



Wednesday, October 29, 2014

## **Commercial Workshop – Building Codes**

presented by

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National Roofing Contractors Association



1

### **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



2



## Texas code adoptions

Texas Department of Insurance:

- IBC 2006
- IRC 2006
- IECC 2009

Many jurisdictions adopt later editions



3



## *International \_\_\_\_\_ Code (I-codes)*

- Building (IBC)
- Residential (IRC)
- Fire (IFC)
- Energy Conservation (IECC)
- Plumbing (IPC)
- Private Sewage Disposal
- Mechanical (IMC)
- Fuel Gas
- Wildland-Urban Interface
- Existing Building (IEBC)
- Property Maintenance (IPMC)
- Zoning (IZC)
- Pool and Spa
- Green Construction (IgCC)



4



## ***International Building Code, 2012 Edition (IBC 2012)***



5



### **International Building Code, 2012 Edition**

**101.2 Scope.** The provisions of this code shall apply to the construction, *alteration*, relocation, enlargement, replacement, *repair*, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

**Exception:** Detached one- and two-family *dwellings* and multiple single-family *dwellings* (townhouses) not more than three *stories* above *grade plane* in height with a separate *means of egress* and their accessory structures shall comply with the *International Residential Code*.



6



## **Ch. 15-Roof Assemblies and Rooftop Structures**

*International Building Code, 2012 Edition*

### **SECTION 1501**

#### **GENERAL**

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



7



## **Sec. 1510-Reroofing**

*International Building Code, 2012 Edition*

**1510.1 General.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

**Exception:** Reroofing 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.



8



## **Sec. 1503-Weather Protection**

*International Building Code, 2012 Edition*

**[P] 1503.4 Roof drainage.** Design and installation of roof drainage systems shall comply with Section 1503 of this code and Sections 1106 and 1108, as applicable, of and the *International Plumbing Code*.

**[P] 1503.4.1 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. 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*.



9



## **Sec. 1503-Weather Protection**

*International Building Code, 2012 Edition*

**1503.6 Crickets and saddles.** A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

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

AAMA/WDMA/CSA 101/I.S./A440



10



## Sec. 1504-Performance Requirements

*International Building Code, 2012 Edition*

**1504.3 Wind resistance of nonballasted roofs.** Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.

**1504.3.1 Other roof systems.** Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4474, UL 580 or UL 1897.



11



## Sec. 1504-Performance Requirements

*International Building Code, 2012 Edition*

**1504.3.2 Metal panel roof systems.** Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592.

**Exception:** Metal roofs constructed of cold-formed steel, where the roof deck acts as the roof covering and provides both weather protection and support for structural loads, shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2210.1.



12



## **Sec. 1504-Performance Requirements**

*International Building Code, 2012 Edition*

**1504.4 Ballasted low-slope roof systems.** Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with Section 1504.8 and ANSI/SPRI RP-4.



