



**Low Slope Roofing Systems**  
**The University of Wisconsin Madison**  
Madison, Wisconsin – December 11-13, 2013

***Let's Talk Roofing Codes: What They Are  
and Their Impact on Owners, Designers,  
(Manufacturers, Distributors) and Contractors***

presented by

**Mark S. Graham**

Associate Executive Director, Technical Services  
National Roofing Contractors Association  
Rosemont, Illinois

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**Some background**

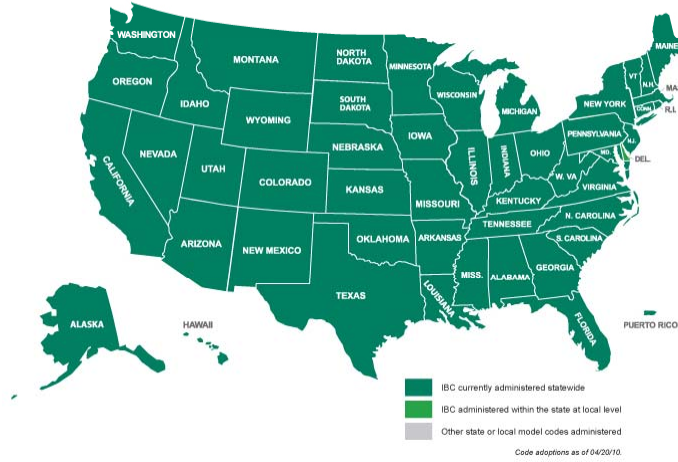
- The I-Codes are “model codes” developed by the International Code Council (ICC)
- Model codes serve as the technical basis for state or local code adoption
- The code provides the minimum legal requirements for building construction...and operation
- The code is enforced by the “authority having jurisdiction”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

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## Code adoption

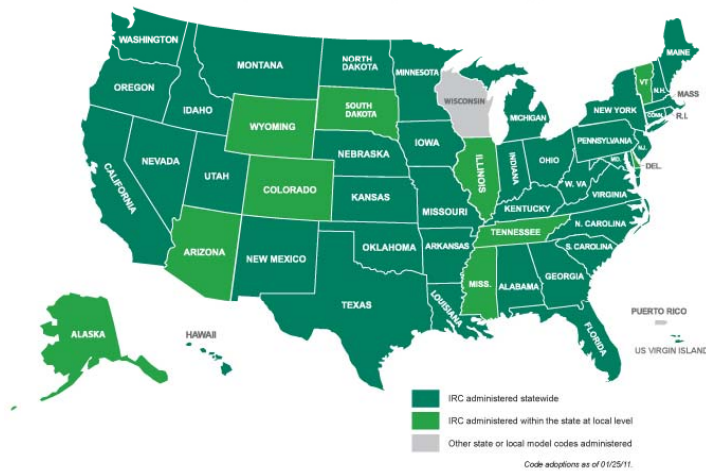
### **INTERNATIONAL BUILDING CODE ADOPTION MAP**

The IBC is in use or adopted in 50 states, the District of Columbia, the U.S. Virgin Islands, NYC, Guam and the Northern Marianas Islands.



### **INTERNATIONAL RESIDENTIAL CODE ADOPTION MAP**

The IRC is in use or adopted in 49 states, the District of Columbia and the U.S. Virgin Islands



### **Code enforcement**

- AHJ's code official
- Construction litigation

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### **Legal considerations**

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

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

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## **Who is responsible for compliance?**

- The building owner
- And, everyone else involved

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## **AIA General Conditions**

AIA A201 – General Conditions of The Contract for Construction

### **Article 3 Contractor**

**3.2.3** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, 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.

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## **AIA General Conditions**

AIA A201 – General Conditions of The Contract for Construction

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

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



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**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 *dwelling*s and multiple single-family *dwelling*s (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*.

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**International Building Code, 2012 Edition**

Specific roofing-related requirements

- Ch. 12-Interior Environment (attic ventilation)
- Ch. 13-Energy Efficiency (thermal insulation)
- Ch. 15-Roof Assemblies and Rooftop Structures
- Ch. 16-Structural Design (design loads)
- Ch. 22-Steel (structural metal panel roofing)
- Ch. 24-Glass and Glazing (skylights)
- Ch. 26-Plastic (foam plastic insulation)
- Ch. 35-Referenced Standards

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## **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.

Building code requirements for vegetative roof systems and rooftop PV are in Ch. 15

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

*International Building Code, 2012 Edition*

- Sec. 1501-Scope
- Sec. 1502-Defintions
- Sec. 1503-Weather Protection
- Sec. 1504-Performance Requirements (wind)
- Sec. 1505-Fire Classification
- Sec. 1506-Materials
- Sec. 1507-Requirements for Roof Coverings
- Sec. 1508-Roof Insulation
- Sec. 1509-Rooftop Structures
- Sec. 1510-Reroofing

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**Roofing-related building code provisions addressed in this presentation**

- Reroofing
- Prescriptive requirements
- Fire resistance
- Wind-uplift resistance
- Alternate approval

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**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.

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## **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:...**

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## **Prescriptive requirements**

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## **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

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## **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.

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

*International Building Code, 2012 Edition*

- Asphalt shingles
- Clay & concrete tile
- Metal roof panels
- Metal roof shingles
- Roll roofing
- Slate shingles
- Wood shingles
- Wood shakes
- Built-up roofs
- Modified bitumen roofs
- Thermoset single-ply roofs
- Thermoplastic single-ply roofs
- SPF roofs
- Liquid-applied roofing
- Roof gardens/landscaped roofs
- Photovoltaic modules/shingles

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## **Fire resistance**

### **Classification of exterior fire resistance:**

Class A: Severe fire-test exposure

Class B: Moderate fire-test exposure

Class C: Light-fire test exposure

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## 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.

