



International Roofing Expo

February 6-8, 2018
New Orleans, LA

The 2018 I-codes: Roofing-related changes



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Learning objectives

- Beware of roofing-related changes in 2018 I-codes:
 - *International Building Code, 2018 Edition*
 - *International Residential Code, 2018 Edition*
 - *International Energy Conservation Code, 2018 Edition*
 - *International Existing Building Code, 2018 Edition*
 - *International Plumbing code, 2018 Edition*
 - *International Fire Code, 2018 Edition*

Prerequisites

- Intermediate- to advanced-level
- Some knowledge of code requirements
- General knowledge of 2015 I-codes
- Understand...I am the messenger
 - “...don't shoot the messenger...”

Some background

- 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)
- The code can also provide a basis for construction claims-related litigation



THE I-CODES

- ICC Performance Code (ICCPC)
- International Building Code (IBC)
- International Energy Conservation Code (IECC)
- International Existing Building Code (IEBC)
- International Fire Code (IFC)
- International Fuel Gas Code (IFGC)
- International Green Construction Code (IgCC)
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- International Private Sewage Disposal Code (IPSDC)
- International Property Maintenance Code (IPMC)
- International Residential Code (IRC)
- International Swimming Pool and Spa Code (ISPSDC)
- International Wildland-Urban Interface Code (IWUIC)
- International Zoning Code (IZC)

Publication cycle

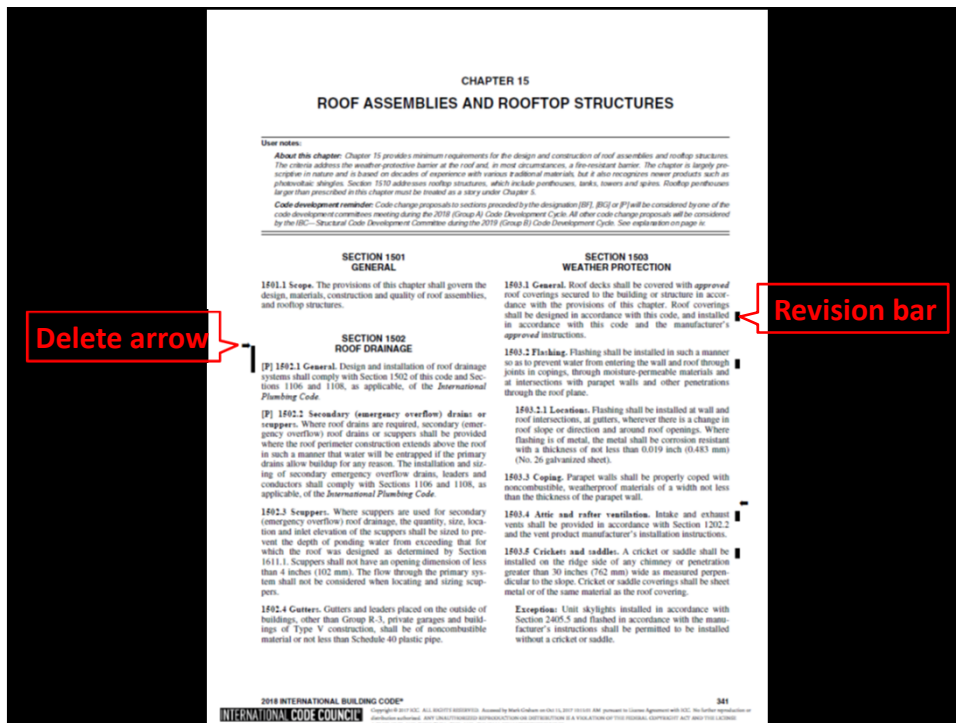
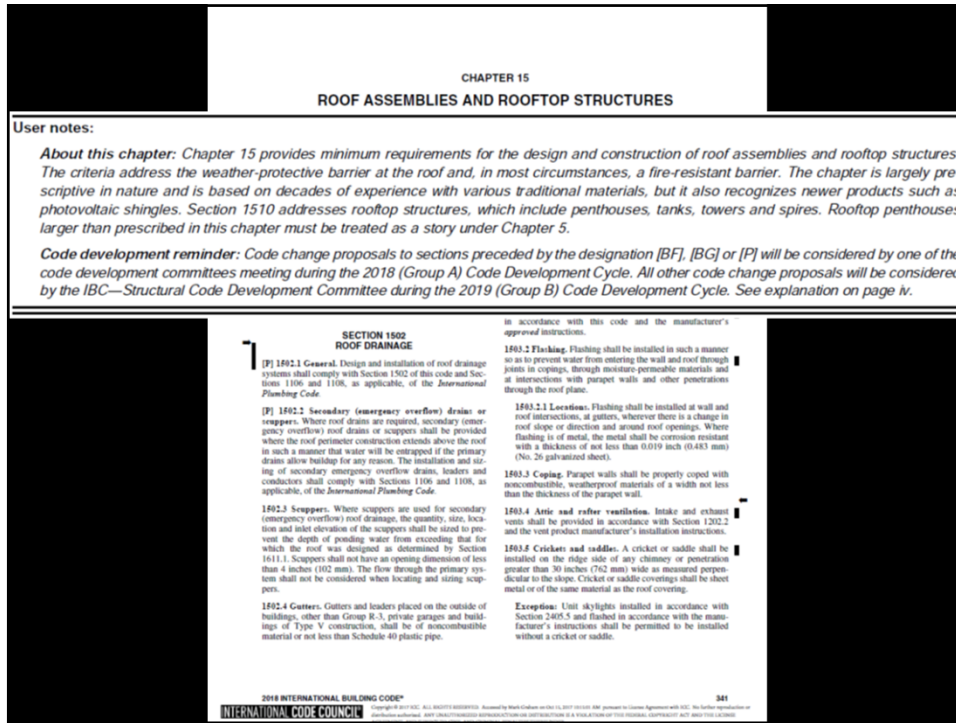
- 2000 edition
- 2003 edition
- 2006 edition
- 2009 edition
- 2012 edition
- 2015 edition
- 2018 edition

