



We Speak  Building

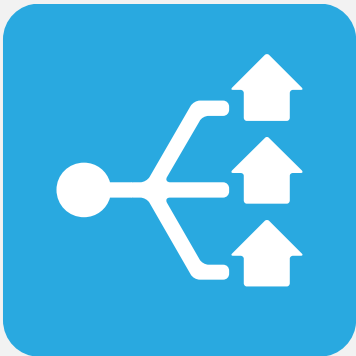
The text "We Speak" is in green, and "Building" is in blue. The icon is a blue graduation cap with a green speech bubble overlapping its base.

Performance Requirements and Options in the International Energy Conservation Code

Mike Turns, Senior Program Manager

mturns@psdconsulting.com

Programs



- ✓ Design
- ✓ Implementation
- ✓ Marketing
- ✓ QA/QC

Professional Services



- ✓ Technical Consulting
- ✓ Training
- ✓ Energy Engineering
- ✓ Rater Providership

Software



- ✓ TREAT
- ✓ Field tools
- ✓ Program Management Applications
- ✓ M&V



- Energy Code History and Trajectory
- Energy Code Compliance Paths
- Overview of Performance-Related Requirements





Energy Code History

Sub-heading

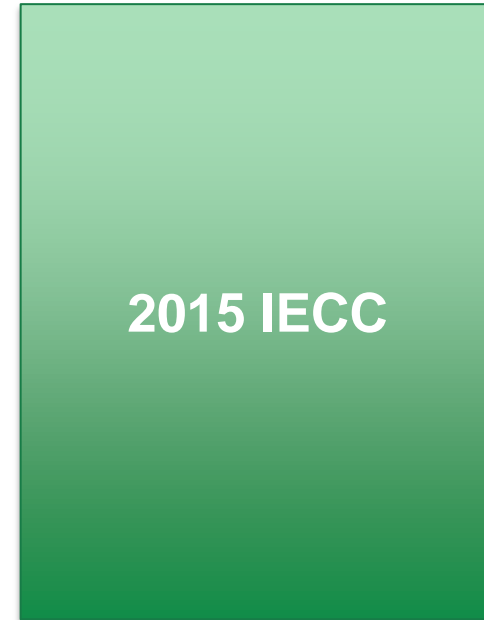
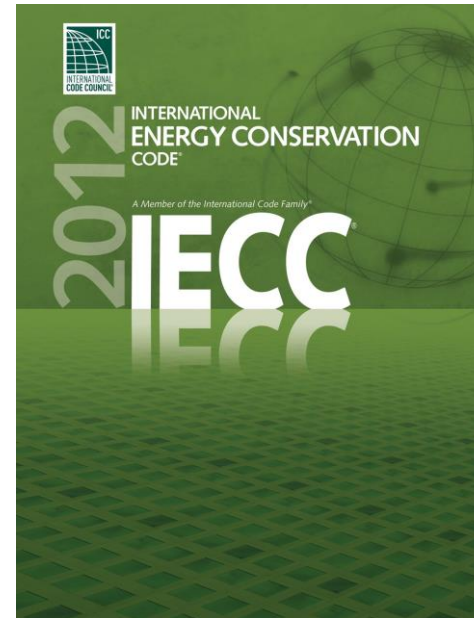
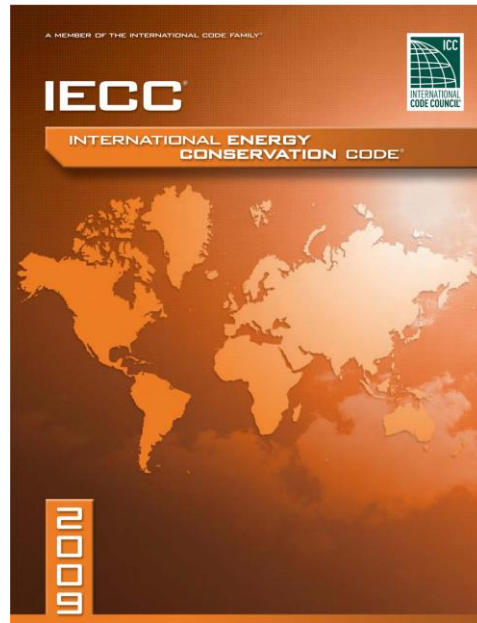
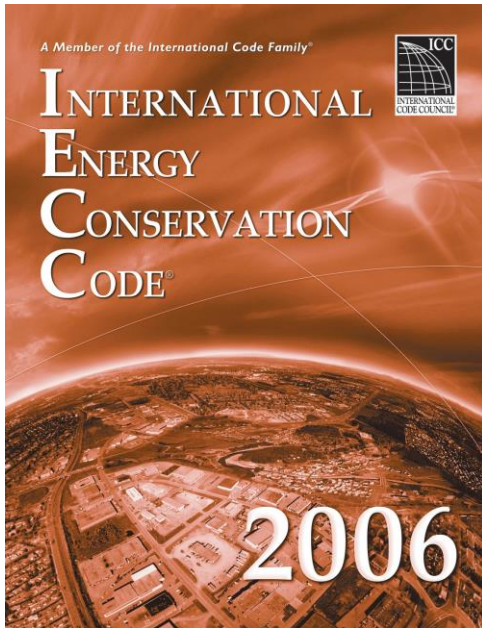
Model Building Codes