13



## **Sec. 1504-Performance Requirements**

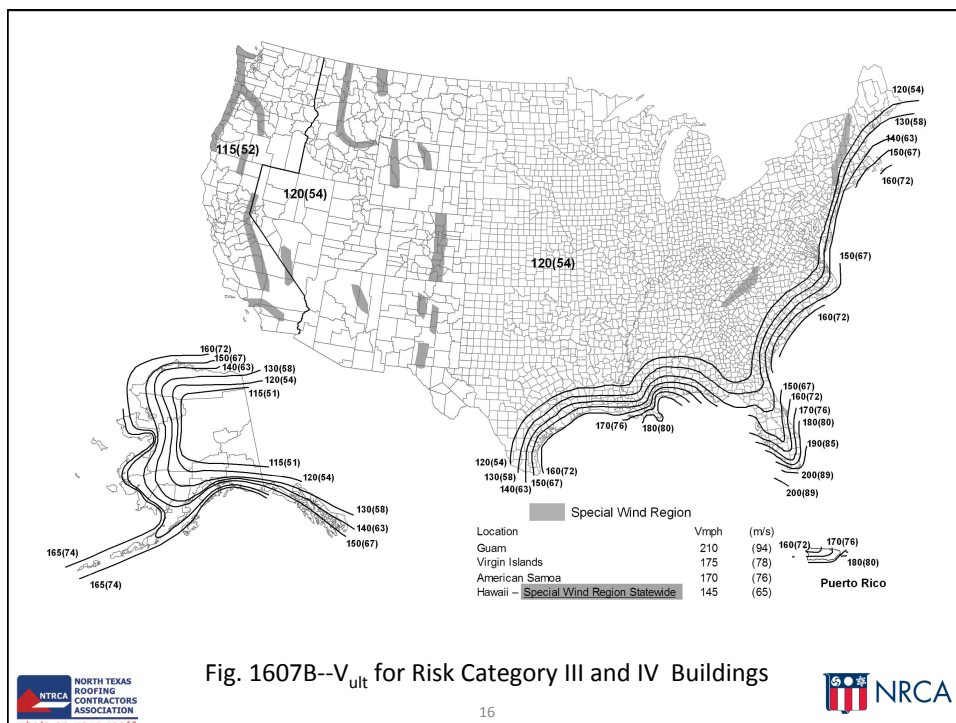
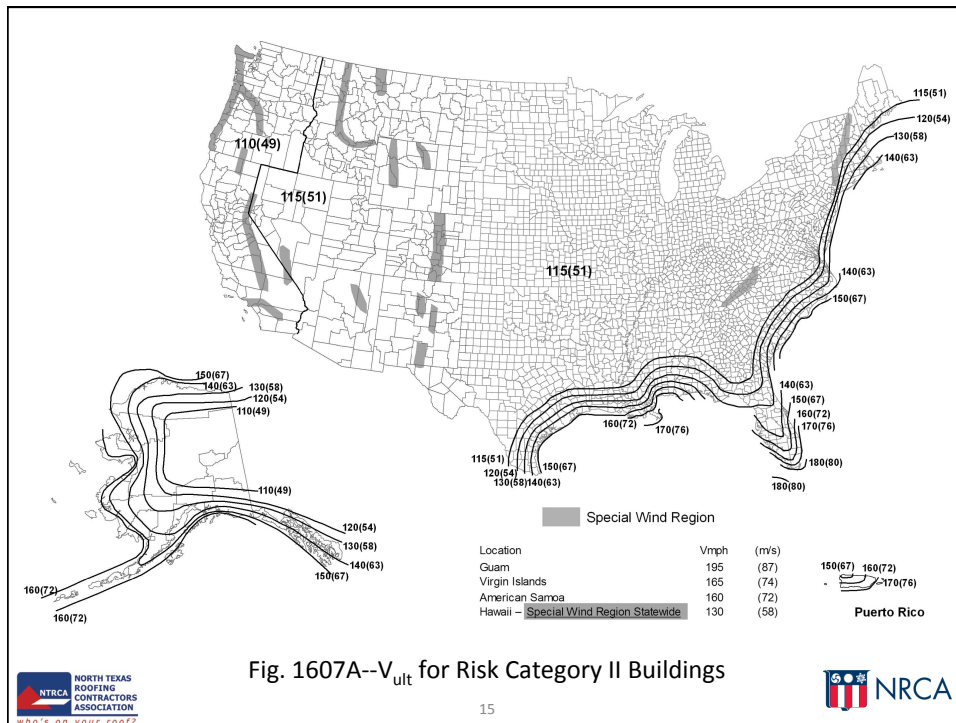
*International Building Code, 2012 Edition*

**1504.5 Edge securement for low-slope roofs.** Low-slope built-up, modified bitumen and single-ply roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except  $V_{ult}$  wind speed shall be determined from Figure 1609A, 1609B, or 1609C as applicable.