Three-year code development and publication cycle

My 2015 IRE program

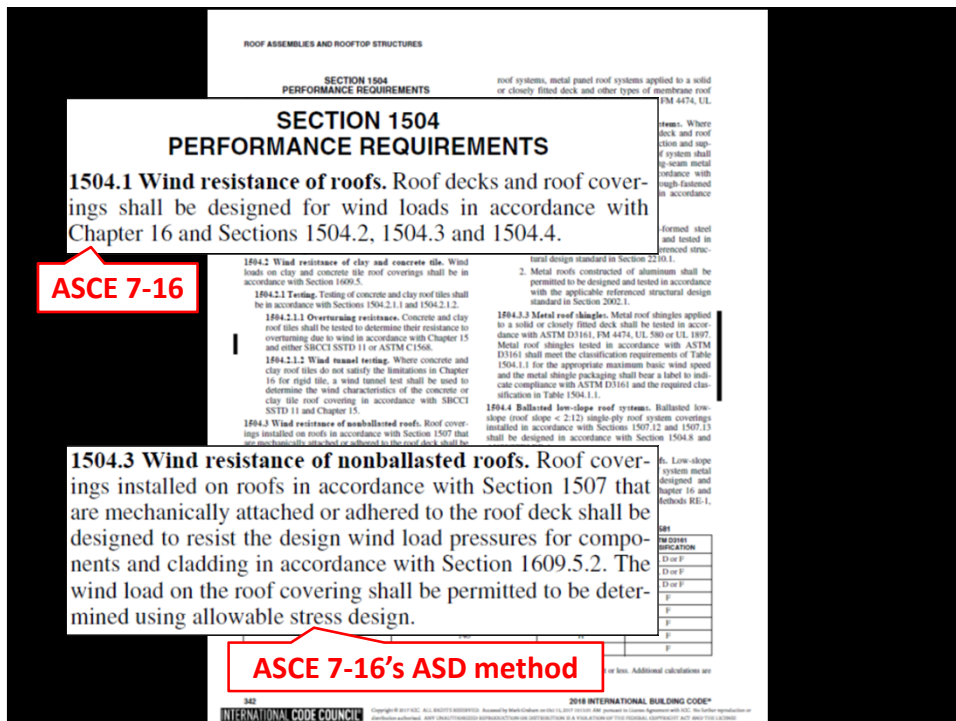
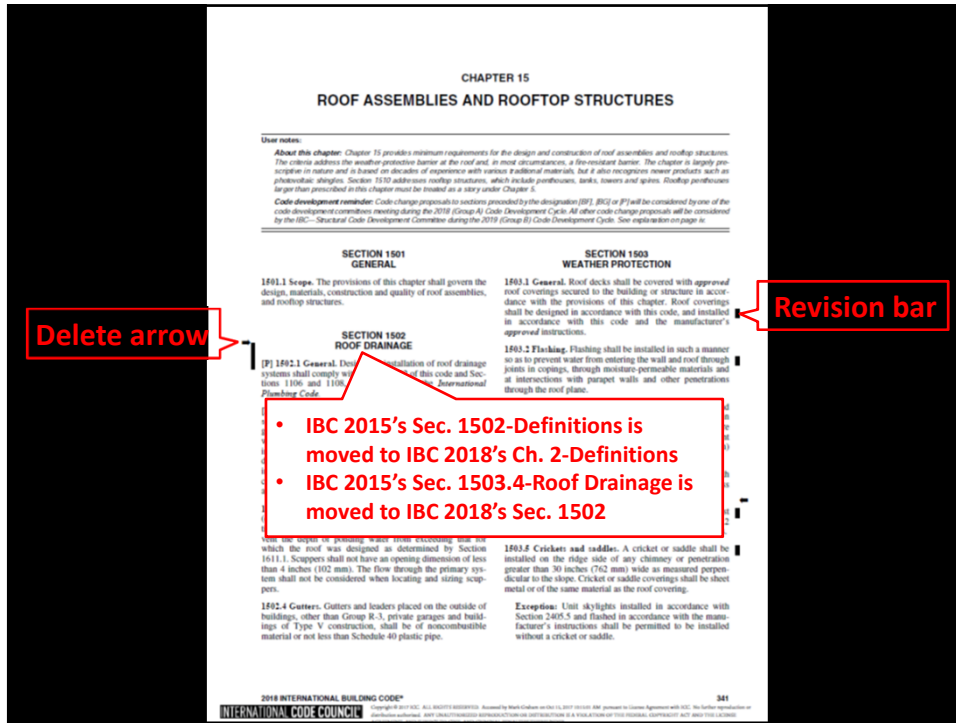
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**INTERNATIONAL
ROOFING
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Exhibits & Conference:
FEBRUARY 6-8, 2018
Ernest N. Morial Convention Center | Halls B-D
New Orleans, Louisiana USA



**NRCA
ROOFING
CONTRACTOR**

WE12 - ASCE 7-16 and its Impact on Wind-Uplift Design

Wednesday, February 7 from 9:30 AM to 11:00 AM

Overview About the Presenter(s)

ASCE 7-16, "Minimum Design Loads and Associated Criteria for Buildings and Structures," serves as the technical basis for wind load determination and has been incorporated into the International Building Code, 2018 Edition as a requirement for determining wind loads. ASCE 7-16 contains a number of significant roofing-specific changes that will have a significant impact on wind design and the application of roof systems. In this presentation, Mark S. Graham, NRCA's vice president of technical services, will provide an overview of roofing-related revisions to ASCE 7-16. Resulting changes to perimeter and corner fastening patterns will also be discussed. Several examples will be presented showing the magnitude of the differences between ASCE 7-16's values from those of ASCE 7-10 and ASCE 7-05 (and FM 1-28). Time will be allotted at the end of the presentation for questions from the audience on the topic. Learning Objectives: 1. Learn about ASCE 7-16 and its applicability 2. Review the roofing-related changes contained in ASCE 7-16 3. Learn the ASCE 7-16's impact on perimeter and corner fastening 4. Discover the differences in ASCE 7-16's results and those from ASCE 7-10 and ASCE 7-05

WE12

Credits: 1.5 of RCI CEHs/1.5 hours of DBPR/CILB credits

Education Tracks: Technical

Event Type: Conference > Session

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

**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.

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.

1504.2 Wind resistance of clay and concrete tile. Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.5.

1504.2.1 Testing. Testing of concrete and clay roof tiles shall be in accordance with Sections 1504.2.1.1 and 1504.2.1.2.

1504.2.1.1 Overturning. roof tiles shall be tested for overturning due to wind and either SBC1 S5 or SBC1 S6.

1504.2.1.2 Wind test clay roof tiles do not fit for rigid tile, a determine the wind clay tile roof cover SSTD 11 and Chapter 1609.5.

1504.3 Wind resistance of ing installed on roofs in a are mechanically attached designed to resist the design and cladding in accordance with Section 1609.5.

1504.3.1 Other roof of men, fully adhered or

CLASSIFICATION

MAXIMUM BASIC WIND SPEED (mph)	MINIMUM WIND UPLIFT RESISTANCE (psf)	CLASSIFICATION	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 SF: 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.

1504.3.3 Metal roof shingles. Metal roof shingles applied to a solid or closely fitted deck shall be tested in accordance with ASTM D3161, FM 4474, UL 580 or UL 1897. Metal roof shingles tested in accordance with ASTM D3161 shall meet the classification requirements of Table 1504.1.1 for the appropriate maximum basic wind speed and the metal shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table 1504.1.1.

1504.3.2 Structural metal panel roof systems. Where the metal roof panel functions as the roof deck and roof covering and it provides both weather protection and support for loads, the structural metal panel roof system shall comply with this section. Structural standing-seam metal panel roof systems shall be tested in accordance with ASTM E1592 or FM 4474. Structural through-fastened metal panel roof systems shall be tested in accordance with ASTM E1592, FM 4474 or UL 580.

Exception:

1. Metal roofs constructed of cold-formed steel shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2210.1.
2. Metal roofs constructed of aluminum shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2002.1.

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

**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 E188 or UL 790. In addition, *fire-retardant-treated wood* roof coverings shall be tested in accordance with ASTM D2998. 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.