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## 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.

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## **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.

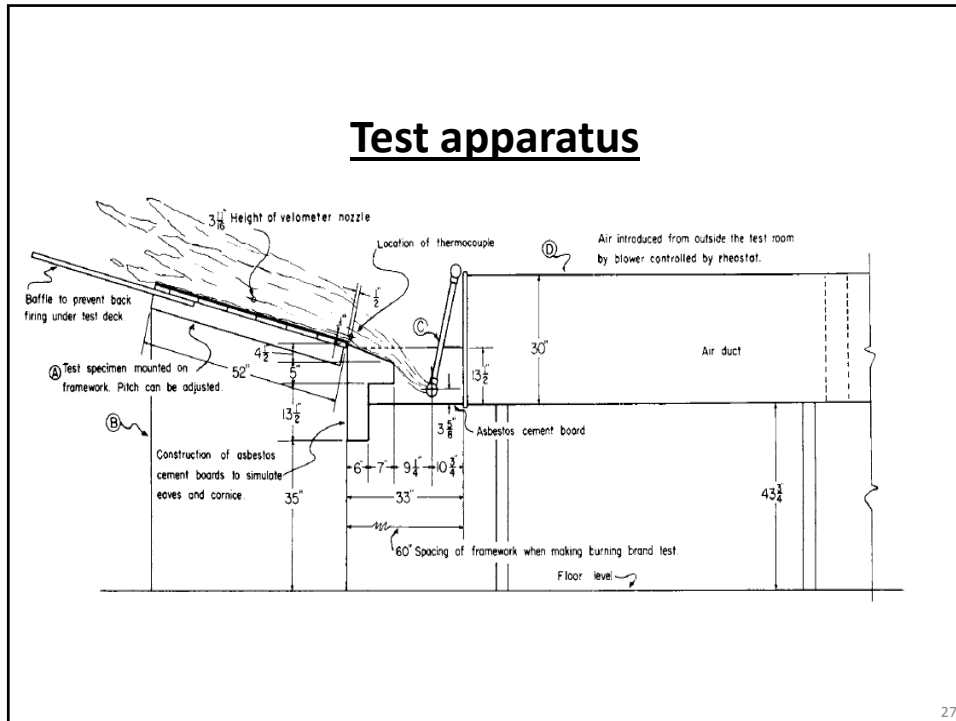
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## **ASTM E108 or UL 790 testing**

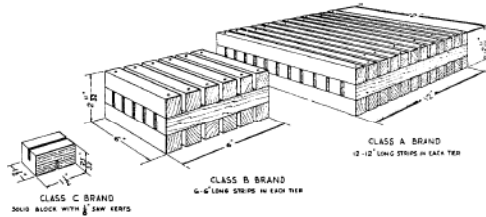
- Spread of flame test (all roof deck types)
- Burning brand test (combustible roof decks)
- Intermittent flame test (combustible roof decks)
- Flying brand test
- Rain test
- Weathering test

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- ### Spread of flame test
- Test specimen sizes:
    - Class A: 8 ft. long x 40 in. wide
    - Class B: 9 ft. long x 40 in. wide
    - Class C: 13 ft. long x 40 in. wide
  - 10 minute duration
  - Pass/fail criteria:
    - No lateral flame spread to edges of test specimen
    - Maximum up-slope flame spread:
      - Class A: 6 ft.
      - Class B: 8 ft.
      - Class C: 13 ft.
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## Burning brand test

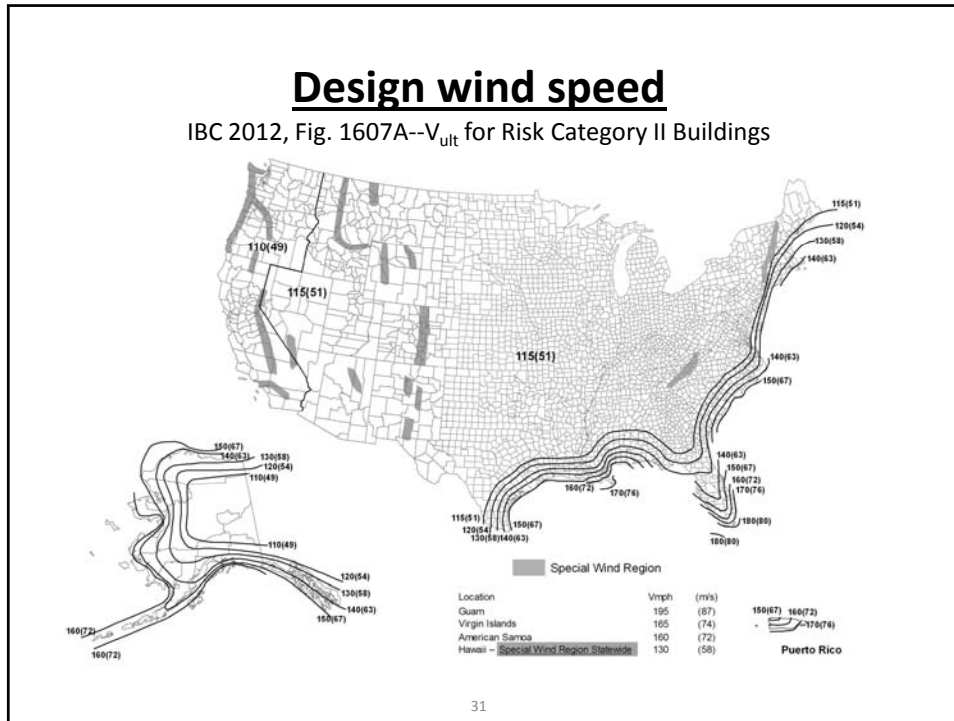


- Brand class/size:
  - Class A brand (12" x 12" x 2-11/32")
  - Class B brand (6" x 6" x 2-11/32")
  - Class C - 20 brands (1-1/2" x 1-1/2" x 25/32" each)
- 1-1/2 hr. duration
- Pass/fail: Sustained flaming on the bottomside of the roof deck