14







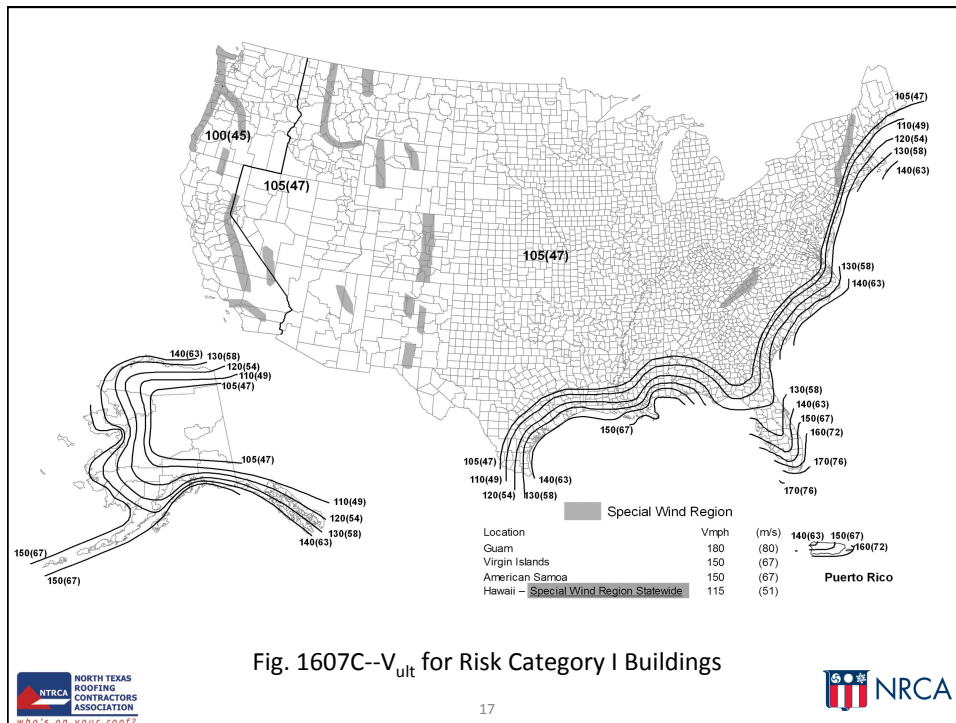


Fig. 1607C-- $V_{ult}$  for Risk Category I Buildings

**TABLE 1609.3.1**  
**WIND SPEED CONVERSIONS** a, b, c

$V_{ult}$	100	110	120	130	140	150	160	170	180	190	200
$V_{asd}$	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

- Linear interpolation is permitted.
- $V_{asd}$  = nominal design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.
- $V_{ult}$  = ultimate design wind speeds determined from Figures 1609A, 1609B, or 1609C.

## Sec. 1504-Performance Requirements

*International Building Code, 2012 Edition*

**1504.8 Aggregate.** Aggregate used as surfacing for roof coverings and aggregate, gravel or stone used as ballast shall not be used on the roof of 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.



**TABLE 1504.8  
MAXIMUM ALLOWABLE MEAN ROOF HEIGHT PERMITTED FOR  
BUILDINGS WITH AGGREGATE ON THE ROOF IN AREAS  
OUTSIDE A HURRICANE-PRONE REGION**

NOMINAL DESIGN WIND SPEED, $V_{50}$ (mph) <sup>b, d</sup>	MAXIMUM MEAN ROOF HEIGHT (ft) <sup>a, c</sup>		
	Exposure category		
	B	C	D
85	170	60	30
90	110	35	15
95	75	20	NP
100	55	15	NP
105	40	NP	NP
110	30	NP	NP
115	20	NP	NP
120	15	NP	NP
Greater than 120	NP	NP	NP

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. Mean roof height as defined in ASCE 7.
- b. For intermediate values of  $V_{50}$ , the height associated with the next higher value of  $V_{50}$  shall be used, or direct interpolation is permitted.
- c. NP = gravel and stone not permitted for any roof height.
- d.  $V_{50}$  shall be determined in accordance with Section 1609.3.1.



