



**NRCA University Webinar**  
October 17, 2013

## **Understanding Energy Codes**

presented by

**Mark S. Graham**

Associate Executive Director, Technical Services  
National Roofing Contractors Association

### **Some background**

- The International Energy Conservation Code is a “model code” 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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# Federal Register, May 17, 2012

**28322** Federal Register / Vol. 77, No. 96 / Thursday, May 17, 2012 / Notices

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Residential Energy: Federal Building, Mail Station D2-11, 1900 Independence Avenue, Washington, DC 20546-2111, (202) 205-1214, email: [rlm@ee.doe.gov](mailto:rlm@ee.doe.gov). For legal advice contact Ruth L. Langford, U.S. Department of Energy, Office of the General Counsel, Federal Building, DC-71, 1900 Independence Avenue NW, Washington, DC 20548-2016, (202) 205-2922, email: [rlm@ee.doe.gov](mailto:rlm@ee.doe.gov).

**SUPPLEMENTARY INFORMATION:**

**I. Introduction.**

**A. Summary Requirements.**

**B. Background.**

**C. Title.**

**D. Description of the Rule.**

**E. Changes to the 2009 IECC.**

**F. Changes to the 2012 IECC.**

**G. Other Matters.**

**H. Paperwork Burden.**

**I. Regulatory Flexibility Analysis.**

**J. Small Business Concerns.**

**K. State Energy Efficiency.**

**L. Other Matters.**

**M. State Energy Efficiency.**

**N. Other Matters.**

**O. Other Matters.**

**P. Other Matters.**

**Q. Other Matters.**

**R. Other Matters.**

**S. Other Matters.**

**T. Other Matters.**

**U. Other Matters.**

**V. Other Matters.**

**W. Other Matters.**

**X. Other Matters.**

**Y. Other Matters.**

**Z. Other Matters.**

- 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 May 17, 2014 their energy code meets or exceeds the levels of IECC 2012

This triggers most states to update their state energy code



# Determining applicable energy code

National Roofing Contractors Association

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**Roofing industry news**

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NRCA offers 159/10 (Members Only) OPEC has published two final rules affecting federal contractors

September contracts increase 13 percent

October PHD is available online (Members Only)

NRCA issues letter for members regarding worker exposure to silica (Members Only)

Professional Roofing's October issue is available online

Oct. 15 deadline remains in effect for taxpayers who requested a six-month extension

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**Find a contractor**

Roof type:

ZIP Code:

**Find roofing contractors by state**

**Renew your membership**

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**Bookstore**

**The NRCA Roofing Manual - 2013 Revised Edition**

One of the most widely recognized technical publications in the U.S., roofing industry has been updated to include The NRCA Roofing Manual: Steep-Slope Roof Systems—2013. This four-volume manual gives you comprehensive information about how and steep-slope roof system design, materials and installation.

Member Price: \$425.00  
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## Determining applicable energy code

Home

**Technical**

NRCA's Technical Services Section is responsible for coordinating and developing NRCA's technical activities and research programs. Directed by NRCA's Technical Operations Committee, which establishes NRCA's technical programs and priorities, the Technical Services Section provides technical support to NRCA members and the roofing industry.

NRCA's technical activities are conducted by seven NRCA technical committees and task forces. This year, 28 volunteer members are contributing their time and expertise to NRCA's technical efforts.

The technical information contained on NRCA's website is adapted from various technical publications written by NRCA's technical committees, task forces and technical services staff. Additional information periodically will be added to this section, so please visit it frequently. If you are looking for roofing-related technical information not available on NRCA's website, call NRCA's Technical Services Section at (847) 299-9070.

**Technical search**

Search NRCA's glossary of roofing terms. Search for information by roofing term or browse by letter.

In addition, NRCA offers a technical library with thousands of roofing-related articles. Search for information by keyword, author, title or source.

**Consumer information**

NRCA provides a wide range of information and services to help homeowners and building owners make informed decisions about replacing and maintaining their roof systems. Consumers can search for a roofing contractor or find answers to technical questions.

