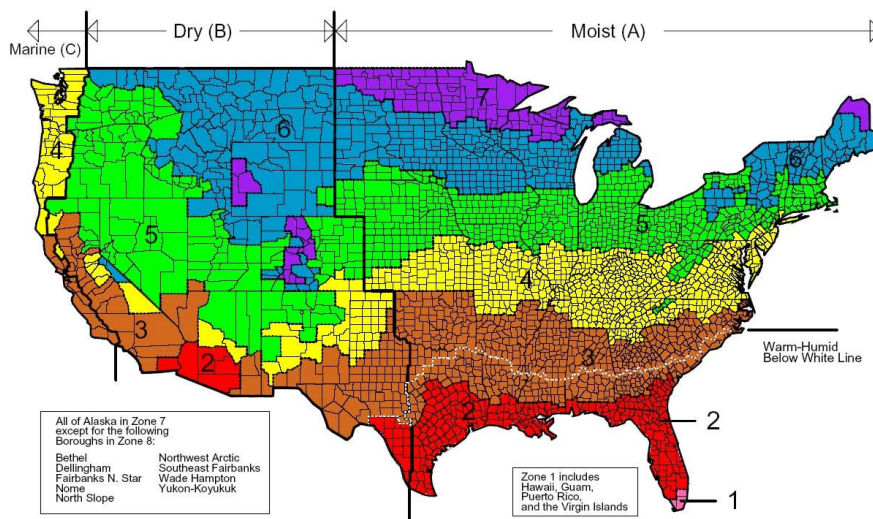
Roof requirements:

- R-value
- Roof reflectivity
- Air retarder

47

IECC 2018, Fig. C301.1-Climate zones

Fig. R301.1 (residential climate zones) is similar



48

COMMERCIAL ENERGY EFFICIENCY

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD^{a,1}

| CLIMATE ZONE | 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-25 + R-11 LS | R-30 + R-11 LS | R-30 + R-11 LS | R-30 + R-11 LS | R-30 + R-11 LS |
| Attic and other | R-38 | R-38 | R-38 | 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-49 |

COMMERCIAL ENERGY EFFICIENCY

49

Roofing-specific adaptation of Table C402.1.3

International Energy Conservation Code, 2018 Edition

| 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 | R-25ci | | |
| 4 | R-30ci | | |
| 5 | R-30ci | R-25 + R-11 LS | R-49 |
| 6 | R-30ci | | |
| 7 | R-30ci | | |
| 8 | R-35ci | R-30 + R-11 LS | |

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)

50

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* | |
|--------------|-----------|-----------|-----------|------------|------------|------------|---------|
| 1 | R-12 ci | R-15 ci | R-15 ci | R-20 ci | R-20 ci | R-20 ci | |
| 2 | R-14 ci | | R-20ci | | R-25 ci | R-25 ci | R-25 ci |
| 3 | R-10 ci | | | | | R-30 ci | R-30 ci |
| 4 | R-12 ci | R-20 ci | R-25 ci | R-25 ci | R-30 ci | R-30 ci | |
| 5 | R-15 ci | | | | | | |
| 6 | R-11 ci | R-25 ci | R-25 ci | R-30 ci | R-35 ci | R-35 ci | |
| 7 | R-15 ci | R-25 ci | R-25 ci | R-30 ci | R-35 ci | R-35 ci | |
| 8 | | | | | | | |

* Applies to roof replacement projects
ci = continuous insulation

51

Reflectivity

International Energy Conservation Code, 2018 Edition (Commercial)

C402.3 Roof solar reflectance and thermal emittance. Low-sloped roofs directly above cooled conditioned spaces in Climate Zones 1, 2 and 3 shall comply with one or more of the options in Table C402.3.