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## Wind-uplift resistance

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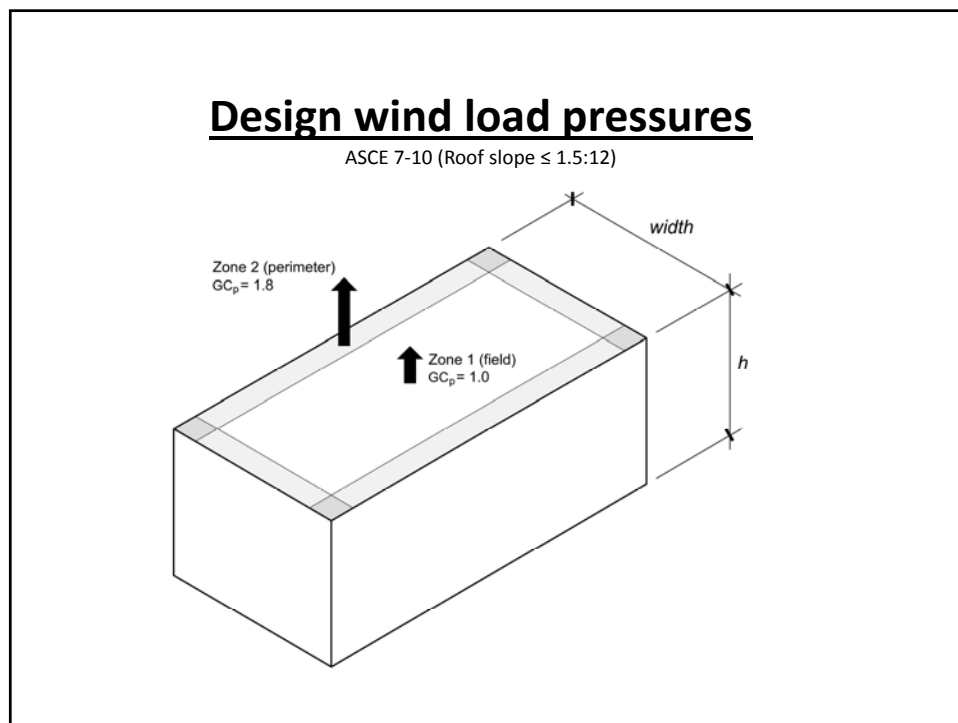
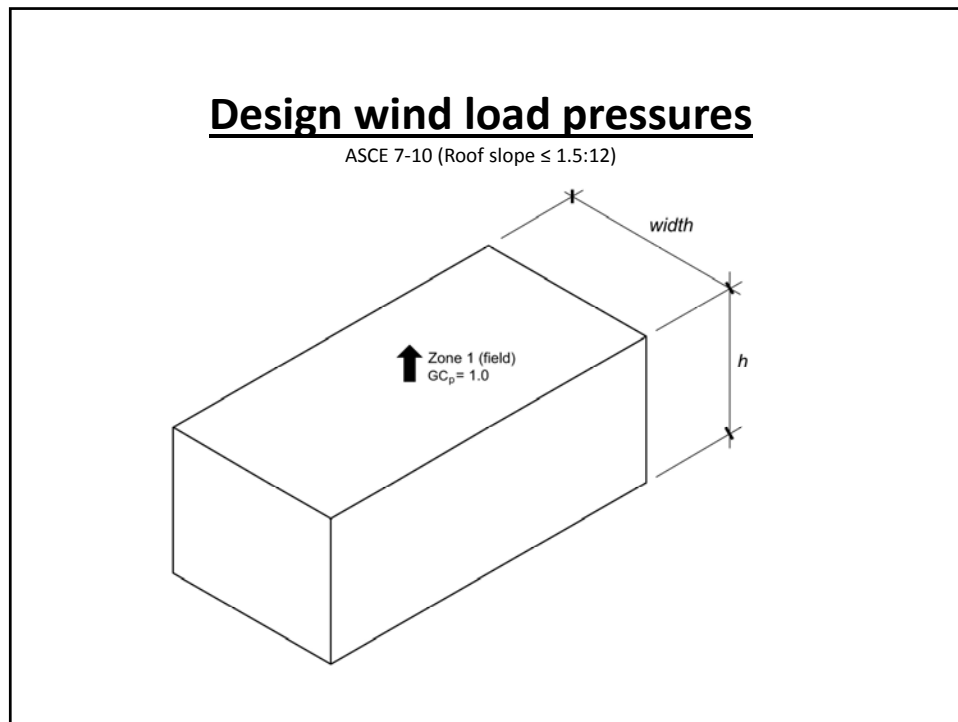
## Sec. 1504-Performance Requirements