## Sec. 1505-Fire Classification

*International Building Code, 2012 Edition*

**1505.1 General.** Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. 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.



## Sec. 1505-Fire Classification

*International Building Code, 2012 Edition*

TABLE 1505.1<sup>a,b</sup>  
MINIMUM ROOF COVERING CLASSIFICATION  
FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C <sup>c</sup>	B	C <sup>c</sup>	B	B	C <sup>c</sup>

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

- 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 in height 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.



## Sec. 1505-Fire Classification

*International Building Code, 2012 Edition*

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

### **Exceptions:**

1. Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on noncombustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.
3. Class A roof assemblies include 16 oz/sq. ft. (0.0416 kg.m<sup>2</sup>) copper sheets installed over combustible decks.



23



## Sec. 1505-Fire Classification

*International Building Code, 2012 Edition*

**1505.8 Photovoltaic systems.** Rooftop installed photovoltaic systems that are adhered or attached to the roof covering or photovoltaic modules/shingles installed as roof coverings shall be labeled to identify their fire classification in accordance with the testing required in Section 1505.1.



24



## **Sec. 1506-Materials**

*International Building Code, 2012 Edition*

**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.



25



## **Sec. 1507-Requirements for Roof Coverings**

*International Building Code, 2012 Edition*

- Sec. 1507.2-Asphalt shingles
- Sec. 1507.3-Clay and concrete tile
- Sec. 1507.4-Metal roof panels
- Sec. 1507.5-Metal roof shingles
- Sec. 1507.6-Mineral-surfaced roll roofing
- Sec. 1507.7-Slate shingles
- Sec. 1507.8-Wood shingles
- Sec. 1507.9-Wood shakes
- [continued...]



26



## **Sec. 1507-Requirements for Roof Coverings**

*International Building Code, 2012 Edition*

- Sec. 1507.10-Built-up roofs
- Sec. 1507.11-Modified bitumen roofing
- Sec. 1507.12-Thermoset single-ply roofing
- Sec. 1507.13-Thermoplastic single-ply roofing
- Sec. 1507.14-Spray polyurethane foam roofing
- Sec. 1507.15-Liquid-applied roofing
- Sec. 1507.16-Roof gardens and landscaped roofs
- Sec. 1507.17-Photovoltaic modules/shingles



27



## **Sec. 1507-Requirements for Roof Coverings**

IBC 2012, Section 1507.2-Asphalt Shingles

**1507.2.7 Attachment.** Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), shingles shall be installed as required by the manufacturer.



28



## Sec. 1507-Requirements for Roof Coverings

IBC 2012, Section 1507.2-Asphalt Shingles

**1507.2.7.1 Wind resistance.** Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table 1507.2.7.1(1) for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D 7158 and the required classification in Table 1507.2.7.1(1).

**Exception:** Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and labeled to indicate compliance with ASTM D 3161 and the required classification in Table 1507.2.7.1(2).



29



**TABLE 1507.2.7.1(1)  
CLASSIFICATION OF ASPHALT  
ROOF SHINGLES PER ASTM D 7158<sup>a</sup>**

NOMINAL DESIGN WIND SPEED, $V_{asd}^b$ , (mph)	CLASSIFICATION REQUIREMENT
85	D, G or H
90	D, G or H
100	G or H
110	G or H
120	G or H
130	H
140	H
150	H

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

a. The standard calculations contained in ASTM D 7158 assume exposure category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

b.  $V_{asd}$  shall be determined in accordance with Section 1609.3.1.

