



Arizona Roofing Contractors Association
Webinar -- May 18, 2017

Roofing-specific requirements of IECC 2015

presented by



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Objectives

- Understand IECC applicability
- Be aware of IECC 2015's R-value requirements
- Be aware of IECC 2015's roof surface reflectivity requirements
- Be aware of IECC 2015's air barrier (retarder) requirements

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

International Code Council (ICC)

THE I-CODES
ICC International Code (ICC)
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 Building Code (IGBC)
International Mechanical Code (IMC)
International Plumbing Code (IPC)
International Private Sewer and Sanitary Code (IPSSC)
International Residential Code (IRC)
International Sign Code (ISC)
International Vehicle Code (IVC)



Roofing-specific provisions



ICC publication cycle

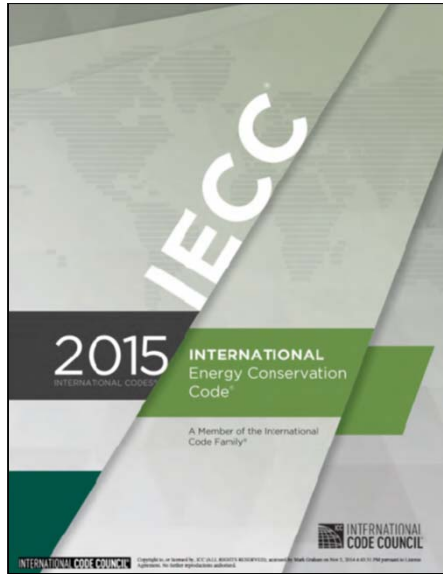
- 2000 edition
 - 2003 edition
 - 2006 edition
 - 2009 edition
 - 2012 edition
 - 2015 edition
 - 2018 edition (finalized; published later this year)
- Three-year code development and publication cycle

Arizona IECC adoption

- Arizona is a “home rule” state
 - Individual jurisdictions adopt their own code(s)
- Some examples:
 - IECC 2015: Chandler, Scottsdale
 - IECC 2012: Phoenix, Tucson, Glendale, Tempe, Peoria
 - IECC 2009: Mesa
 - IECC 2006: Gilbert (IECC 2012 voluntary)
- Designers need to check code applicability locally

IECC applicability to roofing projects

- IECC 2012 and IECC 2015 apply to new construction and roof replacement projects
- IECC 2009 and previous editions apply to new construction projects only



IECC 2015:

Commercial buildings:

- All except “Residential Buildings”

Residential buildings:

- One- and two-family dwellings, multiple single-family dwellings and Group R-2, R-3 and R-4 buildings three stories or less

Format of IECC 2015

Commercial (CE):

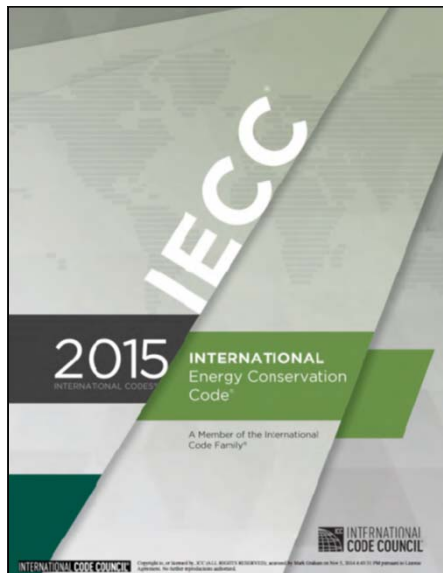
- Ch. 1-Scope
- Ch. 2-Definitions
- Ch. 3-General requirements
- Ch. 4-Commercial energy efficiency
- Ch. 5-Existing buildings
- Ch. 6-Reference standards

Residential (RE):

- Ch. 1-Scope
- Ch. 2-Definitions
- Ch. 3-General requirements
- Ch. 4-Residential energy efficiency
- Ch. 5-Existing buildings
- Ch. 6-Reference standards
- Appendix RA-Atmospheric venting
- Appendix RB-Solar-ready provisions