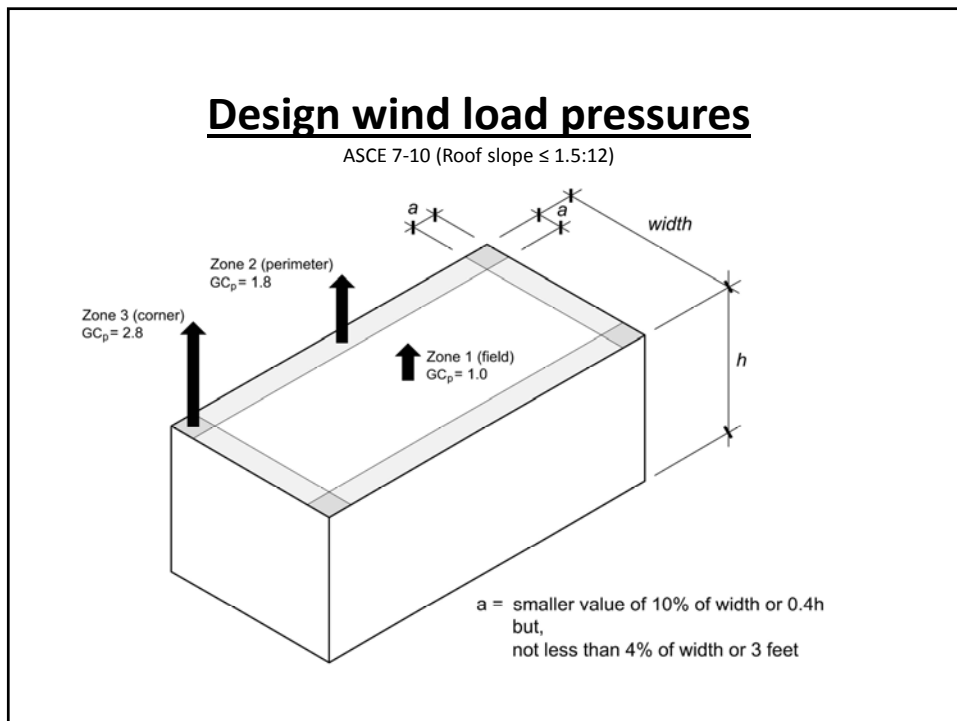
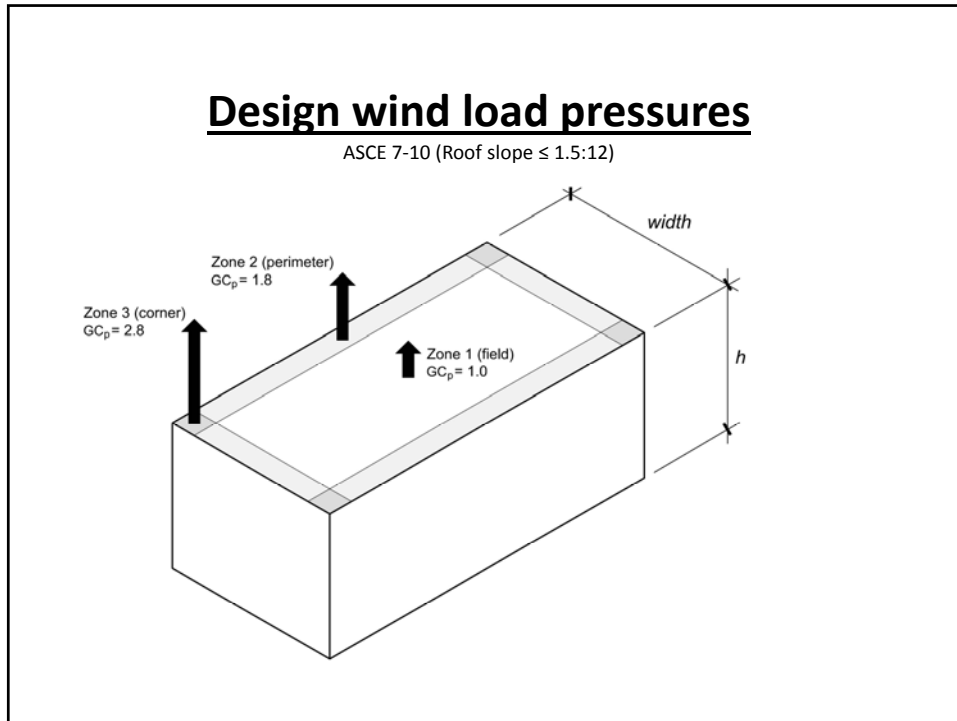
*International Building Code, 2012 Edition*

**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.







## Design wind load pressures

*International Building Code, 2012 Edition*

### SECTION 1603

#### CONSTRUCTION DOCUMENTS

**1603.1 General.** *Construction documents* shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the *construction documents*.

[continued...]

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**1603.1.4 Wind design data.** The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force resisting system of the structure:

1. Ultimate design wind speed,  $V_{ult}$  (3-second gust), miles per hour (km/hr) and nominal design wind speed,  $V_{ascd}$ , as determined in accordance with Section 1609.3.1.
2. Risk category.
3. Wind exposure. Where more than one wind exposure is utilized, the wind exposure and applicable wind direction shall be indicated.
4. The applicable internal pressure coefficient.
5. Components and cladding. The design wind pressures in terms of psf (kN/m<sup>2</sup>) to be used for the design of exterior component and cladding materials not specifically designed by the *registered design professional*.

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**www.roofwinddesigner.com**



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## **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.

## Wind uplift test methods

### FM Approvals (FM)

FM 4474:

- Class 60 (30 psf field)
- Class 90 (45 psf field)
- Class 120 (60 psf field)
- Class 150 (75 psf field)
- Class 180 (90 psf field)
- and on, and on....

### Underwriters Laboratories (UL)

UL 580 and UL 1897:

- Class 30 (30 psf)
- Class 60 (60 psf)
- Class 90 (90 psf)

Testing at and certification by FM or UL is not required by the Code

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## 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.

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## **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.