[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:

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

[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. **UL 2703 added**

[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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NOMINAL DESIGN WIND SPEED, V_{50} (mph)	Exposure category	
	1	2
85	100	100
90	100	100
95	100	100
100	100	100
105	100	100
110	100	100
115	100	100
120	100	100
Greater than 120	100	100

For SI: 1 inch = 25.4 mm; 1 m = 3.28 ft.
 a. Mean roof height as defined in Section 1507.1.6.
 b. For intermediate values of V_{50} , the value of H_{max} shall be used.
 c. For general and intermediate values of V_{50} , H_{max} shall be determined by linear interpolation.

Fire classes added

UL 2703 added

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

[BF] 1506.3 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] 1506.4 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] 1506.5 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 1/2-inch-thick (12.7 mm) wood structural panel solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

[BF] 1506.6 Building-integrated photovoltaic products. Building-integrated photovoltaic products installed in the roof covering shall be tested, listed and labeled for fire classification in accordance with Section 1505.1.

[BF] 1506.9 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] 1506.10 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.

**SECTION 1506
MATERIALS**

1506.1 Seeps. 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.

1507.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roof roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and photovoltaic shingles shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). Underlayment shall be applied in accordance with Table 1507.1.1(2). Underlayment shall be attached in accordance with Table 1507.1.1(3).

Exception:

- As an alternative, self-adhering polymer modified bitumen underlayment complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.
- As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer modified bitumen membrane complying with ASTM D1970 and installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph (54 m/s) shall be applied over the 4-inch-wide (102 mm) membrane strips.
- As an alternative, two layers of underlayment complying with ASTM D226 Type II or ASTM D4869 Type IV shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of underlayment felt, overlapping successive sheets 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

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A new underlayment sub-section has been added

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

TABLE 1507.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, $V < 140$ MPH	MAXIMUM BASIC DESIGN WIND SPEED, $V \geq 140$ MPH
Asphalt shingles	1507.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757
Clay and concrete tiles	1507.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing
Metal panels	1507.4	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type IV
Metal roof shingles	1507.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Mineral-surfaced roll roofing	1507.6	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Slate shingles	1507.7	ASTM D226 Type II ASTM D4869 Type III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood shingles	1507.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood shakes	1507.9	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Photovoltaic shingles	1507.17	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

TABLE 1507.1.1(2)
UNDERLAYMENT APPLICATION

TABLE 1507.1.1(2)
UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, $V < 140$ MPH	MAXIMUM BASIC DESIGN WIND SPEED, $V \geq 140$ MPH
Asphalt shingles	1507.2	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches

Roofing	Section	Underlayment Application	Underlayment Application
Slate shingles	1507.7	manufacturer's installation instructions	By 6 feet.
Wood shakes	1507.8		For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. End laps shall be 4 inches and shall be offset by 6 feet.
Wood shingles	1507.9		
Photovoltaic shingles	1507.17	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

1507.18.7 **Wind resistance.** BIPV roof panels shall be tested in accordance with UL 1807. BIPV roof panel packaging shall bear a label to indicate compliance with UL 1807.

**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 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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**SECTION 1510
ROOFTOP STRUCTURES**

[BG] 1510.1 **General.** The provisions of this section shall govern the construction of rooftop structures.

1510.1.1 **Area limitation.** The aggregate area of penthouses and other enclosed rooftop structures shall not exceed one-third the area of the supporting roof deck. Such penthouses and other enclosed rooftop structures shall not be required to be included in determining the building area or number of stories as regulated by Section 503.1. The area of such penthouses shall not be included in determining the fire area specified in Section 901.7.

[BG] 1510.2 **Penthouses.** Penthouses in compliance with Sections 1510.2.1 through 1510.2.5 shall be considered as a portion of the story directly below the roof deck on which such penthouses are located. Other penthouses shall be considered as an additional story of the building.

[BG] 1510.2.1 **Height above roof deck.** Penthouses constructed on buildings of other than Type I construction shall not exceed 18 feet (5486 mm) in height above the height of the roof of the roof of buildings limited in height.

use tanks or elevators houses shall be permitted 28 feet (8534 mm)

enthouses shall not be other of mechanical or is and related machinery roof assembly.

Provisions such as shall be made to protect ment and the building

Penthouses shall be sets as required for the on which such pent-

struction, the exterior ties with a fire separation 4 feet (1219 mm) and shall be permitted to fire-resistance rating. h of penthouses with a 20 feet (6096 mm) or more to have a fire-resistance two stories the plane or of Type II falls and roofs of penthouse distance greater than 20 feet (6096) have not less than a 1- or a lesser fire-resistance

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ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

wood complying with Section 2303.2 for exterior installation.

3. Where exterior wall covering panels are used, the panels shall have a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use, with each face tested independently in accordance with ASTM E84 or UL 723. The panels shall be tested in the minimum and maximum thicknesses intended for use in accordance with, and shall comply with the acceptance criteria of, NFPA 285 and shall be installed as tested. Where the panels are tested as part of an exterior wall assembly in accordance with NFPA 285, the panels shall be installed on the face of the mechanical equipment screen supporting structure in the same manner as they were installed on the tested exterior wall assembly.

[BG] 1510.6.3 **Type V construction.** The height of mechanical equipment screens located on the roof decks of buildings of Type V construction, as measured from grade plane to the highest point on the mechanical equipment screen, shall be permitted to exceed the maximum building height allowed for the building by other provisions of this code where complying with any one of the following limitations, provided that the fire separation distance is greater than 5 feet (1524 mm):

1. Where the fire separation distance is not less than 20 feet (6096 mm), the height above grade plane of the mechanical equipment screen shall not exceed 4 feet (1219 mm) more than the maximum building height allowed.
2. The mechanical equipment screen shall be constructed of noncombustible materials.
3. The mechanical equipment screen shall be constructed of fire-retarded-treated wood complying with Section 2303.2 for exterior installation.
4. Where the fire separation distance is not less than 20 feet (6096 mm), the mechanical equipment screen shall be constructed of materials having a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E84 or UL 723.

[BG] 1510.7 **Photovoltaic panels and modules.** Rooftop-mounted photovoltaic panels and modules shall be designed in accordance with this section.

[BG] 1510.7.1 **Fire classification.** Rooftop-mounted photovoltaic panels and modules shall have the fire classification in accordance with Section 1505.9.

[BG] 1510.7.2 **Photovoltaic panels and modules.** Rooftop-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.

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

Exceptions: Aerial supports not greater than 12 feet (3658 mm) in height as measured from the roof deck to the highest point on the aerial supports shall be permitted to be constructed of combustible materials.

[BG] 1510.8.2 **Bulkheads.** Bulkheads used for the shelter of mechanical or electrical equipment or vertical shaft openings in the roof assembly shall comply with Section 1510.2 as penthouses. Bulkheads used for any other purpose shall be considered as an additional story of the building.

[BG] 1510.8.3 **Dormers.** Dormers shall be of the same type of construction as required for the roof in which such dormers are located or the exterior walls of the building.

[BG] 1510.8.4 **Fences.** Fences and similar structures shall comply with Section 1510.6 as mechanical equipment screens.