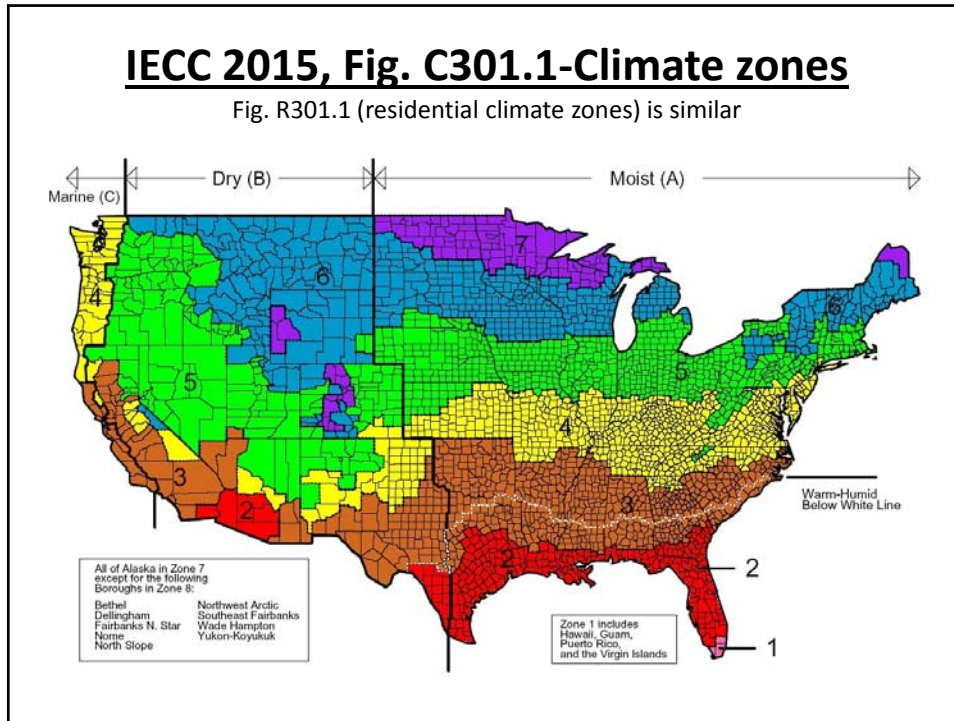
“Low-energy buildings” are exempted

- Those with a peak design rate of energy usage less than 3.4 Btu/h · ft² (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area for space conditioning purposes.
- Those that do not contain conditioned space.
- Greenhouses.



Roof requirements:

- R-value
- Roof reflectivity
- Air retarder



IECC 2015, Table C301.1 excerpt
 Climate Zones by county

ARIZONA

- 5B Apache
- 3B Cochise
- 5B Coconino
- 4B Gila
- 3B Graham
- 3B Greenlee
- 2B La Paz
- 2B Maricopa
- 3B Mohave
- 5B Navajo
- 2B Pima
- 2B Pinal
- 3B Santa Cruz
- 4B Yavapai
- 2B Yuma

Minimum R-value

IECC 2015, Table C402.1.3—R-value Method (Commercial buildings)

Climate zone	Assembly description		
	Insulation entirely above deck	Metal buildings	Attic and other
1	R-20ci (all other) R-25ci (Group R)	R-19 + R-11 LS	R-38
2	R-25ci		
3			
4	R-30ci		R-38 (except Marine 4)
5		R-38 (all other) R-49 (Group R, Marine 4)	
6		R-25 + R-11 LS	
7	R-35ci	R-30 + R-11 LS	R-49
8			

ci = Continuous insulation; LS = Liner system

Energy Code’s prescriptive insulation requirements

Insulation entirely above deck roof assembly configuration

Climate Zone	IECC 2006	IECC 2009	IECC 2012*	IECC 2015*
1	R-15ci	R-15ci	R-20 ci	R-20 ci
2		R-20ci		R-25 ci
3				
4			R-25 ci	R-30 ci
5	R-20ci	R-25ci	R-30ci	R-35 ci
6				
7	R-25 ci	R-25ci	R-30ci	R-35 ci
8				

* Applies to roof replacement projects
ci = continuous insulation

Roofing-specific adaptation of Table R402.1.1

International Energy Conservation Code, 2015 Edition (Residential buildings)

Insulation and Fenestration Requirements by Component ^a	
Climate zone	Ceiling R-value
1	30
2	38
3	
4	49
5	
6	
7	
8	
^a R-values are minimums. ... [Other footnotes omitted for clarity]	

R-value determination

IECC 2015, 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?

Tapered insulation

International Energy Conservation Code, 2015 Edition

C402.2.2 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 C402.1.3, 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 C402.1.3.
2. ...

IECC Commentary indicates Exception 1 applies to tapered insulation systems.

2015 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...”

