Roofing Supply Group
Lake Buena Vista, FL – March 5, 2014

Product knowledge

Mark S. Graham
Associate Executive Director, Technical Services
National Roofing Contractors Association

Topics

- Asphalt shingles
- Asphalt
- Lightweight structural concrete roof decks
- Energy Code update
- Tapered insulation
- New LTTR values

Asphalt shingles

- ASTM D225 (organic shingles)

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Asphalt shingles

- ~~ASTM D225 (organic shingles)~~
- ASTM D3462 (fiberglass shingles)
- ICC-ES AC 438 (alternative asphalt shingles)

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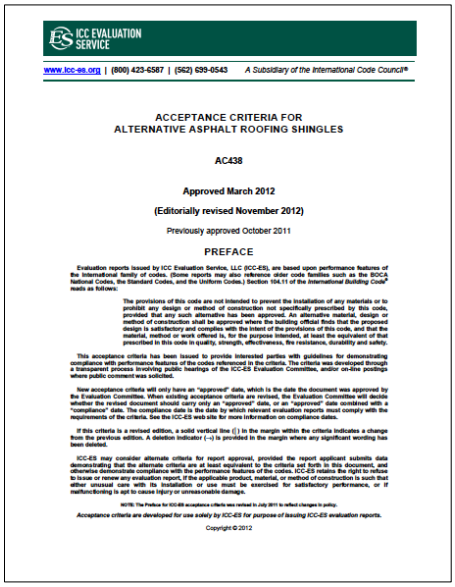
ICC-ES AC438



ICC EVALUATION SERVICE

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

ACCEPTANCE CRITERIA FOR
ALTERNATIVE ASPHALT ROOFING SHINGLES

AC438

Approved March 2012

(Editorially revised November 2012)

Previously approved October 2011

PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the International family of codes. (Some reports may also reference older code families such as the BOCA National Codes, the Standard Codes, and the Uniform Codes.) Section 104.11 of the *International Building Code*® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials 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.

This acceptance criteria has been issued to provide interested parties with guidelines for demonstrating compliance with performance features of the codes referenced in the criteria. The criteria was developed through a transparent process involving public hearings of the ICC-ES Evaluation Committee, and/or on-line postings where public comment was solicited.

New acceptance criteria will only have an "approved" date, which is the date the document was approved by the Evaluation Committee. When existing acceptance criteria are revised, the Evaluation Committee will decide whether the revised document should carry only an "approved" date, or an "approved" date combined with a "compliance" date. The compliance date is the date by which relevant evaluation reports must comply with the requirements of the criteria. See the ICC-ES web site for more information on compliance dates.

If this criteria is a revised edition, a solid vertical line (|) in the margin within the criteria indicates a change from the previous edition. A deletion indicator (-) is provided in the margin where any significant wording has been deleted.

ICC-ES may consider alternate criteria for report approval, provided the report applicant submits data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. ICC-ES retains the right to refuse to issue or renew any evaluation report, if the applicable product, material, or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause injury or unreasonable damage.

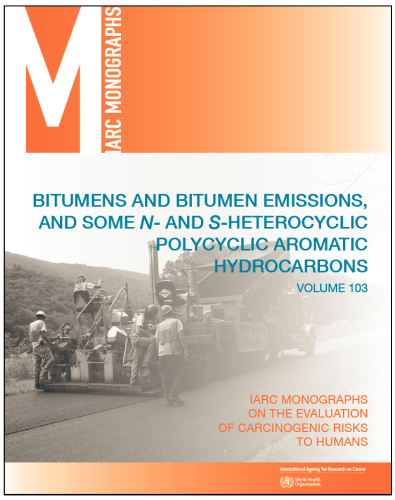
NOTE: The Preface for ICC-ES acceptance criteria was revised in July 2011 to reflect changes in policy.

Acceptance criteria are developed for use solely by ICC-ES for purpose of issuing ICC-ES evaluation reports.