- Early 1990s
 - Building Officials Code Administrators International (BOCA)
 - Southern Building Code Congress International (SBCCI)
 - International Conference of Building Officials (ICBO)
- 1994 Merger
 - International Code Council (ICC)
 - I-Codes
 - Adopted by states or municipalities (and sometimes modified)

DOE Energy Policy

- Energy Conservation and Policy Act (ECPA)
 - Periodically review model codes
 - Participate in code development process
 - Seek adoption technically feasible and economically justified energy efficiency measures
 - States required to review latest model energy code and adopt, or explain why not to the Secretary
- Building Energy Codes Program
 - **Current goal:** 50% more efficient than 2006 IECC

The March of the Energy Code – Efficiency Increases

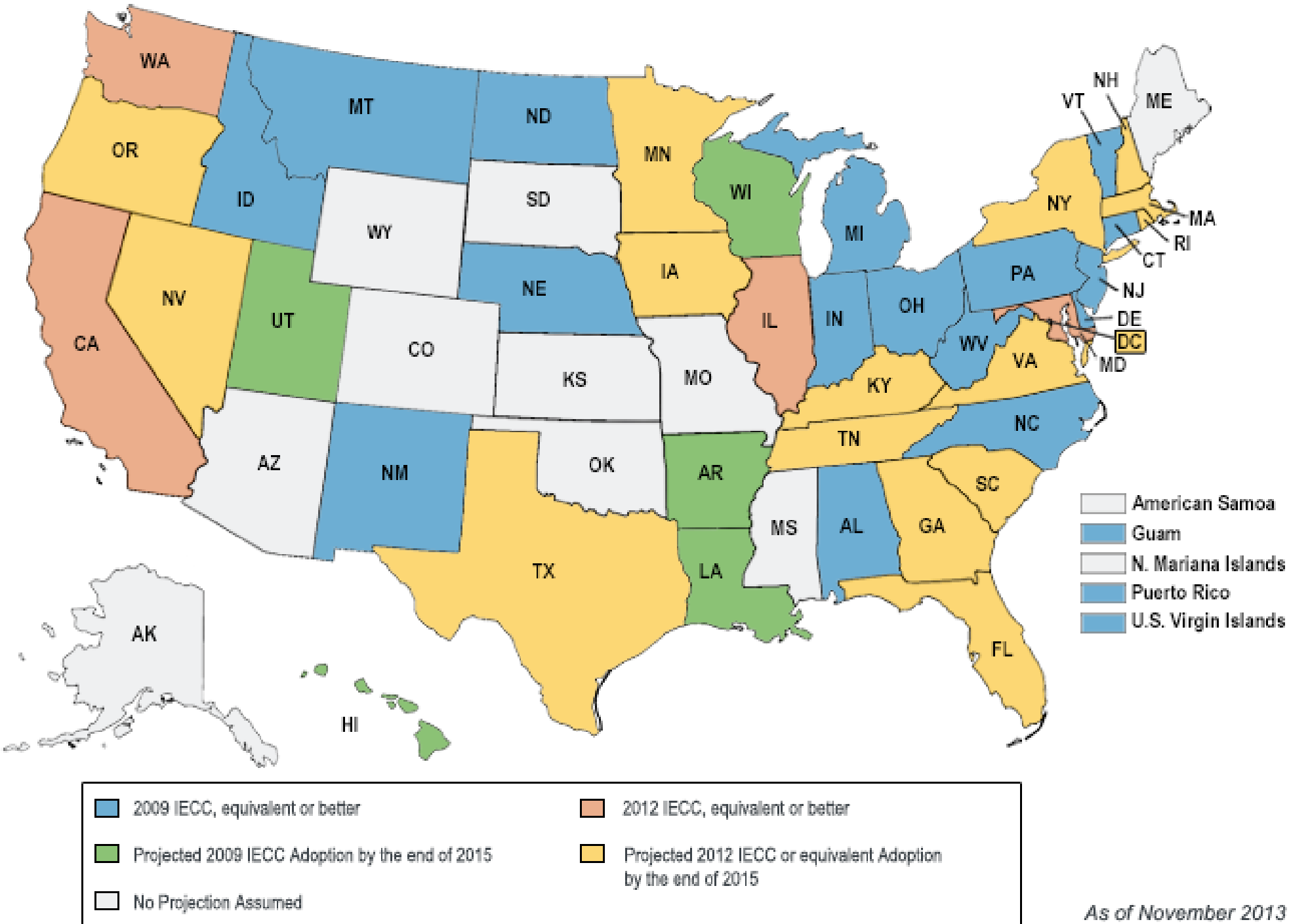


15%

15%

6%?

Projected Residential Building Energy Code Adoption Activity



As of November 2013

Source: www.energycodes.gov

Projections are based on current code status and typical state adoption cycles.

Compliance Pathways

The background features several overlapping, wavy bands of color. From top to bottom, there is a light green band, a dark green band, and a blue band. These bands curve across the page, creating a sense of movement and depth. The text 'Compliance Pathways' is centered in the upper portion of the image, above the green bands.

Compliance Pathways

1. Prescriptive Path

- Insulation requirements, two sub-paths:
 - Prescriptive R- and U-values