**TABLE 1507.2.7.1(2)  
CLASSIFICATION OF ASPHALT  
ROOF SHINGLES PER ASTM D 3161**

NOMINAL DESIGN WIND SPEED, $V_{asd}^a$ , (mph)	CLASSIFICATION REQUIREMENT
85	A, D or F
90	A, D or F
100	A, D or F
110	F
120	F
130	F
140	F
150	F

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

a.  $V_{asd}$  shall be determined in accordance with Section 1609.3.1.



## SPF roof systems

IBC 2012, Section 1507.14.3--Application

**1507.14.3 Application.** Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Table 1507.14.3 shall be applied no less than 2 hours nor more than 72 hours following the application of the foam.

**TABLE 1507.14.3  
PROTECTIVE COATING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D 6083
Silicone coating	ASTM D 6694
Moisture-cured polyurethane coating	ASTM D 6947





## **Liquid-applied Roofing**

IBC 2012, Section 1507.15--Liquid-applied Roofing

**1507.15 Liquid-applied roofing.** The installation of liquid-applied roofing shall comply with the provisions of this section.

**1507.15.1 Slope.** Liquid-applied roofing shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

**1507.15.2 Material standards.** Liquid-applied roofing shall comply with ASTM C 836, ASTM C 957, ASTM D 1227 or ASTM D 3468, ASTM D 6083, ASTM D 6694 or ASTM D 6947.



33



## **Vegetative Roofs**

IBC 2012, Section 1507.16--Roof Gardens and Landscaped Roofs

**1507.16 Roof gardens and landscaped roofs.** Roof gardens and landscaped roofs shall comply with the requirements of this chapter and Sections 1607.12.3 and 1607.12.3.1 and the *International Fire Code*.

**1507.16.1 Structural fire resistance.** The structural frame and roof construction supporting the load imposed upon the roof by the roof gardens or landscaped roofs shall comply with the requirements of Table 601.



34



## Rooftop Photovoltaic

IBC 2012, Section 1509—Rooftop Structures

**1509.7 Photovoltaic systems.** Rooftop mounted photovoltaic systems shall be designed in accordance with this section.

**1509.7.1 Wind resistance.** Rooftop mounted photovoltaic systems shall be designed for wind loads for component and cladding in accordance with Chapter 16 using an effective wind area based on the dimensions of a single unit frame.

**1509.7.2 Fire classification.** Rooftop mounted photovoltaic systems shall have the same fire classification as the roof assembly required by Section 1505.

**1509.7.3 Installation.** Rooftop mounted photovoltaic systems shall be installed in accordance with the manufacturer's installation instructions.

**1509.7.4 Photovoltaic panels and modules.** Photovoltaic panels and modules mounted on top of a roof shall be listed and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's installation instructions.

## Sec. 1510-Reroofing

*International Building Code, 2012 Edition*

**1510.1 General.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

**Exception:** Reroofing 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.

## **Sec. 1510-Reroofing**

*International Building Code, 2012 Edition*

**1510.3 Recovering versus replacement.** New roof coverings shall not be installed without first removing all existing layers of roof coverings down to the roof deck 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 wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