[BG] 1510.8.5 **Flagpoles.** Flagpoles and similar structures shall not be required to be constructed of noncombustible materials and shall not be limited in height or number.

[BG] 1510.9 **Structural fire resistance.** The structural frame and roof construction supporting loads imposed upon the roof by any rooftop structure shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note a, shall not apply to roofs containing rooftop structures.

**SECTION 1511
REROOFING**

1511.1 **General.** Materials and methods of application used for re-covering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

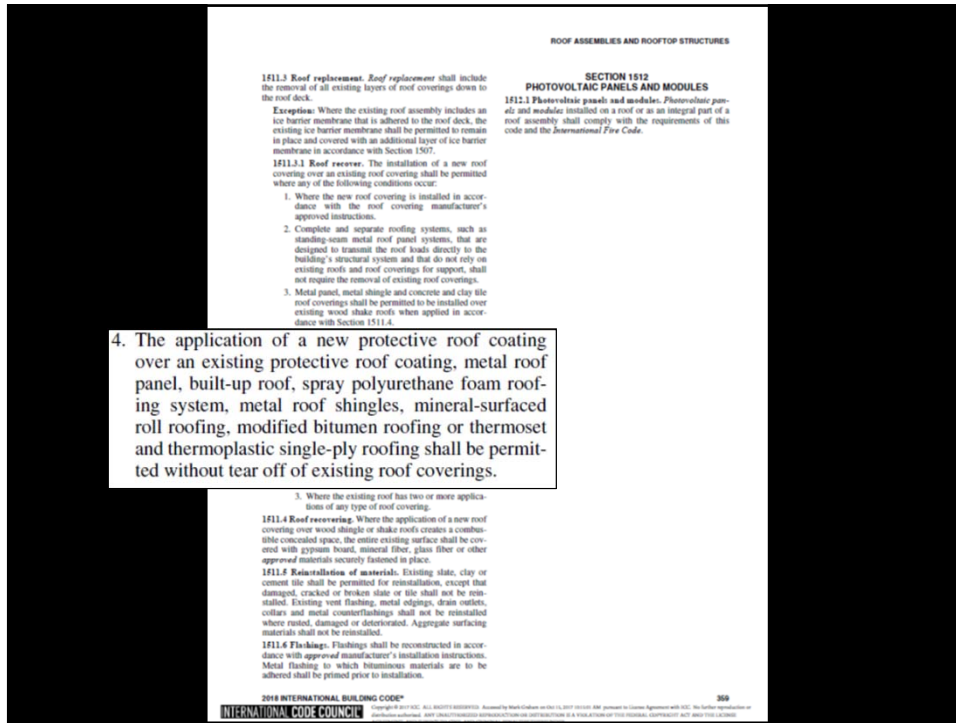
Exceptions:

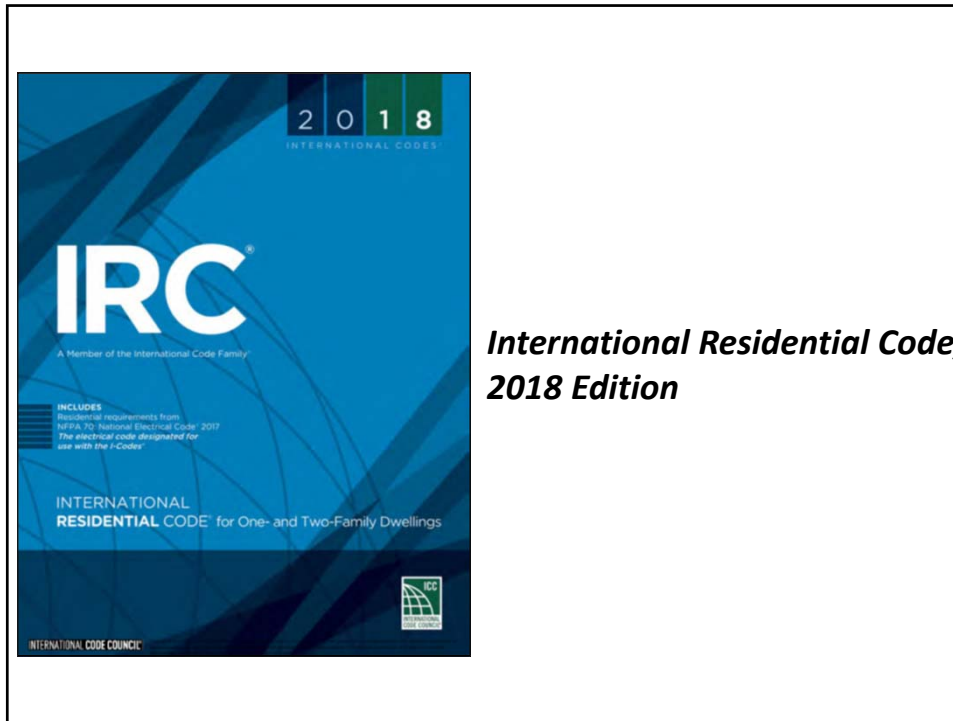
1. Roof replacement or roof removal of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2 percent slope) in Section 1507 for roofs that provide positive roof drainage.
2. Recovering or replacing an 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.

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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International Residential Code, 2018 Edition

**CHAPTER 9
ROOF ASSEMBLIES**

User note:
About this chapter: Chapter 9 addresses the design and construction of roof assemblies. A roof assembly includes the roof deck, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings. The types of roof covering materials and installation addressed by Chapter 9 are asphalt shingles, clay and concrete tile, metal roof shingles, mineral/ceramic roof roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above-deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.

IRC 2018 Ch. 9 changes are similar to those of IBC 2018 Ch. 15 except:

- ASCE 7-10's wind maps apply
- Some rooftop PV reformatting:
 - New Sec. R324-Solar Energy Systems
- New Sec. R905.17 (BIPV applied directly to the roof deck)

Impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. 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 R902.1, the treating company and the quality control agency.

R902.3 Building-integrated photovoltaic product. Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section R902.1.