 - UA Alternative (*REScheck*)
- Air leakage, duct insulation and leakage
- Equipment sizing/selection
- Lighting

2. Performance Path

- Simulated Performance Alternative (REM/Rate, etc.)

3. Energy Rating Index Path (2015 only)

Performance-Related Requirements

A decorative graphic consisting of several overlapping, wavy bands of color. The colors are various shades of green and blue. The bands flow from the left side of the image towards the right, with some crossing over others, creating a sense of movement and depth. The top band is a bright green, followed by a darker green, and then a blue band that curves upwards towards the right edge.

Performance-Related Code Requirements - Timeline

2006

- Air sealing list
- Simulated Performance Alternative

2009

- Blower door test (optional)
- Detailed air sealing and insulation inspection criteria
- Duct testing
- Simulated Performance Alternative

2012

- Blower door test
- Detailed air sealing and insulation inspection criteria
- Duct testing
- Simulated Performance Alternative

2015

- Blower door test
- Detailed air sealing and insulation inspection criteria
- Duct testing
- Simulated Performance Alternative
- Energy Index Path

- Building envelope air tightness and insulation installation shall be demonstrated by:
 - Blower door test
 - Visual inspection
- 2009: One or the other
2012: Both
2015: Both
- Building official may require third party agency to conduct either blower door test, visual inspection or both