**Energy codes**

Most roofing professionals understand a building's roof assembly serves an important role in controlling a building's overall energy efficiency and costs. However, some may not realize that codes mandate minimum thermal insulation requirements for the energy efficiency of most buildings.

Energy conservation codes usually are adopted by individual states and are applicable to all buildings within that state. Most states have adopted one of several editions of the International Energy Code (IECC), published by the International Code Council (ICC), to serve as the technical basis of their energy codes. In some instances, individual states modify the IECC to address specific regional or local issues.

To assist roofing professionals, NRCA compiled a database of states' current energy code adoption. This information was obtained either from individual states' Web sites or the Department of Energy's "Energy Code's Program" website, <http://www.energycodes.gov/states/>. Users are encouraged to contact the government agency having jurisdiction to verify the specific energy code(s) applicable to their projects.

Click here to access NRCA's database of energy codes by state.

**EnergyWise Roof Calculator Online**

IECC provides two methods of determining commercial buildings' minimum insulation requirements: the use of specific tables within the Code or compliance with American Society for Heating, Refrigerating and Air-Conditioning Engineers Inc. (ASHRAE) Standard 90.1 (ASHRAE 90.1), "Energy Standard for Buildings Except Low-Rise Residential Buildings," building envelope provisions.

If you want to determine minimum R-value requirements per ASHRAE 90.1, you should consider using EnergyWise Roof Calculator Online.

NRCA, in partnership with The Roofing Industry Alliance for Progress developed EnergyWise Roof Calculator Online, developed this free, Web-based application based in part on the Prescriptive Building Envelope Option contained in ASHRAE Standard 90.1, versions 1999(2001), 2004 and 2007.

EnergyWise Roof Calculator Online also provides a graphical method of constructing roof assemblies to evaluate thermal performance and estimated energy costs under normal operating conditions. The application is intended to be a simplified guide. For complex energy evaluation calculations, consult the ASHRAE Fundamentals Handbook or an experienced mechanical engineer.

Click here to access EnergyWise Roof Calculator Online.

**Roofing-related Energy Code Requirements**

If you want to become more familiar with roofing-related energy code requirements, you are encouraged to read "Conserving energy" by Mark Graham, NRCA's Associate Executive Director of Technical Services. This article provides an overview of energy codes' minimum requirements and how these requirements apply to existing buildings when reroofing.

## Determining applicable energy code

Home > Technical

**Energy codes**

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## Determining applicable energy code

The screenshot shows the NRCA website's 'Energy codes by state' page. At the top, there is a navigation bar with links for 'Members only', 'Bookstore', 'Technical', 'Education', 'Member directory', 'Government advocacy', 'Safety and insurance', 'About', and 'Consumers'. Below the navigation bar, the page title is 'Energy codes by state'. A sub-header reads: 'To see the energy codes from a particular state, please select the state from the dropdown list.' Below this is a dropdown menu with the text 'Please select' and a downward arrow. To the right of the dropdown are social media icons for Facebook, Twitter, LinkedIn, and YouTube. On the right side of the page, there are several sections: 'Renew your membership' with a call to action, 'Roofing industry news' featuring 'ALPINE SNOWGUARDS' and 'BEST EFFICIENCY AND PERFORMANCE WITH ENHANCED DENSDECK PRIME', and 'Find a contractor' with a form for 'Roof type' and 'ZIP Code'. At the bottom right, there is a 'Sponsored links' section with the NRCA logo.

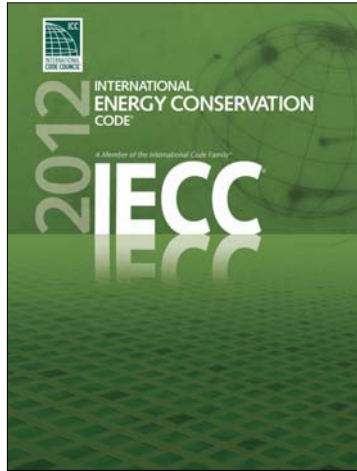
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## Determining applicable energy code