ANSI/SPRI RP-4 is available on SPRI's website: [www.spri.org](http://www.spri.org)

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## **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.

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## 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.

[Continued...]

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**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, $V_{wd}$ (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  $V_{wd}$ , the height associated with the next higher value of  $V_{wd}$  shall be used, or direct interpolation is permitted.

c. NP = gravel and stone not permitted for any roof height.

d.  $V_{wd}$  shall be determined in accordance with Section 1609.3.1.

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### **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**

<b>MATERIAL</b>	<b>STANDARD</b>
Acrylic coating	ASTM D 6083
Silicone coating	ASTM D 6694
Moisture-cured polyurethane coating	ASTM D 6947

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### **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.

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## **Alternate approval**

IBC 2012, Sec. 104.11

**104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

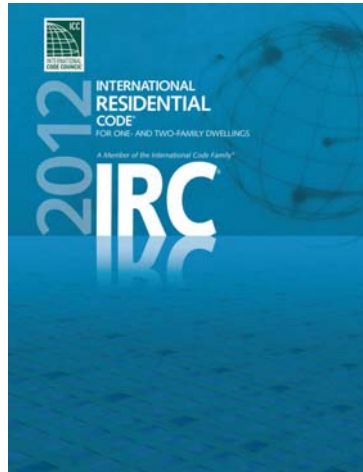
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**104.11.1 Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

**104.11.2 Tests.** Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

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



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

- Chapter 9-Roof Assemblies
- Similar to IBC 2012, Chapter 15
- Required fire classification by local ordinance
- More prescriptive-based language

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***International Plumbing Code,  
2012 Edition (IPC 2012)***



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***International Plumbing Code, 2012 Edition***

Roof drain, drain piping, scupper, gutter and downspout sizing is dictated by the *International Plumbing Code*.

IPC Chapter 11-Storm Drainage

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***International Fire Code,  
2012 Edition (IFC 2012)***



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***International Fire Code, 2012 Edition***

Fire safety during roofing operations and rooftop PV and vegetative roof systems are dictated by the *International Fire Code*.

- IFC Sec. 303-Kettles (e.g.,  $\geq 20$  ft.)
- IFC Sec. 3317-Safeguarding Roofing Operations
- IFC Sec. 605.11-Solar Photovoltaic Power Systems
- IFC Sec. 317-Rooftop Gardens and Landscaped Roofs

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## **Energy Code**

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## **Some history...**

Energy efficiency of buildings

- 1973: Arab oil embargo
- 1974: NBS Interim Report 74-452 (prelim. criteria)
- 1975: ASHRAE 90-75 (energy-efficiency std.)
- 1977: BOCA/ICBO/SBCCI code (CABO MEC)
- 1980: ASHRAE 90-80
- 1989: ASHRAE 90.1-89
- 1992: Energy Policy Act (EPAAct)
- 1998: *International Energy Conservation Code*
- 1999: ASHRAE 90.1-99

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## More recent history...

Energy efficiency in buildings

- 2004: ASHRAE 90.1-04
- 2006: *International Energy Conservation Code, 2006 Edition*
- 2007: ASHRAE 90.1-07
- 2009: *International Energy Conservation Code, 2009 Edition*
- 2009: ASHRAE 189.1-09
- 2010: ASHRAE 90.1-10
- 2011: *International Energy Conservation Code, 2012 Edition*
- 2012: *International Green Construction Code, 2012 Edition*

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## Federal Register, May 17, 2012

**2012** Federal Register / Vol. 77, No. 90 / Thursday, May 17, 2012 / Notice

statements on the agenda. The Chairman of the Committee will conduct the meeting to facilitate the orderly conduct of business. Public comment will follow the 10-minute rule.

**Minutes:** The NRC will prepare meeting minutes within 45 days of the meeting. The minutes will be posted on the NRC's website at [www.nrc.gov/activities/committees/](http://www.nrc.gov/activities/committees/).

**Staff:** Contact at Washington, DC, on May 17, 2012.

**LaTanya R. Bales,**  
Nuclear Regulatory Commission Management Officer  
for rule-making (505) 493-1616, 505 and  
BUREAU ONE 6046-01

**DEPARTMENT OF ENERGY**  
(5010-104-0000-01-01-01-0001)  
**100-100-AC09**  
**Updating State Residential Building Energy Efficiency Codes.**  
**AGENCY:** Office of Energy Efficiency and Renewable Energy, Department of Energy.

**ACTION:** Notice of final determination.

**SUMMARY:** The Department of Energy (DOE or Department) has determined that the 2012 editions of the International Code Council (ICC) International Energy Conservation Code (IECC) 2009 IECC or 2012 editions would achieve greater energy efficiency in low-rise residential buildings than the 2009 IECC. These publications of the affirmative final determination. States are required to file certification statements to DOE that they have reviewed the provisions of their residential building code regarding energy efficiency and needed to accept their code to meet or exceed the 2012 IECC. Additionally, this Notice provides guidance to States on how the codes have changed from previous versions, and the certification process.

**DATE:** Certification Statements by the States must be provided by May 17, 2012.

**ADDRESS:** Certification Statements must be addressed to the Building Energy Codes Program Manager, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Federal Building, Mail Station 58, Washington, DC 20585-0121.

**FOR FURTHER INFORMATION CONTACT:** Michael Crawford, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Federal Building, Mail Station 58, Washington, DC 20585-0121, or legal@ee.rhdo.gov.