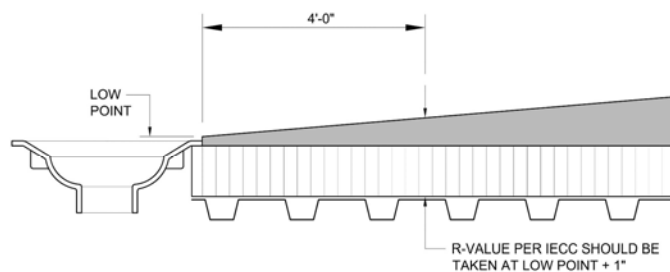
[continued...]

2015 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. “

Graphically depicted...



Reflectivity

International Energy Conservation Code, 2015 Edition (Commercial)

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

Exceptions: ...

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

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

[Footnotes omitted for clarity]

Air barrier

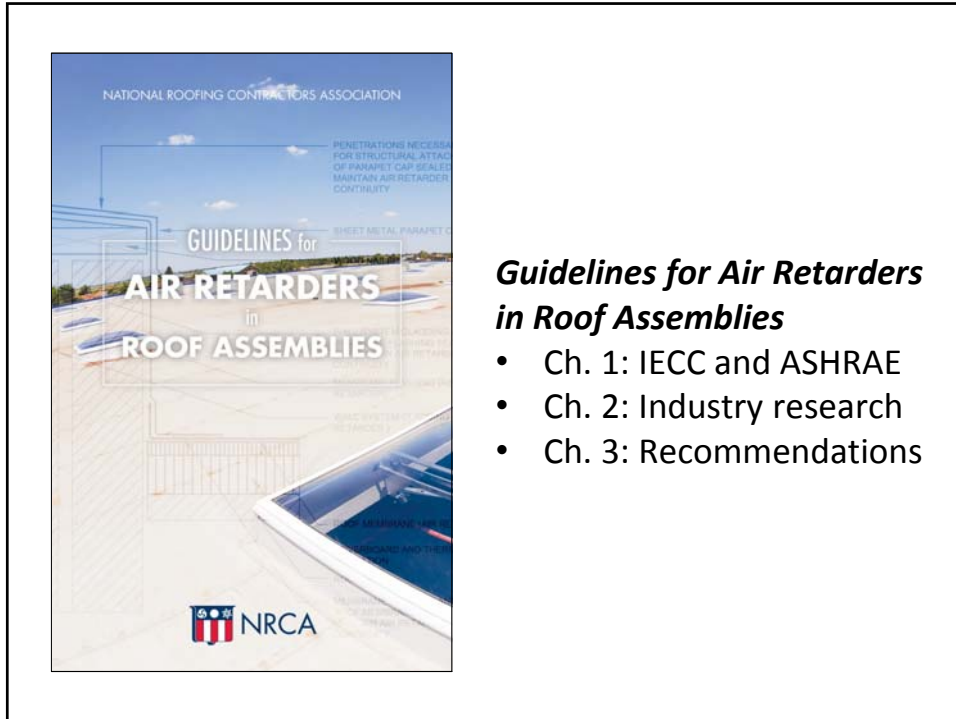
International Energy Conservation Code, 2015 Edition (Commercial), Sec. C402.5

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

Test methods:

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

Air barrier not required in reroofing projects unless also recladding (IECC 2015 only: Sec. C502.4)

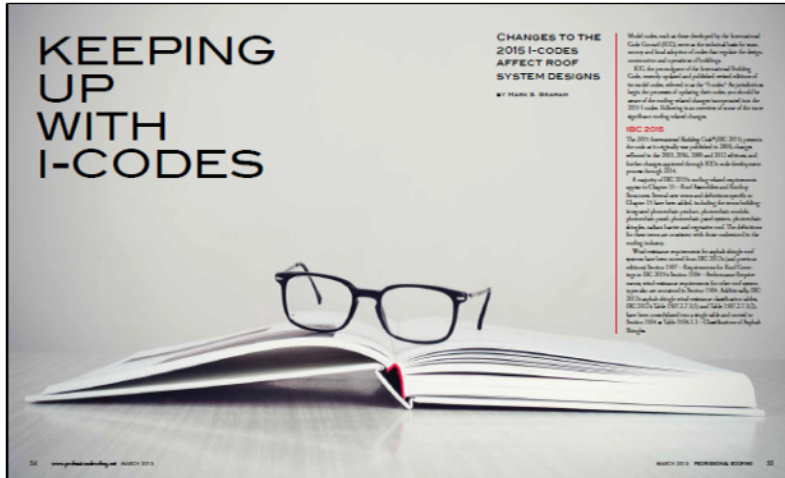


In summary: IECC 2015 – Commercial (CE)

- R-value
- Roof reflectivity (Climate Zones 1-3 only)
- Air retarders (All Climate Zones except 2B)
- Roof replacement:
 - R-value requirements to IECC 2015 levels
 - Roof reflectivity per IECC 2015
 - Air retarder per IECC 2105 (whole building envelope replacement only)

Significant roofing-related changes

2015 I-codes



Professional Roofing, March 2015

ANALYZING R-VALUE REQUIREMENTS
Cost paybacks to increases in R-values may not be practical

November 2014

Recent increases in the model energy code building energy performance requirements have resulted in increased R-values being specified for many buildings' exterior envelopes, including roof systems.