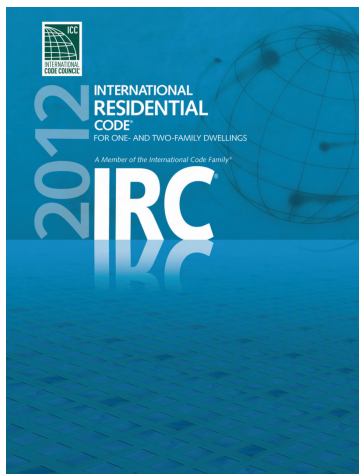
**Exceptions:...**



37



## ***International Residential Code, 2012 Edition (IRC 2012)***



38

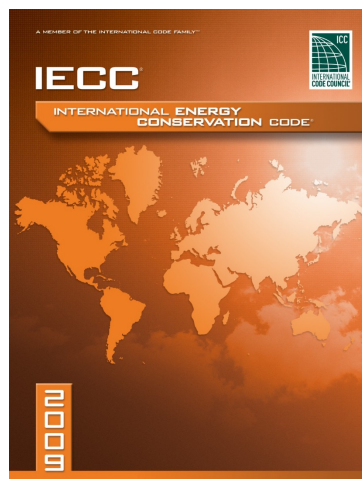


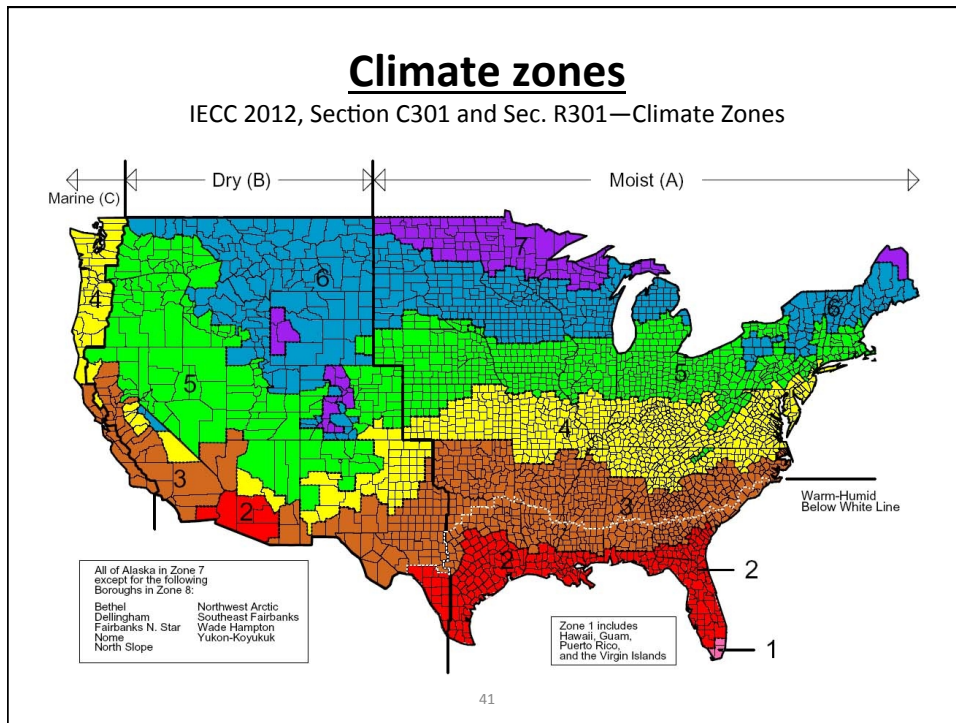
### **International Residential Code, 2012 Edition**

- Chapter 9-Roof Assemblies
- Similar to IBC 2009, Chapter 15
- Fire classification not required unless:
  - Roof edge less than 3 feet from lot line
  - Local ordinance
- More prescriptive-based language



### ***International Energy Conservation Code, 2009 Edition (IECC 2009)***






### Roofing-specific adaptation of Table 402.1.1


*International Energy Conservation Code, 2009 Edition (Residential buildings)*

Insulation and Fenestration Requirements by Component <sup>a</sup>	
Climate zone	Ceiling R-value
1	30
2	
3	
4	38
5	
6	
7	49
8	

<sup>a</sup> R-values are minimums. ...  
[Other footnotes omitted for clarity]



42



### **Roofing-specific adaptation of Table 502.2(1)**

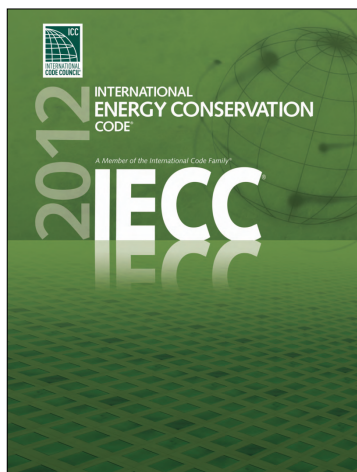
*International Energy Conservation Code, 2009 Edition (Commercial buildings)*