**1. Introduction**

A statutory requirement of the Energy Conservation and Production Act, as amended (ECPA), requires implementation for the building energy efficiency program. (42 U.S.C. 6391 (a)(1) Section 1001) of ECPA provides that when the 2009 Model Energy Code (MIEC), or any successor to this code, is revised, the Secretary must determine, not later than 12 months after the revision, whether the revised code would improve energy efficiency in residential buildings and, if so, publish an affirmative final determination to the Federal Register. (42 U.S.C. 6391(a)(1)(2) Section 1002) Following precedent set by the U.S. and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) considers high-rise (greater than three

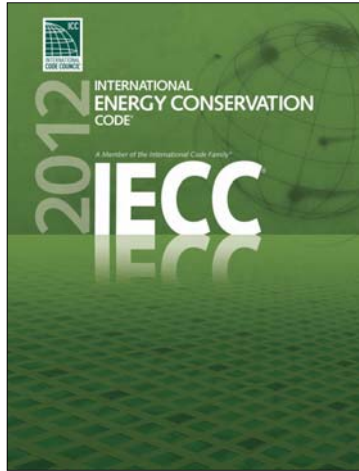
### Key points:

- US DOE has determined IECC 2012 will achieve greater energy efficiency in low-rise residential buildings than IECC 2009
- States must certify by 5/17/14 their energy code meets or exceeds the levels of IECC 2012

This triggers most states to update their state energy code

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



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## **Format of IECC 2012**

### **IECC – Commercial**

Ch. 1[CE]: Scope and Admin.

Ch. 2[CE]: Definitions

Ch. 3[CE]: General Req.

Ch. 4[CE]: Commercial Energy  
Efficiency

Ch. 5[CE]: Referenced Stds.

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### **IECC – Residential**

Ch. 1[RE]: Scope and Admin.

Ch. 2[RE]: Definitions

Ch. 3[RE]: General Req.

Ch. 4[RE]: Residential Energy  
Efficiency

Ch. 5[RE]: Referenced Stds.

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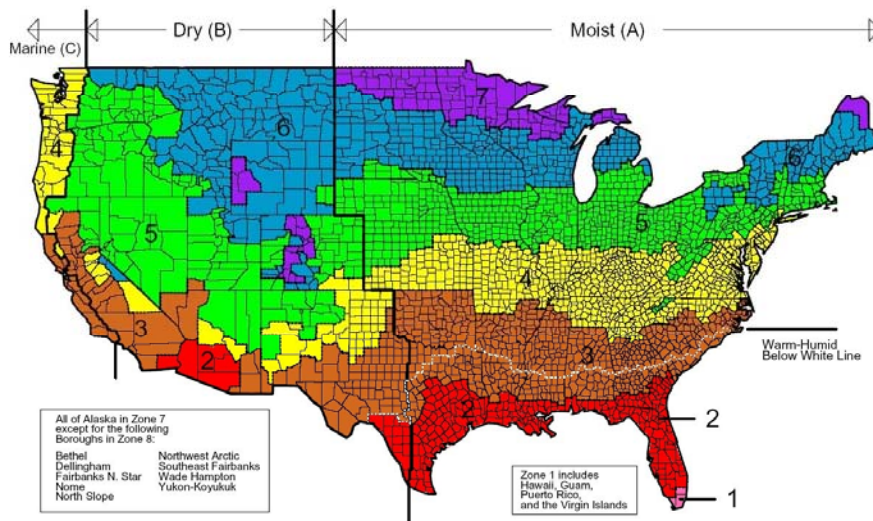
## Commercial vs. Residential

- Commercial unless Residential
- R202-General Definitions:  
**Residential Building.** For this code, includes detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane

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## Climate zones

IECC 2012, Section C301 and Sec. R301—Climate Zones



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## IECC – Residential Provisions

- R-value
- Air leakage

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## Roofing-specific adaptation of Table R402.1

*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	49
5	
6	
7	
8	

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

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**R402.2 Specific insulation requirements (Prescriptive).** In addition to the requirements of Section R402.1, insulation shall meet the specific requirements of Sections R402.2.1 through R402.2.12.

**R402.2.1 Ceilings with attic spaces.** When Section R402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly, R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

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**R402.2.2 Ceilings without attic spaces.** Where Section R402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section R402.1.1 shall be limited to 500 square feet (46 m<sup>2</sup>) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section R402.1.3 and the total UA alternative in Section R402.1.4.

**R402.2.3 Eave baffle.** For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material.

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## Air retarders

IECC 2012, Section R402.4-Air Leakage (Mandatory)

**R402.4 Air leakage (Mandatory).** The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

**R402.4.1 Building thermal envelope.** The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

**R402.4.1.1 Installation.** The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the code official, an approved third party shall inspect all components and verify compliance. **R402.4.1.2 Testing.** The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted...

\*\*

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## Roofing-specific adaptation of Table R402.4.1.1

*International Energy Conservation Code, 2012 Edition*

<b>Air Barrier and Insulation Installation</b>	
<b>Component</b>	<b>Criteria</b>
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the bar barrier shall be sealed. Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.

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## **IECC – Commercial Provisions**

- R-value
- Roof reflectivity (Climate Zones 1-3)
- Air barrier (Climate Zones 4-8)

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## **Ch. 4—Commercial Energy Efficiency**

*International Energy Conservation Code, 2012 Edition*

**C401.2 Application.** Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1
2. The requirements of Sections C402, C403, C404 and C405. In addition, commercial buildings shall comply with either Section C406.2, C406.3 or C406.4
3. The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

[Continued...]