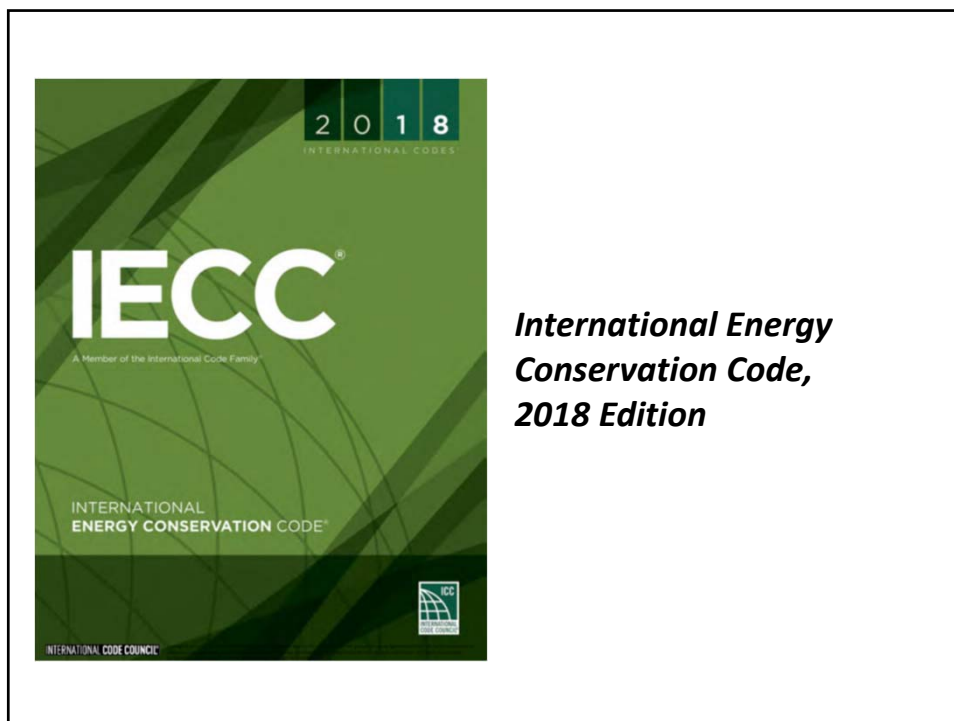
R902.4 Rooftop-mounted photovoltaic panel systems. Rooftop-mounted photovoltaic panel systems installed on or

R903.2.2 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more 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 R308.6 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

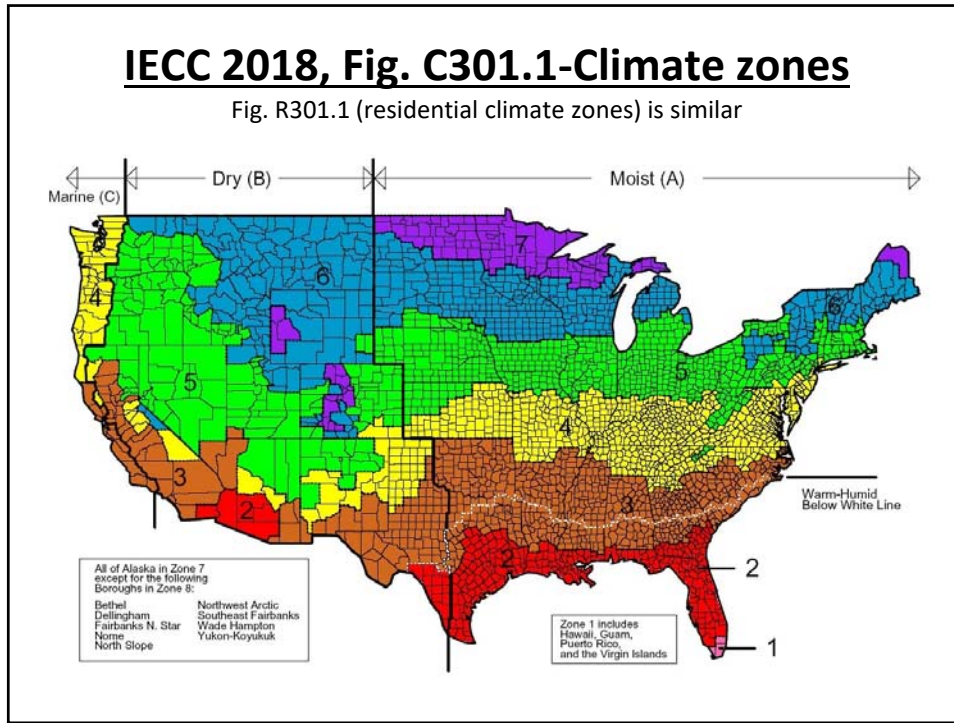
R903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

2018 INTERNATIONAL RESIDENTIAL CODE®



IECC 2018's roofing-related requirements

- No substantive changes from IECC 2015
 - R-value
 - Roof reflectivity and emissivity
 - Air barriers
- ASHRAE 90.1-16 alternative
 - ASHRAE 90.1-12 referenced in IECC 2015



COMMERCIAL ENERGY EFFICIENCY

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD¹

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-49	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, above grade																
Masonry	R-5.5ci	R-5.5ci	R-5.5ci	R-7.0ci	R-7.0ci	R-9.0ci	R-9.0ci	R-11.0ci	R-11.0ci	R-11.0ci	R-13.0ci	R-13.0ci	R-15.0ci	R-15.0ci	R-15.0ci	R-20.0ci
Metal building	R-11 + R-5ci	R-11 + R-5ci	R-11 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-15 + R-5ci	R-15 + R-5ci	R-17 + R-5ci	R-17 + R-5ci	R-17 + R-5ci	R-19 + R-5ci	R-19 + R-5ci	R-21 + R-5ci	R-21 + R-5ci	R-21 + R-5ci	R-25 + R-5ci
Wood framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci
Wood framed and other	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci
Below-grade wall	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Masonry	NR	NR	R-4.5ci	R-8.0ci	R-10ci	R-10ci	R-10ci	R-10ci	R-10ci	R-10ci	R-12.5ci	R-12.5ci	R-15ci	R-15ci	R-15ci	R-15ci
Insulating	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30
Slab-on-grade floors																
Unheated slab	NR	NR	NR	NR	NR	NR	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below
Heated slab ^d	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below	R-10 for 2" below
Opaque doors																
Nonswing	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For Sl: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.

ci = Continuous insulation, NR = No Requirement, LS = Layer System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.

c. R-5.5ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 (lb-inch²/ft²-°F).

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Slab floor joint systems shall be insulated to R-10.

g. "Mass walls" shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

COMMERCIAL ENERGY EFFICIENCY

Roofing-specific adaptation of Table C402.1.3

International Energy Conservation Code, 2018 Edition

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

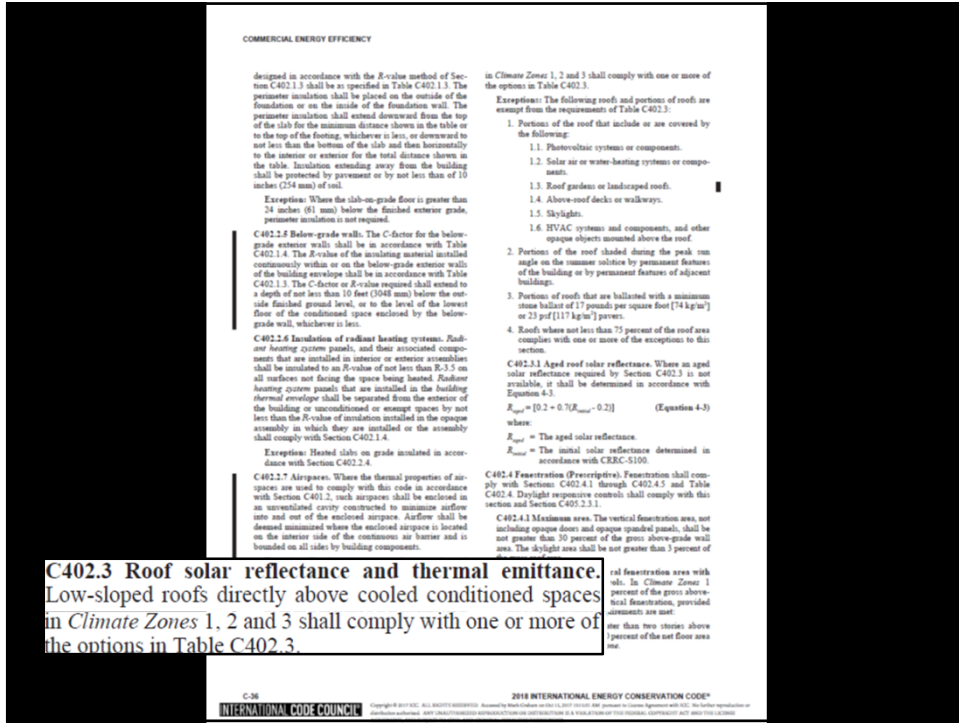
ci = Continuous insulation
 LS = Liner system (a continuous membrane installed below the purlins and uninterrupted by framing members; uncompressed, faced insulation rests on top of the membrane between the purlins)