<b>Opaque Thermal Envelope Assembly Requirements</b>			
<b>Climate zone</b>	<b>Roof assembly configuration</b>		
	<b>Insulation entirely above deck</b>	<b>Metal buildings (with R-5 thermal blocks)</b>	<b>Attic and other</b>
1	R-15ci	R-19	R-30
2	R-20ci	R-13 + R-13	R-38
3			
4			
5			
6	R-25ci	R-13 + R-19	R-49
7			
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)



### ***International Energy Conservation Code, 2012 Edition (IECC 2012)***



## Roofing-specific adaptation of Table R402.1.1

*International Energy Conservation Code, 2012 Edition*

Insulation and Fenestration Requirements by Component <sup>a</sup>	
Climate zone	Ceiling R-value
1	30
2	38
3	
4	
5	49
6	
7	
8	

<sup>a</sup> R-values are minimums. ...  
[Other footnotes omitted for clarity]



## Roofing-specific adaptation of Table C402.2

*International Energy Conservation Code, 2012 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			
3			
4	R-25 ci	R-25 + R-11 LS	R-49
5			
6	R-30ci	R-30 + R-11 LS	R-49
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)



## R-value determination

IECC 2012, Section C303.1.4-Insulation Product Rating

**C303.14 Insulation product rating.** The thermal resistance (R-value) of insulation shall be determined in accordance with the U.S. Federal Trade commission R-value rule (CFR Title 16, Part 460) in units of  $h \times ft^2 \times ^\circ F/Btu$  at a mean temperature of 75°F (24°C).

What about tapered insulation?



47



## Tapered insulation

*International Energy Conservation Code, 2012 Edition*

**C402.2.1 Roof assembly.** The minimum thermal resistance (R-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

### **Exceptions:**

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted U-factor is equivalent to the same assembly with the R-value specified in Table C402.2.
2. ...

IECC Commentary indicates Exception 1 applies to tapered insulation systems.



48





## **2012 IECC Code and Commentary**

### Tapered insulation

“...The exception to this section permits a roof that is “continuously insulated” to have areas that do not meet the required *R*-values, provided that the area-weighted values are equivalent to the specified insulation values. This type of insulation referred to as tapered insulation is where the roof insulation varies to provide slope for drainage....”

[continued...]



49



## **2012 IECC Code and Commentary**

### Tapered insulation

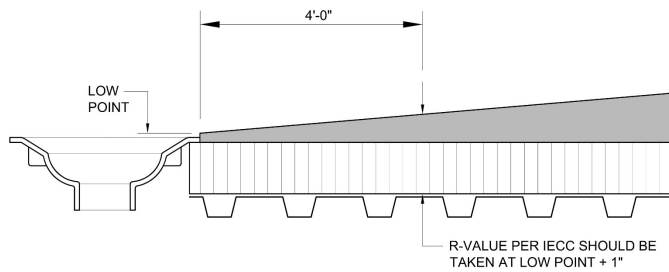
“...This 1-inch (25 mm) limitation does not prevent the provisions from being applied to roofs that have a greater variation; it simply does not allow the additional thickness to be factored into the average insulation values. Where the variation exceeds 1 inch (25 mm), it would be permissible to go to the thinnest spot and measure the *R*-value at that point (for the example call this Point “a”). Then go to a point that is 1 inch (25 mm) thicker than Point “a” and measure the *R*-value there (for the example, call this Point “b”). The remaining portions of the roof that are thicker than the additional 1-inch (25 mm) portion (Point “b”) would simply be assumed to have the same *R*-value that Point “b” had. All portions of the roof that meet or exceed the Point “b” *R*-value would simply use the Point “b” *R*-value when determining the area weighted *U*-factor for the roof. “