- Alternative acceptance
- No weight/mass testing
- No tear strength testing
- ASTM E108 Class C
- ASTM D7158 Class D
- Weather resistance
  - Break strength
- Temperature cycling
- Wind-driven rain

Asphalt

Asphalt



IARC Monograph – 103:

- Group 2A –Probably carcinogenic to humans
- Pgs. 160 – 165 specific to "Roofing workers exposed to bitumens"

No new regulation (yet)

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Some terminology…

Flash point (FP): the lowest temperature at which asphalt vapors above a volatile combustible substance can ignite in air when exposed to an ignition source; tested using ASTM D92.

Equiviscous temperature (EVT): the temperature at which asphalt attains proper viscosity (flow rate) for built-up membrane application; tested using ASTM D4402 – 125 cP (mop application) and 75 cP (mechanical spreader application).

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Some more terminology…

EVT application range: the recommended bitumen application range. The range is approximately 25 F above or below the EVT, thus giving a range of approximately 50 F. The EVT is measured in the mop cart pr mechanical spreader just prior to application of bitumen to the substrate.

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NRCA recommends…

"…NRCA recommends designers specify asphalt with a sufficiently high enough FP temperature top provide a minimum 125-degree differential between an asphalt's EVT and FP temperature to allow for proper application of built-up membranes."

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NRCA asphalt testing -- 1989

- 26 asphalt samples
- EVTs:
  - Type III (mop) 375 – 450 F
  - Type III (spreader) 400 – 500 F
  - Type IV (mop) 395 – 475 F
  - Type IV (spreader) 425 – 505 F
- FPs:
  - Not reported

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NRCA asphalt testing -- 2000

- 19 asphalt lots sampled
- EVTs:
  - Type III (mop) 390 – 440 F
  - Type III (spreader) 415 – 470 F
- FPs: 585 – 640 F
- ASTM D312 compliance:
  - 10 of 19 did not comply

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NRCA asphalt testing – 2014 (to date)

- 14 asphalt lots (7 suppliers) sampled
- EVTs:
  - Type III (mop) 424 – 462 F
  - Type III (spreader) 452 – 486 F
  - Type IV (mop) 455 – 482 F
  - Type IV (spreader) 480 – 506 F
- FPs: 615 – 660 F
- 10 of 14 do not comply with ASTM D312's physical property requirements

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Proposed revision to ASTM D312

- Maximum heating temp.: 550 F (575 F min. FP)
- Maximum EVTs:
  - Type III (mop) 430 F
  - Type III (spreader) 455 F
  - Type IV (mop) 470 F
  - Type IV (spreader) 485 F
- Lot-specific package labeling of EVT

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NRCA's interim recommendations

- Consult manufacturers' installation requirements and MSDS.
- Carefully select asphalt
- Beware of actual FPs; max. heating temp. should be FP – 25 F
- Beware of actual EVTs
- Make field crews aware

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Moisture-related concerns with lightweight structural concrete roof decks

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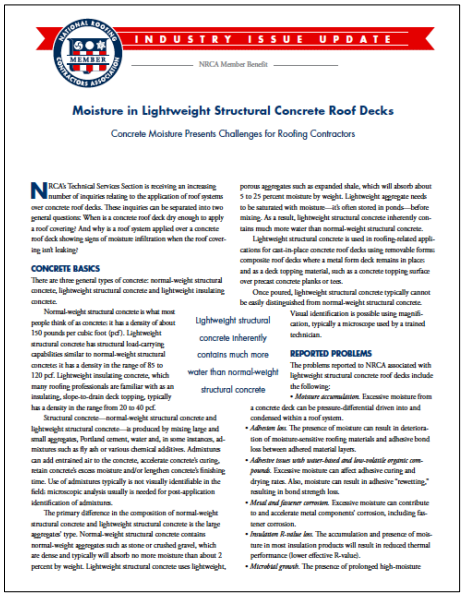
NRCA Industry Issue Update, August 2013



INDUSTRY ISSUE UPDATE

NRCA Member Benefit

Moisture in Lightweight Structural Concrete Roof Decks

Concrete Moisture Presents Challenges for Roofing Contractors

NRCA's Technical Services Section is receiving an increasing number of inquiries relating to the application of roof systems over concrete roof decks. These inquiries can be separated into two general questions: When is a concrete roof deck dry enough to apply a roof covering? And why is a roof system applied over a concrete roof deck showing signs of moisture infiltration when the roof covering isn't leaking?