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						
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						
8							

* Applies to roof replacement projects
 ci = continuous insulation



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

Three-year-aged solar reflectance index ^b of 55 and 3-year aged thermal emittance ^c of 0.75
Three-year-aged solar reflectance index ^d of 64

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with Section C402.3.1 and a 3-year-aged thermal emittance of 0.90.
b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
c. Aged thermal emittance tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h • ft² • °F (12W/m² • K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

Orientation ^e	SEW ^f		SW		S		NW		N		NE	
	SR	TE	SR	TE	SR	TE	SR	TE	SR	TE	SR	TE
PF < 0.1	0.51	0.33	0.51	0.33	0.51	0.33	0.48	0.38	0.51	0.40	0.53	0.41
0.1 ≤ PF < 0.5	0.50	0.37	0.50	0.37	0.50	0.37	0.43	0.53	0.46	0.56	0.43	0.58
PF ≥ 0.5	0.40	0.40	0.40	0.40	0.40	0.38	0.58	0.61	0.61	0.64	0.64	0.64
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
IRGC	0.33	0.33	0.33	0.40	0.40	0.40	NR	NR	NR	NR	NR	NR

NR = No Requirement; PF = Projection Factor.
^e "N" indicates vertical fenestration oriented within 45 degrees of true north. "SEW" indicates orientations other than "N." For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall not use SEW for all orientations.
^f In buildings three or more stories above grade, not less than 25 percent of the net floor area is within a daylight zone.
3. Daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones.
4. Visible transmittance (VT) of vertical fenestration is not less than 1.1 times solar heat gain coefficient (SHGC).
Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 4.
C402.4.1.2 Increased skylight area with daylight responsive controls. The daylight area shall be not more than 6 percent of the roof area provided that daylight responsive controls complying with Section C405.2.3.1 are installed in night zones.
C402.4.2 Minimum skylight fenestration area. In an enclosed space greater than 2,500 square feet (232 m²) in floor area, directly under a roof with not less than 75 percent of the ceiling area with a ceiling height greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/venue/center, convention center, automotive service area, space where manufacturing occurs, manufacturing warehouse, retail store, distribution/loading area, transportation depot or workshop, the total night daylight zone shall be not less than half the floor area and shall provide one of the following:
1. A minimum skylight area to night daylight zone of not less than 3 percent where all skylights have a VT of not less than 0.40 as determined in accordance with Section C503.1.3.
2. A minimum skylight effective aperture of not less than 1 percent, determined in accordance with Equation 4-4.
Skylight Effective Aperture = $0.87 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}$ / Night Zone (Equation 4-4)
where:
Skylight area = Total fenestration area of skylights.
Skylight VT = Area weighted average visible transmittance of skylights.
WF = Area weighted average wall factor, where wall factor is 0.9 if light well depth is less than 2 feet (610 mm) or 0.7 if light well depth is 2 feet (610 mm) or greater.


COMMERCIAL ENERGY EFFICIENCY

C402.5 Air leakage—thermal envelope (Mandatory). The *thermal envelope* of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building *thermal envelope* shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft² (2.0 L/s • m²). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.


C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in *Climate Zone 2B*.

C-38 2018 INTERNATIONAL ENERGY CONSERVATION CODE®
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Exhibits & Conference:
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Ernest N. Morial Convention Center | Halls B-D
New Orleans, Louisiana USA



WE16 - Complying with Energy Code Requirements for Commercial Roof Assemblies

Wednesday, February 7 from 9:30 AM to 11:00 AM

Overview About the Presenter(s)

Updated versions of the International Energy Conservation Code (IECC) and ASHRAE 90.1 have recently been published. During this program, roofing-related energy efficiency provisions will be covered including requirements for: minimum roof system R-value for different roof assembly configurations, air leakage limits, roof covering reflectivity and skylight performance. Changes from previous requirements will be highlighted.