This screenshot shows the same NRCA website page but with the dropdown menu set to 'North Carolina'. The 'Details for North Carolina' section is expanded, providing the following information: 'State-mandated code: 2012 North Carolina Energy Conservation Code', 'Code administration agency: North Carolina Department of Insurance, Engineering Division, 222 Chatham Road, Raleigh, NC 27603, (919) 661-5860, www.ncdoi.com/OSFM/Engineering\_and\_Codes/Default.aspx?field1=Building\_Code\_Council\_105&Ruser=Building\_Code\_Council', 'Applicability: All buildings', and 'Technical basis: More stringent than IECC 2009'. The rest of the page layout, including the navigation bar, 'Renew your membership' section, 'Roofing industry news', and 'Find a contractor' form, remains the same as in the previous screenshot.

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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.

Index

### **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.

Index

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## Commercial vs. Residential

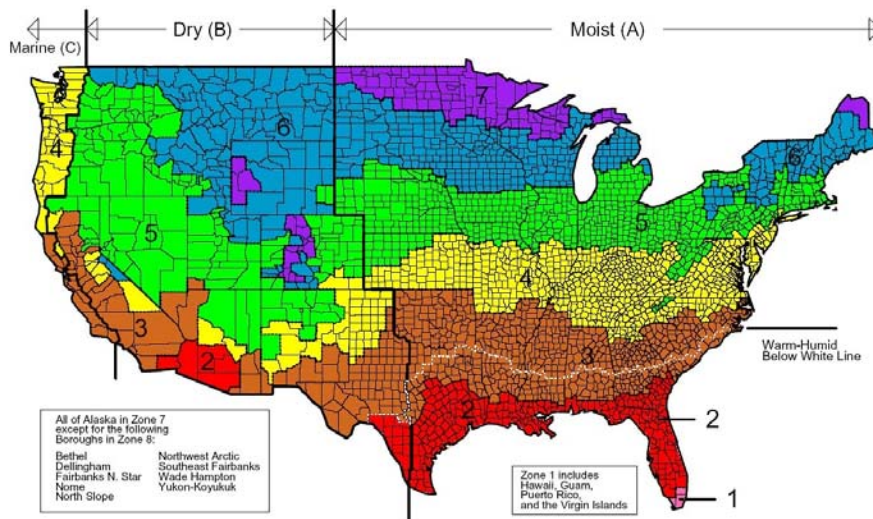
- Commercial unless Residential
- R202-General Definitions:
  - Residential Building.** For this code, includes detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane

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## Climate zones

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



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## **IECC – Residential Provisions**

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## **Ch. 4[RE]—Residential Energy Efficiency**

*International Energy Conservation Code, 2012 Edition*

- Sec. R401—General
- Sec. R402—Building Thermal Envelope
- Sec. R403—Systems
- Sec. R404—Electrical Power and Lighting Systems
- Sec. R405—Simulated Performance Alternative

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## **Minimum thermal insulation requirements**

IECC 2012, Section R402-Building Thermal Envelope

**R402.1 General (Prescriptive).** The *building thermal envelope* shall meet the requirements of Sections R402.1.1 through R402.1.4.

**R402.1.1 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Table R402.1.1 based upon the climate zone specified in Chapter 3.

**R402.1.2 R-value computation.** Insulation material used in layers, such as framing cavity insulation and insulated sheathing, shall be summed to compute the component R-value. The manufacturer’s settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films

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## **Roofing-specific adaptation of Table R402.1**

*International Energy Conservation Code, 2012 Edition*

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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**Summary – IECC 2012 – Residential Provisions**

- R-value increases
- Mandatory air barriers requirements

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**IECC – Commercial Provisions**

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## **Ch. 4[CE]—Commercial Energy Efficiency**

*International Energy Conservation Code, 2012 Edition*

- Sec. C401—General
- Sec. C402—Building Envelope Requirements
- Sec. C403—Building Mechanical Systems
- Sec. C404—Service Water Heating
- Sec. C405—Electrical Power and Lighting Systems
- Sec. C406—Additional Efficiency Package Options
- Sec. C407—Total Building Performance

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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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### **Minimum thermal insulation requirements**

IECC 2009, Section C402.2—Specific insulation Requirements (Prescriptive)

**C402.2 Specific insulation requirements (Prescriptive).** Opaque assemblies shall comply with Table C402.2. Where two or more layers of continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section C303.2. If the continuous insulation board manufacturer's installation instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

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**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. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.<sup>27</sup>

**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			
5	R-25 ci	R-25 + R-11 LS	R-49
6	R-30ci		
7	R-35ci		
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?