CONCRETE BASICS

There are three general types of concrete: normal-weight structural concrete, lightweight structural concrete and lightweight insulating concrete.

Normal-weight structural concrete is what most people think of as concrete: it has a density of about 150 pounds per cubic foot (pcf). Lightweight structural concrete has structural load-carrying capabilities similar to normal-weight structural concrete: it has a density in the range of 85 to 120 pcf. Lightweight insulating concrete, which many roofing professionals are familiar with as an insulating, slope-to-drain deck topping, typically has a density in the range from 20 to 40 pcf.

Lightweight structural concrete inherently contains much more water than normal-weight structural concrete

Structural concrete—normal-weight structural concrete and lightweight structural concrete—is produced by mixing large and small aggregates, Portland cement, water and, in some instances, admixtures such as fly ash or various chemical additives. Admixtures can add entrained air to the concrete, accelerate concrete's curing, retain concrete's excess moisture and/or lengthen concrete's finishing time. Use of admixtures typically is not visually identifiable in the field; microscopic analysis usually is needed for post-application identification of admixtures.

The primary difference in the composition of normal-weight structural concrete and lightweight structural concrete is the large aggregates' type. Normal-weight structural concrete contains normal-weight aggregates such as stone or crushed gravel, which are dense and typically will absorb no more moisture than about 2 percent by weight. Lightweight structural concrete uses lightweight, porous aggregates such as expanded shale, which will absorb about 5 to 25 percent moisture by weight. Lightweight aggregate needs to be saturated with moisture—it's often stored in ponds—before mixing. As a result, lightweight structural concrete inherently contains much more water than normal-weight structural concrete.

Lightweight structural concrete is used in roofing-related applications for cast-in-place concrete roof decks using removable forms; composite roof decks where a metal form deck remains in place; and as a deck topping material, such as a concrete topping surface over precast concrete planks or tees.

Once poured, lightweight structural concrete typically cannot be easily distinguished from normal-weight structural concrete. Visual identification is possible using magnification, typically a microscope used by a trained technician.

REPORTED PROBLEMS

The problems reported to NRCA associated with lightweight structural concrete roof decks include the following:

- *Moisture accumulation.* Excessive moisture from a concrete deck can be pressure-differential driven into and condensed within a roof system.
- *Adhesive loss.* The presence of moisture can result in deterioration of moisture-sensitive roofing materials and adhesive bond loss between adhered material layers.
- *Adhesive issues with water-based and low-volatile organic compounds.* Excessive moisture can affect adhesive curing and drying rates. Also, moisture can result in adhesive "rewetting," resulting in bond strength loss.
- *Metal and fastener corrosion.* Excessive moisture can contribute to and accelerate metal components' corrosion, including fastener corrosion.
- *Insulation R-value loss.* The accumulation and presence of moisture in most insulation products will result in reduced thermal performance (lower effective R-value).
- *Microbial growth.* The presence of prolonged high-moisture

Conclusions

- Concrete roof decks – normal weight and light-weight structural – present challenging moisture-related considerations.
- Further complicated by the use of admixtures and method of finishing.
- NRCA does not support the 28-day drying period or the plastic sheet test

Conclusions - continued

- Roofing contractors can only visually assess the dryness of the concrete's top surface
- Roofing contractors cannot readily assess any remaining free moisture within concrete or its likely release

Roofing contractors are not privy to and may not be knowledgeable about the information necessary to make "…when to roof…" decisions

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International Energy Conservation Code, 2012 Edition

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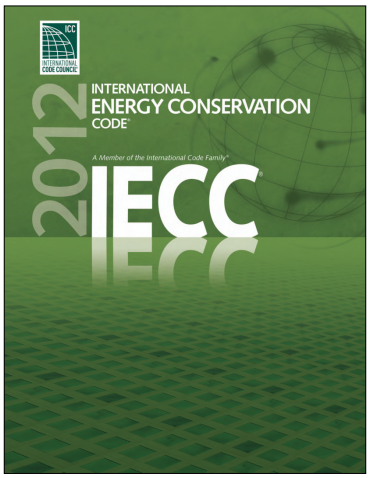
International Energy Conservation Code, 2012 Edition (IECC 2012)