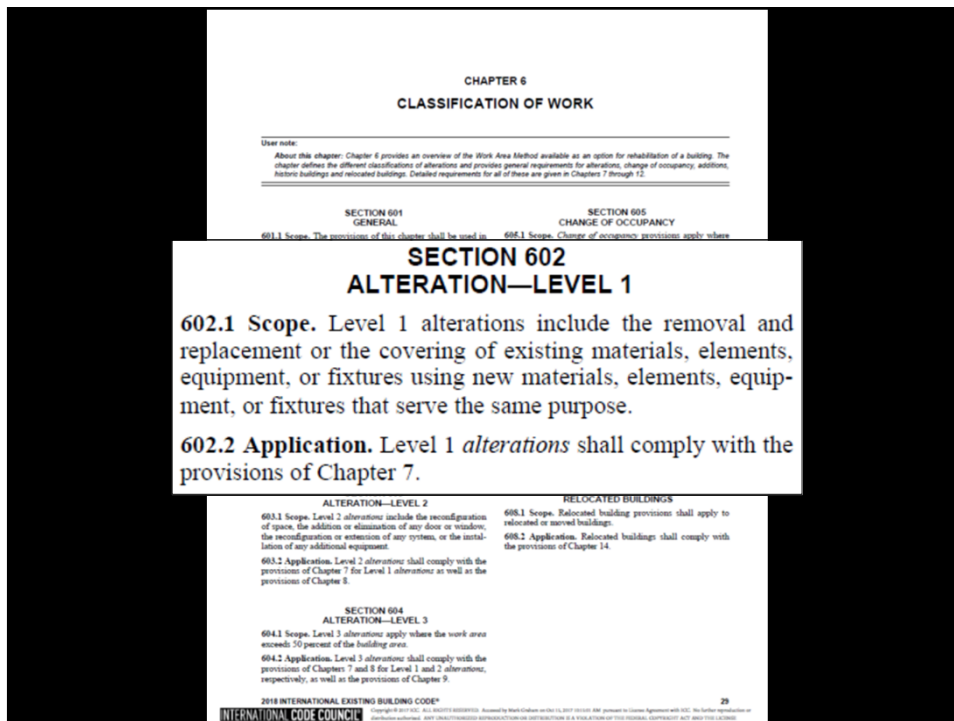
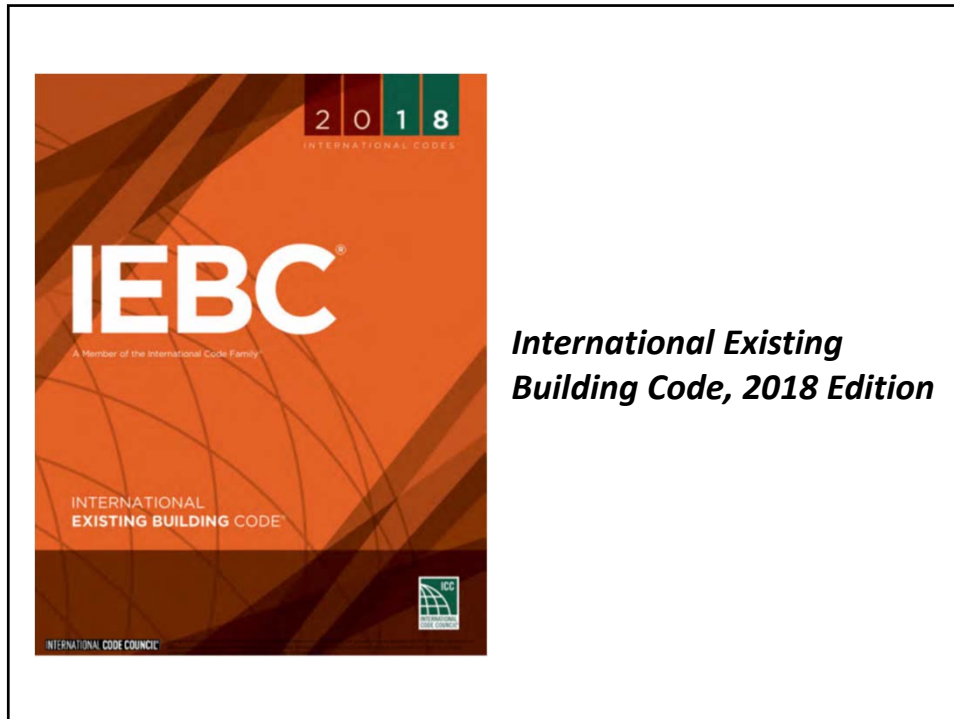
1. Identify roofing-related provisions in IECC 2018.
2. Identify roofing-related provisions in ASHRAE 90.1-2016.
3. Recognize how IECC and ASHRAE 90.1 are similar, are different.
4. Evaluate how current roofing-related energy code provisions have changed compared to previous editions.

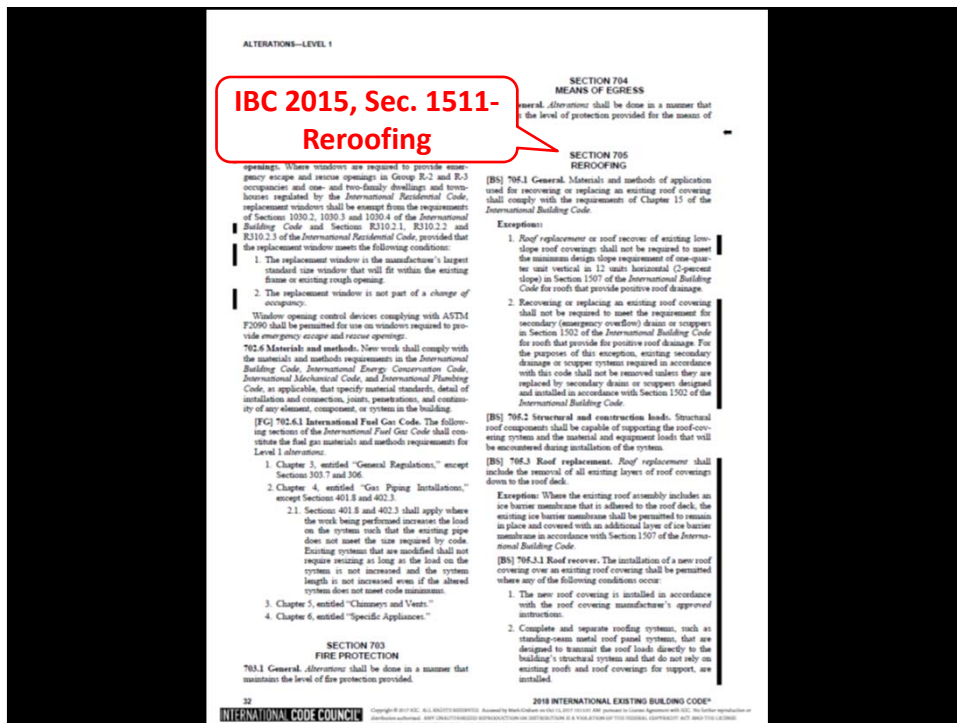
WE16

Credits: 1.5 of RCI CEHS/1.5 hours of DBPR/CILB credits

Education Tracks: [Green Building](#)

Event Type: [Conference](#) > Session





IBC 2015, Sec. 1511-Reroofing

SECTION 706 STRUCTURAL

[BS] 706.1 **General.** Where *alteration* work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the provisions of this section shall apply.

[BS] 706.2 **Addition or replacement of roofing or replacement of equipment.** Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *International Building Code* for new structures.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.
2. Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m²) or less over an existing single layer of roof covering.

[BS] 706.3 **Additional requirements for reroof permits.** The requirements of this section shall apply to *alteration* work requiring reroof permits.

[BS] 706.3.1 **Bracing for unreinforced masonry bearing wall parapets.** Where a permit is issued for reroofing for more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall include installation of parapet bracing unless an evaluation demonstrates compliance of such items. Reduced seismic forces shall be permitted.

[BS] 706.3.2 **Roof diaphragms resisting wind loads in high-wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm or section of a building located where the ultimate design wind speed, V_{ult} , determined in accordance with Figure 1609.3(1) of the *International Building Code*, is greater than 115 mph (51 m/s) or in a special wind region, as defined in Section 1609 of the *International Building Code*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the *International Building Code*.