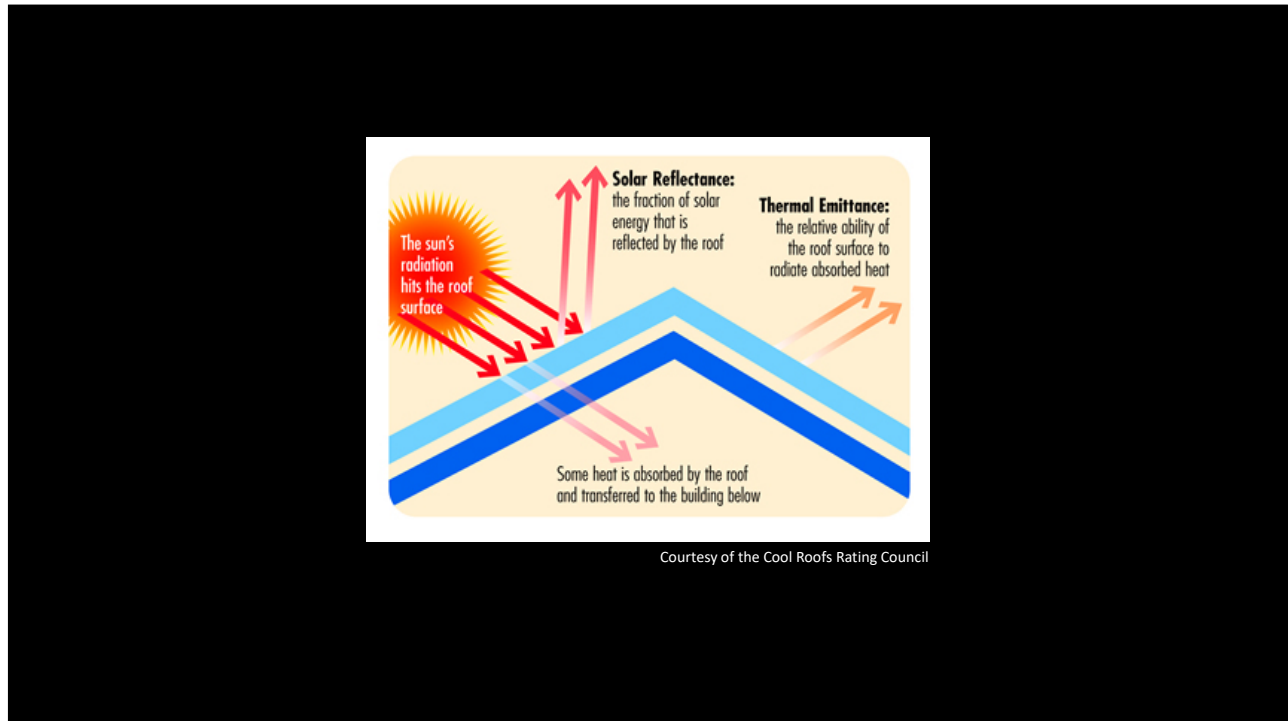
Exceptions: [omitted for clarity]

**TABLE C402.3
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS**

| |
|---|
| Three-year solar reflectance of 0.55 and 3-year aged thermal emittance of 0.75 |
| Three-year-aged solar reflectance index of 64 |

[Footnotes omitted for clarity]

52



53

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.

54

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

55

Air barriers

International Energy Conservation Code, 2018 Edition (Commercial), Sec. C402.5

“A continuous building envelope air barrier shall be provided throughout the building envelope...” (Except 2B)

Test methods:

- Whole building: Not greater than 0.40 cfm/ft³
- Assembly: Not greater than 0.04 cfm/ft³
- Material: Not greater than 0.004 cfm/ft³
 - Deemed to comply: BUR, MB, adhered single ply and SPF

Air barrier not required in reroofing projects unless also recladding (IECC 2018: Sec. C503.3.1 and C504.2)

56

International Plumbing Code, 2018 Edition



- Applicable to all plumbing systems, except those applicable to IRC 2018
- Roofing-related requirements:
 - Ch. 11-Storm drainage

57

**SECTION 1502
ROOF DRAINAGE**

[P] 1502.1 General. Design and installation of roof drainage systems shall comply with Section 1502 of this code and Sections 1106 and 1108, as applicable, of the *International Plumbing Code*.