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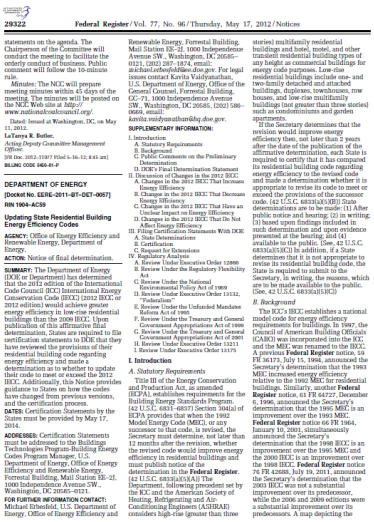
Federal Register, May 17, 2012



29322 Federal Register / Vol. 77, No. 96 / Thursday, May 17, 2012 / Notices

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

Minutes: The NCC will prepare meeting minutes within 45 days of the meeting. The minutes will be posted on the NCC Web site at *http://www.nationalcodecouncil.org/*.

Dated: Issued at Washington, DC, on May 11, 2012.

LaTanya R. Butler,
Acting Deputy Committee Management Officer.

[FR Doc. 2012-11927 Filed 5-16-12; 8:45 am]
BILLING CODE 6450-01-P

DEPARTMENT OF ENERGY

[Docket No. EERE–2011–BT–DET–0057]

RIN 1904–AC59

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 edition of the International Code Council (ICC) International Energy Conservation Code (IECC) (2012 IECC or 2012 edition) would achieve greater energy efficiency in low-rise residential buildings than the 2009 IECC. Upon publication of this 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 made a determination as to whether to update 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.

DATES: Certification Statements by the States must be provided by May 17, 2014.

ADDRESSES: Certification Statements must be addressed to the Buildings Technologies Program-Building Energy Codes Program Manager, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Forrestal Building, Mail Station EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121.

FOR FURTHER INFORMATION CONTACT: Michael Erbesfeld, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Forrestal Building, Mail Station EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121, (202) 287–1874, email: *michael.erbesfeld@ee.doe.gov*. For legal issues contact Kavita Vaidyanathan, U.S. Department of Energy, Office of the General Counsel, Forrestal Building, GC–71, 1000 Independence Avenue SW., Washington, DC 20585, (202) 586–0669, email: *kavita.vaidyanathan@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

I. Introduction
A. Statutory Requirements
B. Certification
C. Public Comments on the Preliminary Determination
D. DOE's Final Determination Statement
II. Discussion of Changes in the 2012 IECC
A. Changes in the 2012 IECC That Increase Energy Efficiency
B. Changes in the 2012 IECC That Decrease Energy Efficiency
C. Changes in the 2012 IECC That Have an Unclear Impact on Energy Efficiency
D. Changes in the 2012 IECC That Do Not Affect Energy Efficiency
III. Filing Certification Statements With DOE
A. State Determinations
B. Certification
C. Request for Extensions
IV. Regulatory Analyses
A. Review Under Executive Order 12866
B. Review Under the Regulatory Flexibility Act
C. Review Under the National Environmental Policy Act of 1969
D. Review Under Executive Order 13132, "Federalism"
E. Review Under the Unfunded Mandates Reform Act of 1995
F. Review Under the Treasury and General Government Appropriations Act of 1999
G. Review Under the Treasury and General Government Appropriations Act of 2001
H. Review Under Executive Order 13211
I. Review Under Executive Order 13175

I. Introduction

A. Statutory Requirements

Title III of the Energy Conservation and Production Act, as amended (ECPA), establishes requirements for the Building Energy Standards Program. (42 U.S.C. 6831–6837) Section 304(a) of ECPA provides that when the 1992 Model Energy Code (MEC), or any successor to that 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 must publish notice of the determination in the **Federal Register**. (42 U.S.C. 6833(a)(5)(A)) The Department, following precedent set by the ICC and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) considers high-rise (greater than three stories) multifamily residential buildings and hotel, motel, and other transient residential building types of any height as commercial buildings for energy code purposes. Low-rise residential buildings include one- and two-family detached and attached buildings, duplexes, townhouses, row houses, and low-rise multifamily buildings (not greater than three stories) such as condominiums and garden apartments.