Adoption of the International Energy Conservation Code (IECC) 2015 Edition (IECC-2015), which includes significant R-value increases for most roof systems, has been limited. The R-value increases were implemented into the code with minimal to no consideration of the added initial construction costs and long-term payback to building owners.

Energy code requirements

The building envelope thermal (prescriptive) requirements contained in IECC-2015 include roof assembly minimum R-value requirements as shown in Figure 1. These R-values apply to all buildings, including roof system replacements, identified by the code as being for "construction" of buildings. IECC-2015 identifies all buildings as commercial except detached one- and two-family dwellings and multiple single-family dwelling townhomes, as well as Group B-2, B-3 and B-4 buildings three stories or lower in height above grade plane.

Compared to IECC-2009, minimum prescriptive R-values with those in the International Energy Conservation Code, 2009 Edition (IECC-2009) code minimum required R-values for roof assemblies have increased from R-5 to R-10 depending on specific climate zones and building level's assembly configurations.

In May 2012, the Department of Energy (DOE) issued a memorandum indicating IECC-2012 provide greater energy efficiency in buildings than IECC-2009. DOE indicated IECC-2012 makes substantial progress with achieving DOE's goal to provide a 30 percent overall improvement in building energy efficiency compared with the code's previous editions.

Code adoption

Also included in DOE's May 2012 memorandum is a requirement for individual states to review their current codes and certify by May 17, 2014, their residential energy efficiency requirements meet or exceed the levels established in IECC-2012. In the past, this type of certificate was often included in individual states approving their building energy codes to the latest edition of the model code.

To determine the status of individual states' energy code

adoption, NRCA conducted a comprehensive survey of state adoption and plans for future code updates. From the survey only seven states were determined to have updated their energy code to IECC-2015 back by DOE's May 17 certification deadline—Illinois, Iowa, Maryland, Montana, North Carolina, Rhode Island and Washington.

Four additional states—California, Florida, Massachusetts and New York—will upgrade to IECC-2015 back by Jan. 1, 2015. The remaining states reported they have no immediate intention of updating their energy codes, some states have no state-mandated energy code.

NRCA considers the findings of its energy code adoption survey to be significant. High R-value advances, including some insulation manufacturers, trade associations and special interest groups, are leading designers and building owners to believe 2012 IECC R-values are required throughout the U.S. One roof system manufacturer and one special interest group are going as far as requiring compliance with the International Energy Conservation Code, 2015 Edition already is required. NRCA's survey reveals these high R-value claims are misleading; in fact, most states do not yet require compliance with IECC-2012.

Climate zone	Minimum prescriptive thermal insulation requirements for commercial buildings		
	Roof assembly configurations	Roof buildings with 6-9 stories (skyscrapers)	Attic and other
1	R-20ea	R-10 + R-11.0a	R-10
2	R-20ea	R-10 + R-11.0a	R-10
3	R-20ea	R-10 + R-11.0a	R-10
4	R-20ea	R-10 + R-11.0a	R-10
5	R-20ea	R-10 + R-11.0a	R-10
6	R-20ea	R-10 + R-11.0a	R-10
7	R-20ea	R-10 + R-11.0a	R-10
8	R-20ea	R-10 + R-11.0a	R-10

a = Continuous insulation
 ea = Energy efficiency evaluation method (per the code and compliant with the energy code, without further code on top of the minimum thermal value)

Figure 1. Minimum prescriptive thermal insulation requirements for commercial buildings.

NRCA "Industry Issue Update," November 2014

Payback analysis:

- 100 sq. single story building
- Costs per R+5 increases
- Energy savings per R+5 increases
- Local energy costs
- Cost ÷ Savings = Payback
- 16 cities in 8 climate zones

Payback results (Phoenix, AZ):

- R-10 to R-15: 18.5 yrs.
- R-15 to R-20: 38.1 yrs.
- R-20 to R-25: 61.3 yrs.
- R-25 to R-30: 133.0 yrs.



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