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## 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.

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## **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...]

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## **2012 IECC Code and Commentary**

### Tapered insulation

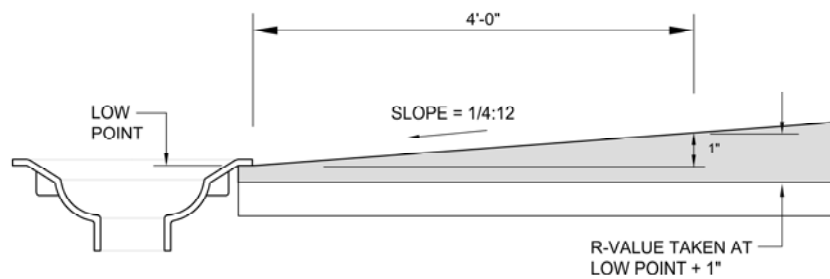
“...This 1-inch (25 mm) limitation does not prevent the provisions from being applied to roofs that have a greater variation; it simply does not allow the additional thickness to be factored into the average insulation values. Where the variation exceeds 1 inch (25 mm), it would be permissible to go 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. “

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## Graphically depicted...



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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]

## **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...]

**C402.4.1.1 Air barrier construction.** The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section C402.4.2. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Recessed lighting fixtures shall comply with Section C404.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

**Exception:** Buildings that comply with Section C402.4.1.2.3 are not required to comply with Items 1 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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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 ½ 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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**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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**C402.4.2 Air barrier penetrations.** Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

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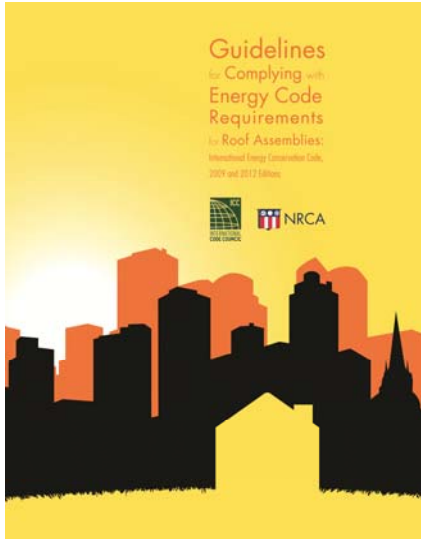


### Summary – IECC 2012 – Commercial Provisions

- R-value increases
- Mandatory reflectivity requirements in Climate Zones 1-3
- Air barriers requirements in Climate Zones 4-8

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

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### EnergyWise Roof Calculator

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**Welcome to EnergyWise Roof Calculator**

EnergyWise Roof Calculator Online is a Web-based application that provides a graphical method of constructing roof assemblies to evaluate thermal performance and estimated energy costs under normal operating conditions.

This application also provides minimum insulation requirements as stipulated in the following 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
- ASHRAE Standard 189.1, "Standard for the Design of High-Performance Green Buildings," versions 2009 and 2011

[Click here](#) for additional information about IECC, IgCC, ASHRAE 90.1 and ASHRAE 189.1

Because this application is intended to be a simplified guide, complex energy calculations, such as solar heat gain and exterior shading considerations, have intentionally not been included. For complex energy evaluation calculations, including evaluations of the entire building envelope, building usage, or changes to heating and air-conditioning equipment, consult the ASHRAE Fundamentals Handbook or an experienced mechanical engineer.

This application determines "Annual Energy Cost" values, which is useful when comparing the energy costs and savings associated with various roof assemblies' designs. This value should not be confused with the building owner's overall energy costs, which in most instances will be somewhat larger than the "Annual Energy Cost" that is attributable to the roof assembly only. For a detailed financial analysis of the long-term costs and potential savings of an energy-efficient roof system, consult an experienced accountant.



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