If the Secretary determines that the revision would improve energy efficiency then, not later than 2 years after the date of the publication of the affirmative determination, each State is required to certify that it has compared its residential building code regarding energy efficiency to the revised code and made a determination whether it is appropriate to revise its code to meet or exceed the provisions of the successor code. (42 U.S.C. 6833(a)(5)(B)) State determinations are to be made: (1) After public notice and hearing; (2) in writing; (3) based upon findings included in such determination and upon evidence presented at the hearing; and (4) available to the public. (See, 42 U.S.C. 6833(a)(5)(C)) In addition, if a State determines that it is not appropriate to revise its residential building code, the State is required to submit to the Secretary, in writing, the reasons, which are to be made available to the public. (See, 42 U.S.C. 6833(a)(5)(C))

B. Background

The ICC's IECC establishes a national model code for energy efficiency requirements for buildings. In 1997, the Council of American Building Officials (CABO) was incorporated into the ICC and the MEC was renamed to the IECC. A previous **Federal Register** notice, 59 FR 36173, July 15, 1994, announced the Secretary's determination that the 1993 MEC increased energy efficiency relative to the 1992 MEC for residential buildings. Similarly, another **Federal Register** notice, 61 FR 64727, December 6, 1996, announced the Secretary's determination that the 1995 MEC is an improvement over the 1993 MEC. **Federal Register** notice 66 FR 1964, January 10, 2001, simultaneously announced the Secretary's determination that the 1998 IECC is an improvement over the 1995 MEC and the 2000 IECC is an improvement over the 1998 IECC. **Federal Register** notice 76 FR 43588, July 19, 2011, announced the Secretary's determination that the 2003 IECC was not a substantial improvement over its predecessor, while the 2006 and 2009 editions were a substantial improvement over its predecessors. A map depicting the

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

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Roofing-related changes

International Energy Conservation Code, 2012 Edition

- R-value increases
- Mandatory roof reflectivity requirements in Climate Zones 1-3
- Mandatory air barrier requirements in Climate Zones 4-8

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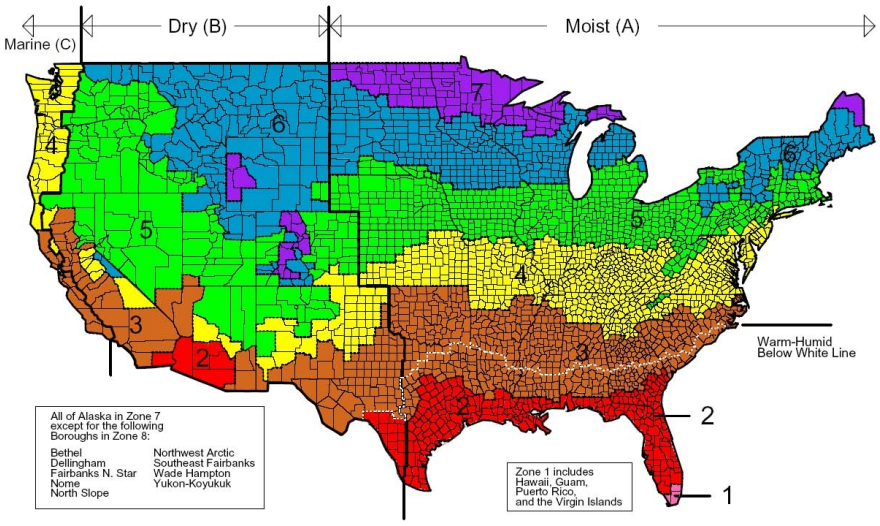
Climate zones

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



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Roofing-specific adaptation of Table R402.1

International Energy Conservation Code, 2012 Edition

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]

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Roofing-specific adaptation of Table C402.2

International Energy Conservation Code, 2012 Edition

Opaque Thermal Envelope Assembly Requirements			
Climate zone	**Roof assembly configuration**		
	Insulation entirely above deck	**Metal buildings (with R-5 thermal blocks)**	**Attic and other**
1	R-20ci	R-19 + R-11 LS	R-38
2			
3			
4	R-25 ci		
5			
6	R-30ci	R-25 + 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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International Energy Conservation Code, 2012 Edition