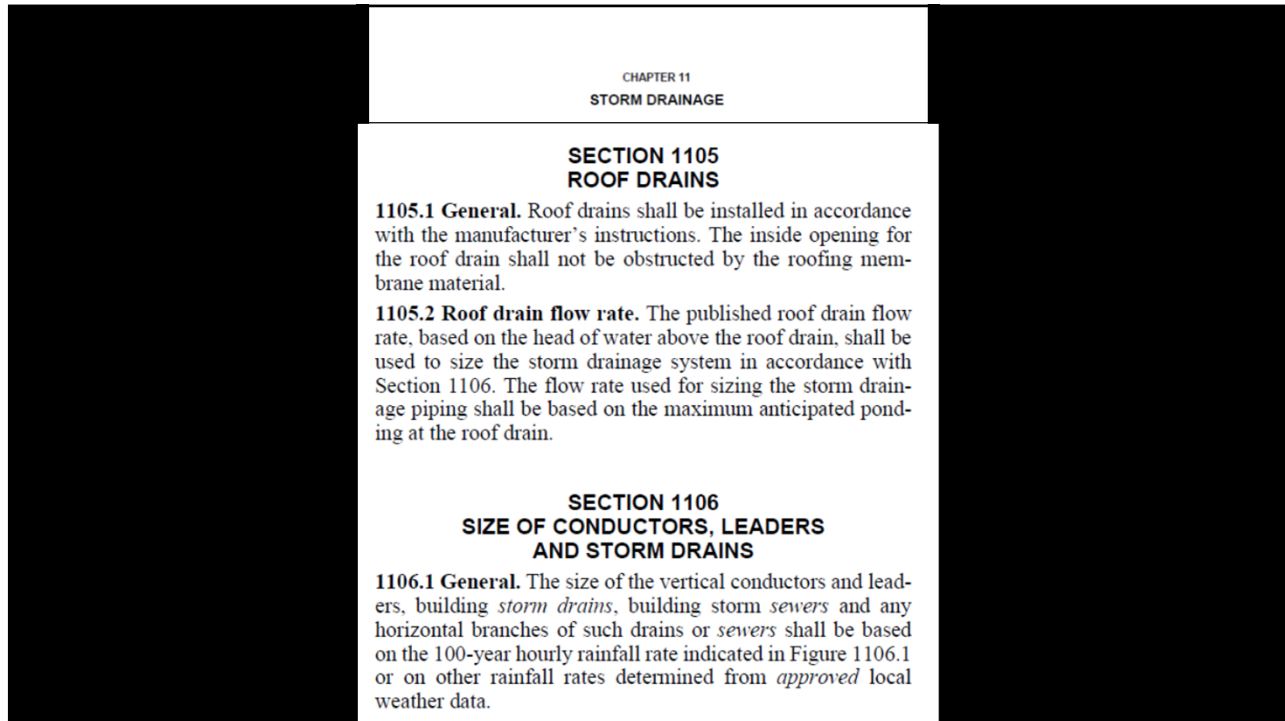
[P] 1502.2 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Sections 1106 and 1108, as applicable, 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.

From IBC 2018

58



59

International Fire Code, 2018 Edition



Applicability:

- Structures, facilities and conditions
- Existing conditions and operations

60

Roofing-related provisions

International Fire Code, 2018 Edition

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

61

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

62

Alternative materials, design and methods of construction and equipment

- IBC 2018, Sec. 104.11
- IRC 2018, Sec. R104.11
- IECC 2018, Sec. C102 and Sec. R102
- IEBC 2018, Sec. 104.11
- IFC 2018, Sec. 104.9
- IPC 2018, Sec. 105.2

63

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

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64

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65

Questions?



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66