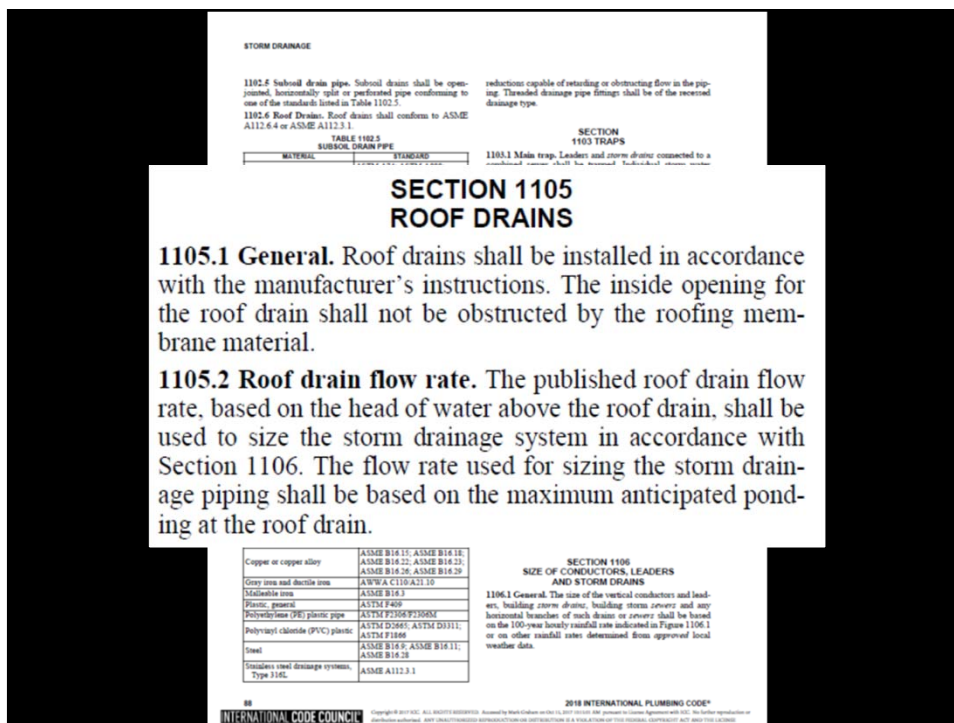
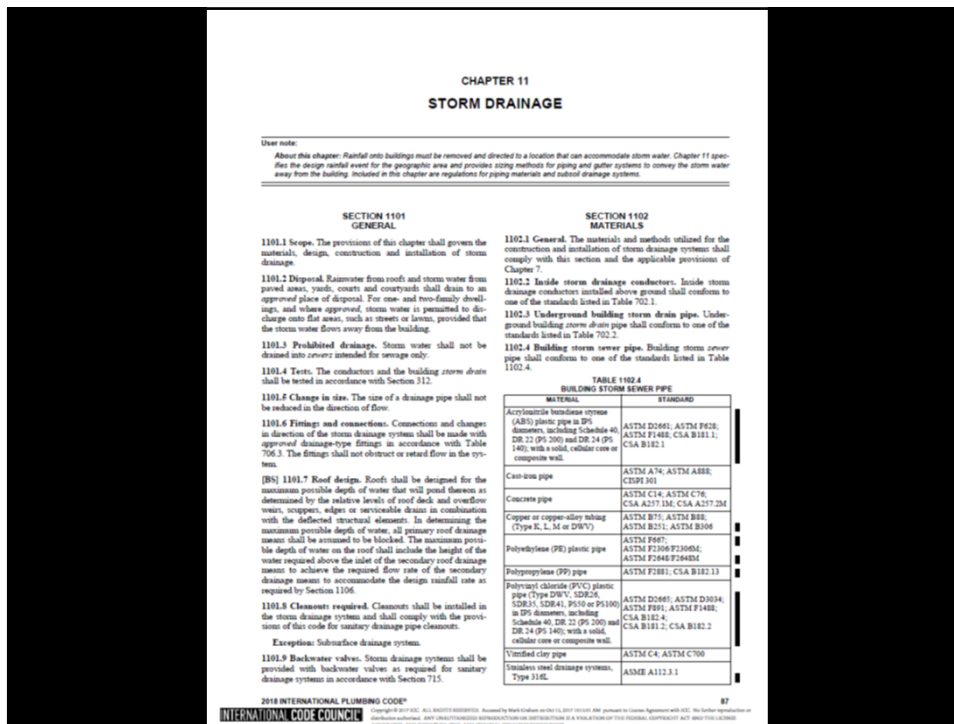
INTERNATIONAL CODE COUNCIL

IEBC 2018's roofing-related requirements

- No substantive changes from IECC 2015



***International Plumbing Code,
2018 Edition***



STORM DRAINAGE

1106.2 Size of storm drain piping. Vertical and horizontal storm drain piping shall be sized based on the flow through the roof drain. The flow rate in storm drain piping shall not exceed that specified in Table 1106.2.

1106.3 Vertical leader sizing. Vertical leaders shall be sized based on the flow rate from horizontal gutters or the maximum flow rate through roof drains. The flow rate through vertical leaders shall not exceed that specified in Table 1106.3.

1106.4 Vertical walls. In sizing roof drains and storm drainage piping, one-half of the area of any vertical wall drains transverse to the roof shall be added to the proper roof area for inclusion in calculating the required size of roof conductors, leaders and horizontal storm drainage piping.

1106.5 Parapet wall scuppers. Where scuppers are used for primary roof drainage or for secondary (emergency overflow) roof drainage or both, the quantity, size, location and elevation of the scuppers shall be chosen to prevent the depth of ponding water on the roof from exceeding the maximum water depth that the roof was designed for as determined by Section 1611.1 of the *International Building Code*. Scupper openings shall be not less than 4 inches (102 mm) in height and have a width that is equal to or greater than the circumference of a roof drain sized for the same roof area. The flow through the primary system shall not be considered when locating and sizing secondary scuppers.

1106.6 Size of roof gutters. Horizontal gutters shall be sized based on the flow rate from the roof surface. The flow rate in horizontal gutters shall not exceed that specified in Table 1106.6.

**SECTION 1108
SECONDARY (EMERGENCY) ROOF DRAINS**

1108.1 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. Where primary and secondary roof drains are manufactured as a single assembly, the inlet and outlet for each drain shall be independent.

3	92
2 + 4	92
2 1/2 + 3	92
4	192
1	192
4	192
2	360
2	360
2 1/2	360
3	563
3	563
2 1/2	563
2	1208
2	1208

min. 1 gallon per minute = 3.785 Lit.

HORIZONTAL DRAINS	
% inch per foot	% inch per foot
1/8	44
1/4	111
3/8	231
1/2	331
5/8	487
3/4	689
1	1,429
1 1/8	2,623
1 1/4	4,187
1 3/8	7,093

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2018 INTERNATIONAL PLUMBING CODE®

IPC 2018's roofing-related requirements

- No substantive changes from IECC 2015



Roofing-related provisions

International Fire Code, 2015 Edition

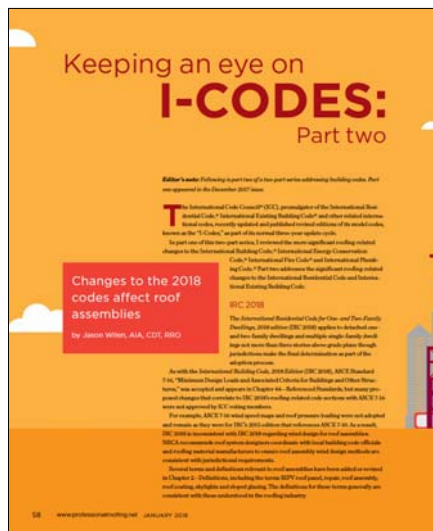
- Sec. 303-Asphalt kettles
- Sec. 317-Rooftop gardens
- Sec. 905.3.8-Rooftop gardens (standpipes)
- Sec. 1204-Solar photovoltaic power systems
- Sec. 3317-Safeguarding roofing operations

IFC 2018's roofing-related requirements

- No substantive changes from IECC 2015



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