Status of states' adoptions

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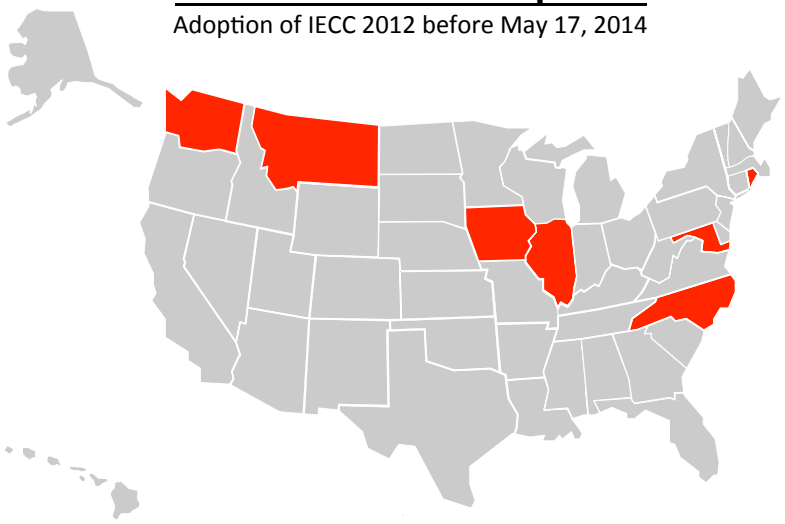
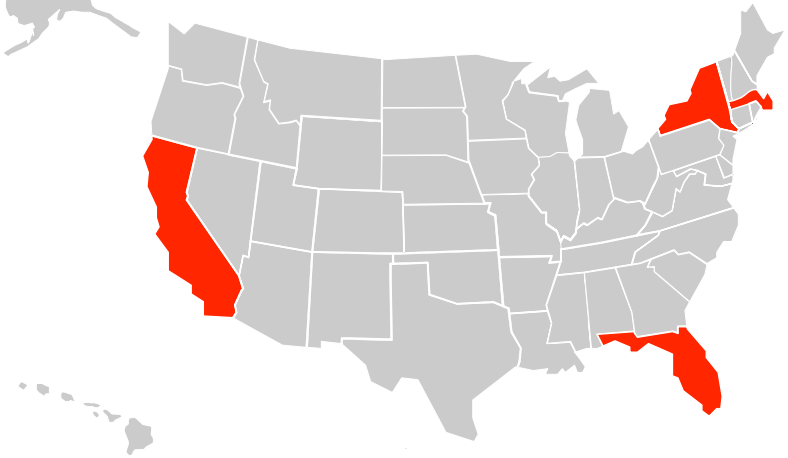
Status of states' adoptions