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**C401.2.1 Application to existing buildings.** Additions, alterations and repairs to existing buildings shall comply with one of the following:

1. Sections C402, C403, C404 and C405; or
2. ANSI/ASHRAE/IESNA 90.1

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### **Roofing-specific adaptation of Table C402.2**

*International Energy Conservation Code, 2012 Edition*

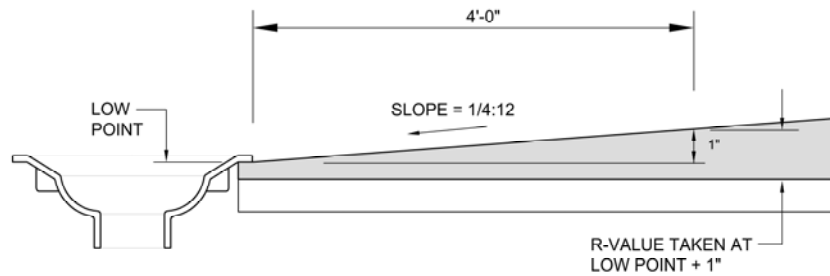
<b>Opaque Thermal Envelope Assembly Requirements</b>			
<b>Climate zone</b>	<b>Roof assembly configuration</b>		
	<b>Insulation entirely above deck</b>	<b>Metal buildings (with R-5 thermal blocks)</b>	<b>Attic and other</b>
1	R-20ci	R-19 + R-11 LS	R-38
2			
3			
4	R-25 ci	R-25 + R-11 LS	R-49
5			
6	R-30ci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

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## What about tapered insulation...?

IBC 2012, Sec. C402.2-Roof Assembly , Exception 1  
allows a 1-inch insulation thickness variation



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## Solar reflectance and thermal emittance

IECC 2012, Section C402.2.1.1

**C402.2.1.1 Roof solar reflectance and thermal emittance.** Low-sloped roofs, with a slope less than 2 units vertical in 12 horizontal, directly above cooled *conditioned spaces* in Climate Zones 1, 2, and 3 shall comply with one or more of the options in Table C402.2.1.1.

**Exceptions:** The following roofs and portions of roofs are exempt from the requirements in Table C402.2.1.1:

1. Portions of roofs that include or are covered by:
  - 1.1 Photovoltaic systems or components.
  - 1.2 Solar air or water heating systems or components.
  - 1.3 Roof gardens or landscaped roofs.
  - 1.4 Above-roof decks or walkways.
  - 1.5 Skylights.
  - 1.6 HVAC systems, components, and other opaque objects mounted above...

[Continued...]

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**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]

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## **Air retarders**

IECC 2012, Section C402.4-Air Leakage (Mandatory)

**C402.4 Air leakage (Mandatory).** The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8.

**C402.4.1 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 C402.4.1.1 and C402.4.1.2.

**Exception:** Air barriers are not required in buildings located in Climate Zones 1, 2 and 3.

[Continued...]

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**C402.4.1.2 Air barrier compliance options.** A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.3.

**C402.4.1.2.1 Materials.** Materials with an air permeability no greater than 0.004 cfm/ft<sup>2</sup> (0.02 L/s · m<sup>2</sup>) under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 15 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than 3/8 inch (10 mm).
2. Oriented strand board having a thickness of not less than 3/8 inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch (12 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch (12 mm).
5. Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m<sup>3</sup>) having a thickness of not less than 1-1/2 inches (36 mm).

[Continued...]

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**C402.4.1.2.2 Assemblies.** Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft<sup>2</sup> (0.2 L/s · m<sup>2</sup>) under a pressure differential of 0.3 inches of water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.

1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
2. A Portland cement/sand parge, stucco or plaster minimum 1/2 inch (12 mm) in thickness.

**C402.4.1.2.3 Building test.** The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 0.40 cfm/ft<sup>2</sup> at a pressure differential of 0.3 inches water gauge (2.0 L/s · m<sup>2</sup> at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official.

[Continued...]

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**C402.4.1.2 Air barrier compliance options.** A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.3.

**C402.4.1.2.1 Materials.** Materials with an air permeability no greater than 0.004 cfm/ft<sup>2</sup> (0.02 L/s · m<sup>2</sup>) under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 15 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than 3/8 inch (10 mm).
2. Oriented strand board having a thickness of not less than 3/8 inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than 1/2 inch (12 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch (12 mm).
5. Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m<sup>3</sup>) having a thickness of not less than 1-1/2 inches (36 mm).

[Continued...]

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6. Open cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m<sup>3</sup>) and having a thickness of not less than 4.5 inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than 1/2 inch (12 mm).
8. Cement board having a thickness of not less than 1/2 inch (12 mm).
9. Built up roofing membrane.
10. Modified bituminous roof membrane.
11. Fully adhered single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch (16 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.

[Continued...]

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\*

“...IECC 2012’s air barrier requirements significantly limit roof system designs...”

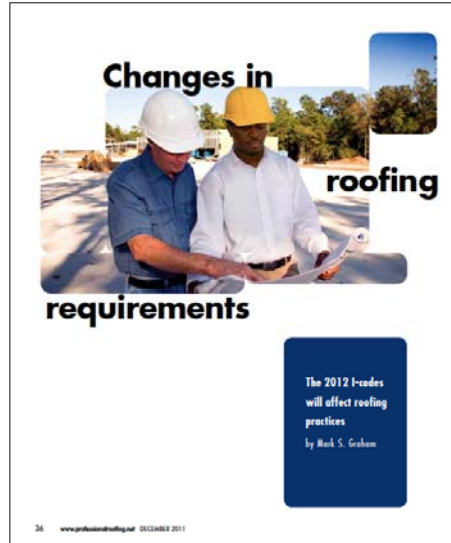
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### **In summary**