50



**Graphically depicted...**



**TABLE C402.2.1.1**

**MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS<sup>a</sup>**

Three-year aged solar reflectance <sup>b</sup> of 0.55 and three-year aged thermal emittance of 0.75
Initial solar reflectance <sup>b</sup> of 0.70 and initial thermal emittance <sup>c</sup> of 0.75
Three-year-aged solar reflectance index <sup>d</sup> of 64
Initial solar reflectance index <sup>d</sup> of 82

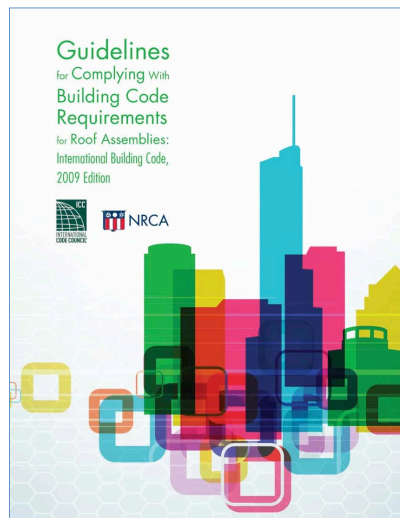
[Footnotes omitted for clarity]

### In summary

- Be knowledgeable of applicable codes
- Watch for state/local modifications
- Comply with the applicable codes
- Building/Residential and Energy Code



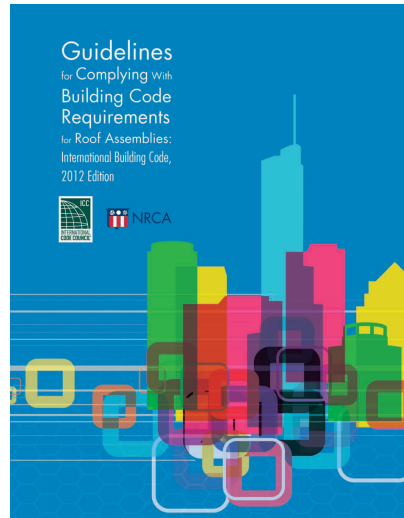
### Building Codes Manual (2009 Codes)



- Based on 2009 I-codes:
  - IBC 2009
  - IRC 2009
  - IECC 2009
  - IPC 2009
  - IFC 2009
- Includes roofing-related code text and NRCA commentary on each section
- Co-branded with ICC; NRCA promotes to industry and ICC promotes to code officials



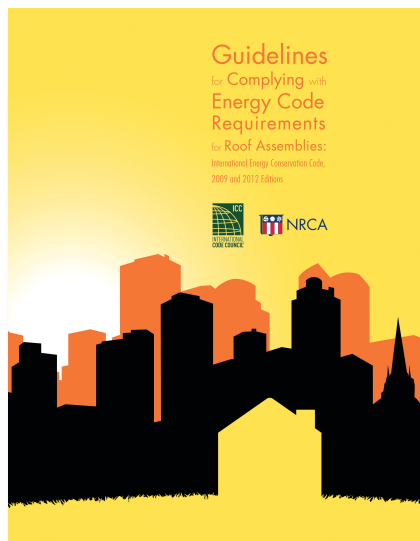
## **Building Codes Manual (2012 Codes)**



- Based on 2012 I-codes:
  - IBC 2012
  - IRC 2012
  - IECC 2012
  - IPC 2012
  - IFC 2012
- Includes roofing-related code text and NRCA commentary on each section
- Co-branded with ICC; NRCA promotes to industry and ICC promotes to code officials



55



### ***Guidelines for Complying with Energy Code Requirements for Roof Assemblies: International Energy Efficiency Code, 2009 and 2012 Editions***

Contact NRCA Customer Service:  
1-888-ASK-NRCA (275-6722)  
or [shop.nrca.net](http://shop.nrca.net)



56





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