Adoption of IECC 2012 before May 17, 2014



Status of states' adoptions

Adoption of IECC 2012 before Jan. 1, 2015

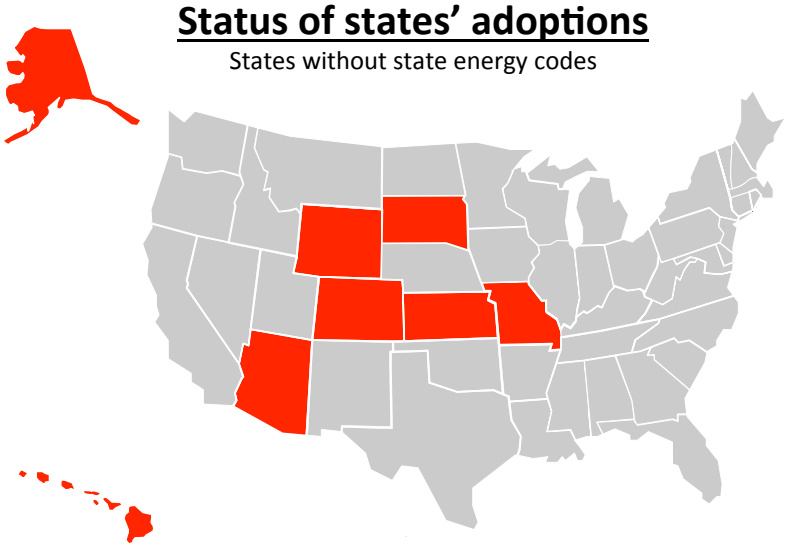


RSG ROOFING SUPPLY GROUP

NRCA

Status of states' adoptions

States without state energy codes



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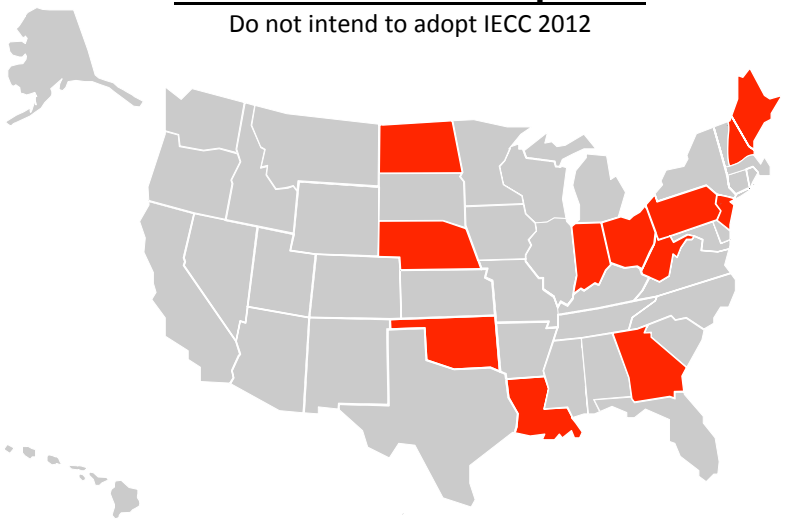
Status of states' adoptions

Do not intend to adopt IECC 2012



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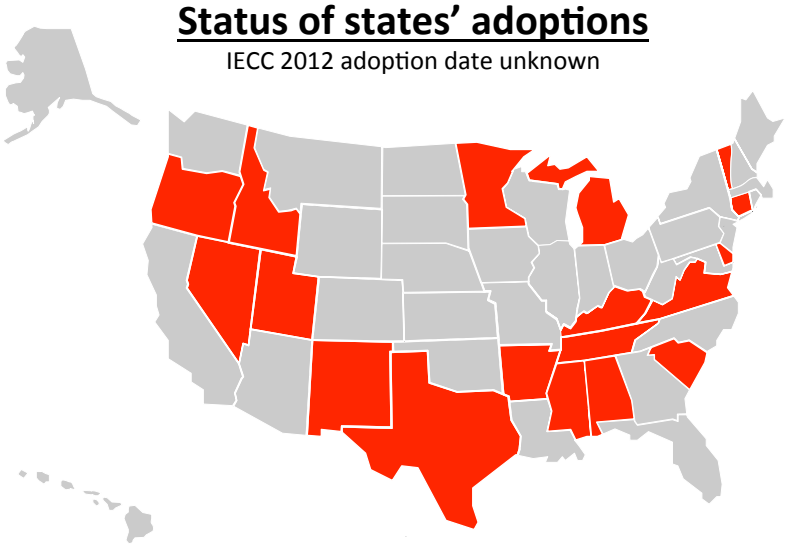
Status of states' adoptions

IECC 2012 adoption date unknown



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Some conclusions

International Energy Conservation Code, 2012 Edition

- Beware of which Energy Code is applicable
- Be knowledgeable of Energy Code update adoptions
- Comply with the Energy Code

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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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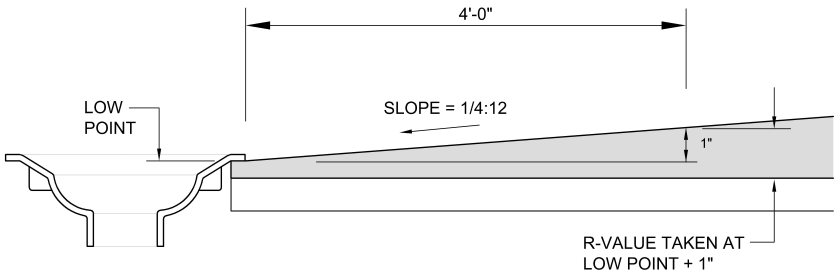
Graphically depicted…