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

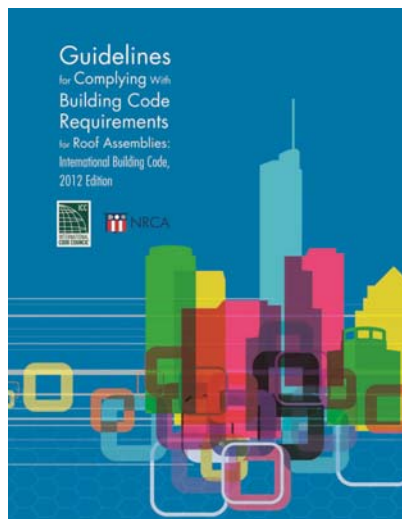
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## Professional Roofing, December 2011



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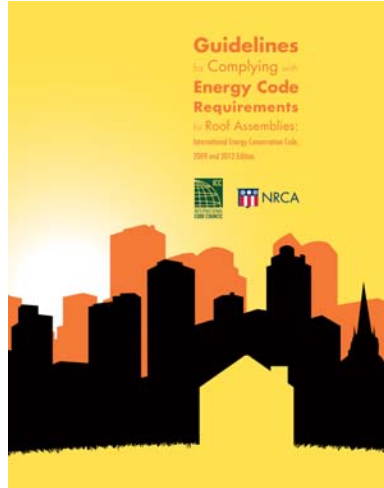
## Building Codes Manual (2012 Codes)



- 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

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## Energy Codes Manual (2009 & 2012 Codes)



- Based upon IECC 2012 with ASHRAE 90.1-07 option and IECC 2012 with ASHRAE 90.1-10 option
- Includes roofing-related code text and NRCA commentary on each section
- Appendix has county-specific prescriptive R-value tables
- Co-branded with ICC; NRCA promotes to industry and ICC promotes to code officials

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## www.roofwinddesigner.com

$C_{f1} = 0.00256(K_{z1})(K_{z2})(K_{z3})(K_{z4})(C_v)^{-1}$

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Roof Wind Designer is intended to provide users with an easy-to-use means for determining roof systems' design wind loads for many commonly encountered building types that are subject to building code compliance.


Design-wind loads are derived using the American Society of Civil Engineers (ASCE) Standard ASCE 7, "Minimum Design Loads for Buildings and Other Structures." This standard is a widely recognized consensus standard and is referenced in and serves as the technical basis for wind load determination in the International Building Code and NFPA 5000: Building Construction and Safety Code. Roof Wind Designer allows users to choose between the 2005 or 2010 editions of ASCE 7. Roof Wind Designer uses Method 1—Simplified Method, 2005 edition, and the Envelope Procedure, Part 2: Low-rise Buildings (Simplified) of Chapter 30, 2010 edition. For a more detailed explanation of the two editions, please [click here](#).

Also, Roof Wind Designer determines roof systems' minimum recommended design wind-resistance loads, which are derived from the building's design wind loads, taking into consideration a safety factor in reliance of ASTM D6630, "Standard Guide for Low Slope Insulated Roof Membrane Assembly Performance." Using these minimum recommended design wind-resistance loads, users can select appropriate wind resistance classified roof systems.

Roof Wind Designer has been developed and is maintained by the National Roofing Contractors Association (NRCA), with the support of the Midwest Roofing Contractors Association (MRCA) and the North/East Roofing Contractors Association (NERCA). Currently, this application is available at no cost.

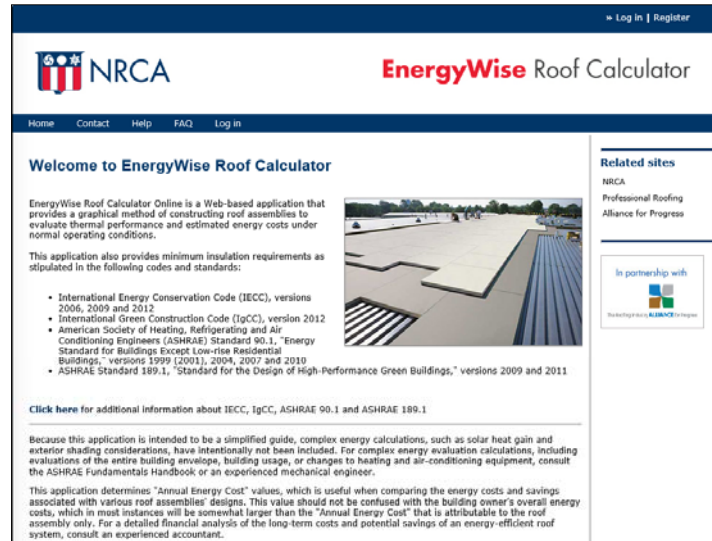
Questions regarding Roof Wind Designer can be directed to the [Contact Us](#) page.

To register for a new account [click here](#). If you already have an account, [click here](#) to login.

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## [energywise.nrca.net](http://energywise.nrca.net)



The screenshot shows the homepage of the EnergyWise Roof Calculator. At the top, there is a navigation bar with "Log In" and "Register" links. Below this is the NRCA logo and the title "EnergyWise Roof Calculator". A main heading reads "Welcome to EnergyWise Roof Calculator". The main content area includes a description of the tool as a web-based application for evaluating thermal performance and energy costs. It lists applicable codes and standards: International Energy Conservation Code (IECC) versions 2006, 2009, and 2012; International Green Construction Code (IgCC), version 2012; American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 90.1, "Energy Standard for Buildings Except Low-rise Residential Buildings," versions 1999 (2001), 2004, 2007 and 2010; and ASHRAE Standard 189.1, "Standard for the Design of High-Performance Green Buildings," versions 2009 and 2011. A "Related sites" sidebar lists NRCA, Professional Roofing, and Alliance for Progress. A partnership logo for "In partnership with" is also visible.

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