Building Envelope Leakage Limits

2009



7 ACH50

2012



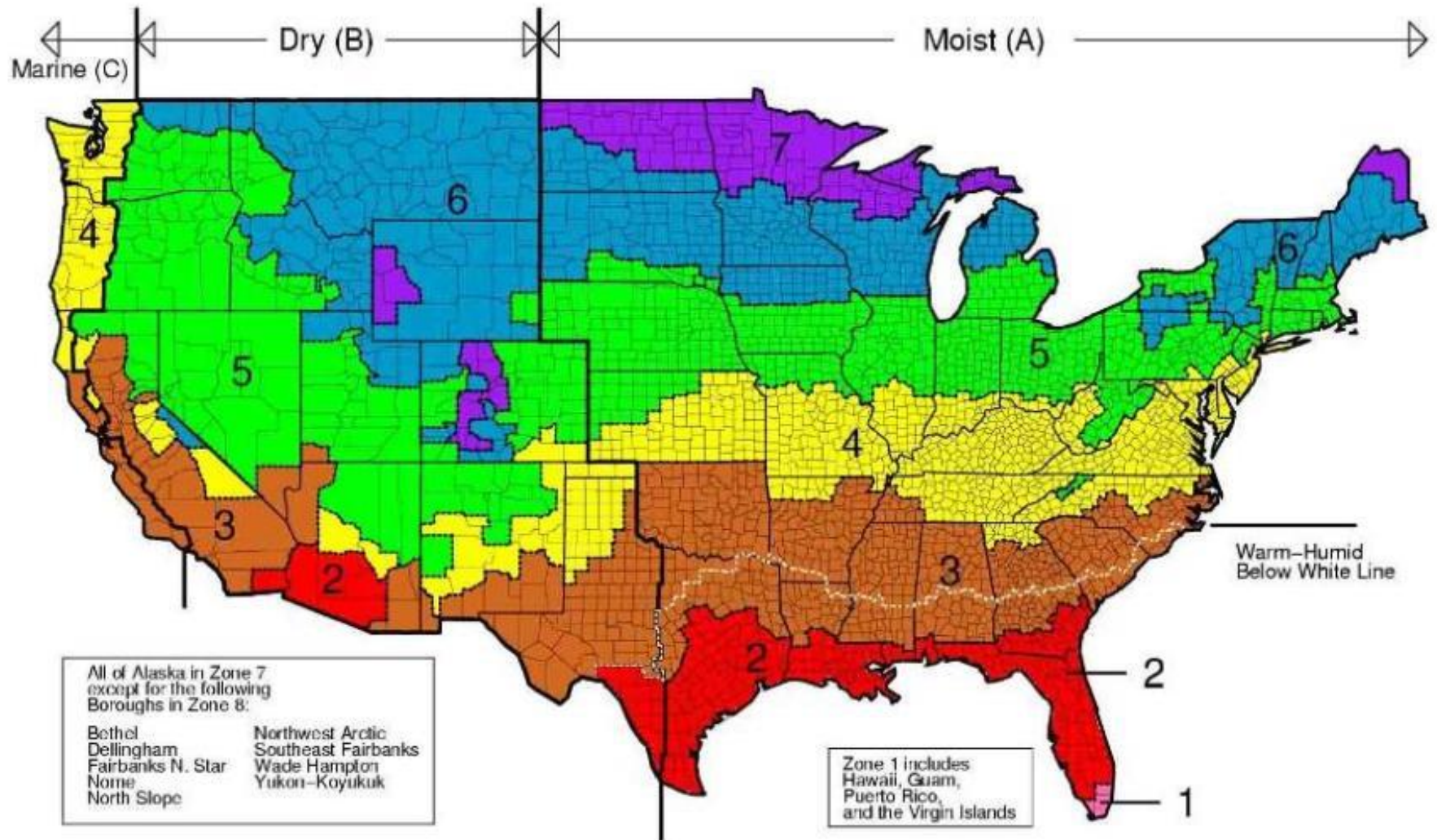
**Climate zones 1-2:
5 ACH50**

**Climate zones 3-8:
3 ACH50**

2015



Climate Zones



IECC Duct Sealing Verification

Maximum CFM25 per 100 sq. ft. conditioned floor area

| | 2009 | 2012 | 2015 |
|-------------------------------|------|-----------------|-----------------|
| Post-construction test | | | |
| Leakage to Outdoors | 8 | NA ¹ | NA ¹ |
| Total Leakage | 12 | 4 | 4 |
| Rough-in test | | | |
| Total Leakage | 6 | 4 | 4 |
| Total w/o air handler | 4 | 3 | 3 |

¹Leakage to outdoors option eliminated.

Energy Rating Index Path – 2015 IECC

| Climate Zone | Required Index | |
|---------------------|-----------------------|-------------|
| 1 and 2 | 52 | (59) |
| 3 | 51 | (59) |
| 4 | 54 | (63) |
| 5 | 55 | (63) |
| 6 | 54 | (62) |
| 7 and 8 | 53 | |

Plus, 2009 IECC envelope requirements as mandatory minimum

Appendix

The background features several overlapping, wavy bands of color. From top to bottom, there is a light green band, a dark green band, and a blue band. These bands curve across the page, creating a dynamic, abstract design.