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New LTTR values

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Thermal resistance (R)

ASTM C518, " Standard Test Method for Steady-state Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus"

-- Originally published in 1963
Current edition is 2010

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Theory of foam aging

ASTM C1303, Appendix X3-Theory of Foam Aging

- R-value of most foam insulations is affected by the gas mixture in the foam
  - R-value of most blowing agents is greater than that of air.
  - R-value of foam insulation is greater when there is more blowing agent and less air

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Theory of foam aging -- continued

ASTM C1303, Appendix X3-Theory of Foam Aging

- For rigid, closed-cell foams, diffusion plays a role:
  - Air diffuses into cells
  - Blowing agent diffuses out of cells or partially dissolves into the polymer matrix
- Diffusion rate depends upon:
  - Type of polymer
  - Type of gas
  - Foam structure
  - Temperature
  - Pressure

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Long-term thermal resistance (LTTR)

- ASTM C1303, "Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation"
- CAN/ULC-S770, "Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

PIMA Quality Mark^{cm} program

- Established in 2003
- Implemented on January 1, 2004
- Report LTTR values based upon CAN/ULC-S770-03
- Third party administration by FM Global

Insulation thickness	LTTR
1.0 inch (25 mm)	6.0
1.5 inches (38 mm)	9.0
1.7 inches (43 mm)	10.3
1.8 inches (46 mm)	10.9
2.0 inches (51 mm)	12.1
2.5 inches (64 mm)	15.3
2.7 inches (69 mm)	16.6
3.0 inches (76 mm)	18.5
3.3 inches (84 mm)	20.4
3.5 inches (89 mm)	21.7
4.0 inches (102 mm)	25.0

"Tech today," *Professional Roofing,* November 2002

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Revision to the PIMA Quality Mark^{cm} program

- Report LTTR values based upon:
  - ASTM C1303-11
  - CAN/ULC-S770-09
- Effective date of January 1, 2014

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New minimum LTTR values

PIMA Quality Mark[cm] program (minimum values)

Revised LTTR values		
Thickness (inches)	**New LTTR values per inch thickness**	**New LTTR values per thickness**
1	5.6	5.6
2	5.7	11.4
3	5.8	17.4
4	5.9	23.6

"Tech today," *Professional Roofing,* August 2013

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Comparing existing vs. new LTTR values

Thickness	LTTR (2004 – 2013)	New LTTR (2014 –)
1 inch	6.0	5.6
1.5 inches	9.0	8.6
2 inches	12.1	11.4
3 inches	18.5	17.4
4 inches	25.0	23.6

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Some concerns

Design/bid/construction scenarios:

- Projects designed in 2013, but will be constructed in 2014
- Projects bid in 2013, but will be constructed in 2014
- Projects designed and bid in 2014 using outdated LTTR values

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NRCA recommends designers specify polyisocyanurate insulation by thickness – not R-value or LTTR.

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Some words of caution…

Do not use the terms “R-value” and “LTTR” interchangeably.

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Questions?

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CERTA

- Established by MRCA in 1986
- Joint agreement with NRCA beginning in 2003
- 1,600+ trainers
- 21,000+ applicators
- Substantially improved fire safety record

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NRCA

roofwinddesigner.com

- Developed jointly by NRCA, MRCA and NERCA
- No cost to users
- Determine building-specific wind loads:
  - ASCE 7-05
  - ASCE 7-10
- Determine required wind resistances
- 14,827 projects

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NRCA

EnergyWise Roof Calculator

energywise.nrca.net

- Developed by NRCA in cooperation with the Roofing Industry Alliance for Progress
- Determine R-value requirements:
  - IECC 2006 and 2012
  - IgCC 2012
  - ASHRAE 90.1-99, -04, -07, -10 and -13
  - ASHRAE 189.1-09
- Calculates heating/cooling costs
- Verifies proper vapor retarder placement
- 7,457 projects

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