Referenced only if there are related questions

2009 IECC Insulation and Fenestration Requirements

| CLIMATE ZONE | FENESTRATION U-FACTOR ^b | SKYLIGHT ^b U-FACTOR | GLAZED FENESTRATION ^{b,e} SHGC | CEILING R-VALUE | WOOD FRAME WALL R-VALUE | MASS WALL R-VALUE ⁱ | FLOOR R-VALUE | BASEMENT ^c WALL R-VALUE | SLAB ^d R-VALUE & DEPTH | CRAWL SPACE ^c WALL R-VALUE |
|-----------------|------------------------------------|--------------------------------|---|-----------------|-------------------------|--------------------------------|-----------------|------------------------------------|-----------------------------------|---------------------------------------|
| 1 | 1.20 | 0.75 | 0.30 | 30 | 13 | 3 / 4 | 13 | 0 | 0 | 0 |
| 2 | 0.65 ^j | 0.75 | 0.30 | 30 | 13 | 4 / 6 | 13 | 0 | 0 | 0 |
| 3 | 0.50 ^j | 0.65 | 0.30 | 30 | 13 | 5 / 8 | 19 | 5 / 13 ^f | 0 | 5 / 13 |
| 4 except Marine | 0.35 | 0.60 | NR | 38 | 13 | 5 / 10 | 19 | 10 / 13 | 10, 2ft | 10 / 13 |
| 5 and Marine 4 | 0.35 | 0.60 | NR | 38 | 20 or 13+5 ^h | 13 / 17 | 30 ^g | 10 / 13 | 10, 2 ft | 10 / 13 |
| 6 | 0.35 | 0.60 | NR | 49 | 20 or 13+5 ^h | 15 / 19 | 30 ^g | 15 / 19 | 10, 4 ft | 10 / 13 |
| 7 and 8 | 0.35 | 0.60 | NR | 49 | 21 | 19 / 21 | 38 ^g | 15 / 19 | 10, 4 ft | 10 / 13 |

2012 IECC Insulation and Fenestration Requirements

| CLIMATE ZONE | FENESTRATION U-FACTOR ^b | SKYLIGHT ^b U-FACTOR | GLAZED FENESTRATION ^{b,e} SHGC | CEILING R-VALUE | WOOD FRAME WALL R-VALUE | MASS WALL R-VALUE ⁱ | FLOOR R-VALUE | BASEMENT ^c WALL R-VALUE | SLAB ^d R-VALUE & DEPTH | CRAWL SPACE ^c WALL R-VALUE |
|-----------------|------------------------------------|--------------------------------|---|-----------------|-------------------------|--------------------------------|-----------------|------------------------------------|-----------------------------------|---------------------------------------|
| 1 | NR | 0.75 | 0.25 | 30 | 13 | 3 / 4 | 13 | 0 | 0 | 0 |
| 2 | 0.40 | 0.65 | 0.25 | 38 | 13 | 4 / 6 | 13 | 0 | 0 | 0 |
| 3 | 0.35 | 0.55 | 0.25 | 38 | 13 | 8/13 | 19 | 5 / 13 ^f | 0 | 5 / 13 |
| 4 except Marine | 0.35 | 0.55 | 0.40 | 49 | 20 or 13+5 | 8/13 | 19 | 10 / 13 | 10, 2ft | 10 / 13 |
| 5 and Marine 4 | 0.32 | 0.55 | NR | 49 | 20 or 13+5 | 13 / 17 | 30 ^g | 15 / 19 | 10, 2 ft | 15 / 19 |
| 6 | 0.32 | 0.55 | NR | 49 | 20+5 or 13+10 | 15 / 20 | 30 ^g | 15 / 19 | 10, 4 ft | 15 / 19 |
| 7 and 8 | 0.32 | 0.55 | NR | 49 | 20+5 or 13+10 | 19 / 21 | 38 ^g | 15 / 19 | 10, 4 ft | 15 / 19 |



| COMPONENT | CRITERIA ^a |
|---------------------------------|--|
| Air barrier and thermal barrier | <p>A continuous air barrier shall be installed in the building envelope.</p> <p>Exterior thermal envelope contains a continuous air barrier.</p> <p>Breaks or joints in the air barrier shall be sealed.</p> <p>Air-permeable insulation shall not be used as a sealing material.</p> |
| Ceiling/attic | <p>The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed.</p> <p>Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.</p> |
| Walls | <p>Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed.</p> <p>The junction of the top plate and top of exterior walls shall be sealed.</p> <p>Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p> <p>Knee walls shall be sealed.</p> |



| | |
|--|---|
| Windows, skylights and doors | The space between window/door jambs and framing and skylights and framing shall be sealed. |
| Rim joists | Rim joists shall be insulated and include the air barrier. |
| Floors (including above-garage and cantilevered floors) | Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation. |
| Crawl space walls | Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped. |



| | |
|----------------------|---|
| Shafts, penetrations | Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed. |
| Narrow cavities | Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space. |
| Garage separation | Air sealing shall be provided between the garage and conditioned spaces. |
| Recessed lighting | Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall. |
| Plumbing and wiring | Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring. |



| | |
|--|---|
| Shower/tub on exterior wall | Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs. |
| Electrical/phone box on exterior walls | The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed. |
| HVAC register boots | HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall. |
| Fireplace | An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors. |