What’s new?

The 2012 code requires more insulation, a tighter envelope, tighter ducts, better windows, and more efficient lighting than the 2009 code.

Here is a summary of the important changes for residential builders in the 2012 International codes:

- While the 2009 codes required that 50% of lighting fixtures in a new home to be so-called “high-efficacy” fixtures (fixtures using a CFLs or equivalent), the percentage has been raised to 75% in the new code.
- Duct tightness requirements have become more stringent.
- Blower-door testing requirements have become mandatory and more stringent; the 2009 threshold of 7 ach50 has been changed to 5 ach50 for climate zones 1 and 2, and 3 ach50 for homes in all other zones.
- All homes in zones 3 through 8, and some homes in zones 1 and 2, will be required to have a whole-house mechanical ventilation system.
- In many climate zones, window glazing U-factor and solar heat gain coefficient (SHGC) requirements have been changed.
- Wall insulation requirements have become more stringent in climate zones 3, 4, 6, 7, and 8; for the first time, builders in climate zones 6, 7, and 8 will be required to install exterior rigid foam insulation (or to use some other comparable wall insulation strategy).

The bottom line: every new home will need to be tested with a blower door, every cold-climate builder will need to come up with a strategy to stop thermal bridging through studs.
Chapter 11 in the IRC

The 2012 International Residential Code (IRC) still includes energy efficiency requirements in Chapter 11. However, these requirements are now identical to the residential provisions found in the 2012 International Energy Conservation Code (IECC).

In essence, chapter 11 of the IRC is just a reprint of the applicable sections of the 2012 IECC.

Until the most recent round of code revisions, residential builders could choose to comply with one of two energy codes: either Chapter 11 in the IRC (the “Energy Efficiency” chapter), or the residential section of the IECC. Most builders found it easier to follow the IRC. However, any builder who wanted to follow the performance path (rather than the prescriptive or component-tradeoff path) had to use the IECC, since the IRC didn’t include a performance path option.

The fact that there were two parallel energy codes — one in the IRC, and one in the IECC — was confusing to many builders. While the two codes were aligned on most matters, they occasionally conflicted, further adding to confusion.

The 2012 code revisions have simplified the situation. Now that the IRC now simply references the requirements of the IECC, residential builders have only one option.

If you are willing to endure the limitations of a quirky website, you can download several versions of the IRC as well as several versions of the IECC — one paragraph at a time — from a website maintained by the International Codes Council.

High-efficacy lamps

In section R404.1, the 2012 IECC requires that “a minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.” The percentage has been raised from 50% in the 2009 code.

The code defines a high-efficacy lamp as either:

- A compact fluorescent lamp (CFL);
- A T8 or smaller linear fluorescent lamp; or
- Any lamp meeting the following minimum efficiency requirements: 60 lumens per watt for lamps over 40 watts, 50 lumens per watt for lamps over 15 watts but no more than 40 watts, and 40 lumens per watt for lamps rated
This definition excludes incandescent light bulbs. High-efficacy lamps are allowed to have any type of base; screw-base (Edison-base) lamps comply with the new code.

### Duct tightness testing

Like the 2009 codes, the 2012 IECC requires duct leakage testing unless the duct system is located entirely inside of the home’s thermal envelope. The new code has increased the stringency of the duct leakage thresholds.

The code permits builders to test a duct system in one of three ways:

- One option is a so-called “rough-in” test before the air handler is installed. While the 2009 code had a threshold of 4 cfm per 100 square feet of conditioned floor area for this test, the 2012 code has lowered this threshold to 3 cfm.
- Another option is a so-called “rough-in” test after the air handler is installed. While the 2009 code had a threshold of 6 cfm per 100 square feet of conditioned floor area for this test, the 2012 code has lowered this threshold to 4 cfm.
- The third option is a so-called “post-construction” test. While the 2009 code had a threshold of 12 cfm per 100 square feet of conditioned floor area for this test, the 2012 code has lowered this threshold to 4 cfm.

The bottom line: get out your tub of mastic, and seal everything well.

### Better air tightness requirements

The 2009 International codes included provisions to improve the air tightness of new homes. Builders were given two compliance options: either follow a checklist of measures or have the home tested with a blower door.

The new 2012 code doesn’t give builders a choice anymore; builders now have to comply with both the checklist requirements and the requirement to conduct a blower-door test.

The air-sealing checklist in the 2012 IECC is called Table R402.4.1.1, “Air Barrier and Insulation Installation.” The 2012 table is based on the
earlier checklist (2009 IECC, Table 402.4.2); however, the 2012 version is written in mandatory language, and a few ambiguities in the earlier table have been cleared up.

All items on the checklist must be followed; however, the way builders prove compliance is likely to vary from jurisdiction to jurisdiction. The 2012 code provides a lot of leeway to the local inspector; according to the code, “Where required by the code official, an approved third party shall inspect all components and verify compliance.”

Table R402.4.1.1 requires:

“A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. Air-permeable insulation shall not be used as a sealing material.”

“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.”

“Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.”

“The space between window/door jambs and framing and skylights and framing shall be sealed.”

“Rim joists shall be insulated and include the air barrier.”

“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.”

“Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspace shall be covered with a Class I vapor retarder with overlapping joints taped.”

“Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.”

“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.”
“Air sealing shall be provided between the garage and conditioned spaces.”

“Recased light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall.”

“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.”

“Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.”

“The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.”

“HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.”

“An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.”

Every new home must pass a blower-door test

Once you have completed the air-sealing checklist, you still need to conduct a blower-door test.

According to section R402.4.1.2 of the 2012 IECC, “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 with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.”

It’s up to the local code official to determine whether builders can conduct their own tests or whether builders need to contract with a third-party tester.
What about mechanical ventilation?

Although the 2012 IECC includes provisions to improve a home’s airtightness, it is silent on the question of whether new homes need mechanical ventilation systems. However, the 2012 IRC does include requirements for mechanical ventilation.

<table>
<thead>
<tr>
<th>RUN-TIME PERCENTAGE</th>
<th>25%</th>
<th>33%</th>
<th>50%</th>
<th>66%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN EACH 4-HOUR SEGMENT</td>
<td>4</td>
<td>3</td>
<td>2.15</td>
<td>1.3</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

<table>
<thead>
<tr>
<th>DWELLING UNIT FLOOR AREA (square feet)</th>
<th>0 - 1</th>
<th>2 - 3</th>
<th>4 - 5</th>
<th>6 - 7</th>
<th>&gt; 7</th>
<th>Airflow in CFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1,500</td>
<td>30</td>
<td>45</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>1,501 - 3,000</td>
<td>45</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>3,001 - 4,500</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>4,501 - 6,000</td>
<td>75</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>6,001 - 7,500</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>135</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>&gt; 7,500</td>
<td>105</td>
<td>120</td>
<td>135</td>
<td>150</td>
<td>165</td>
<td></td>
</tr>
</tbody>
</table>

For SI: 1 square foot = 0.0929 m², 1 cubic foot per minute = 0.0004719 m³/s.

Better windows

Builders in many climate zones will need to choose windows with a lower U-factor and a lower solar heat-gain coefficient (SHGC).

Here are the changes to the prescriptive window requirements:

In climate zone 1, the maximum window U-factor changes from U-1.2 to U-0.65, while the maximum SHGC changes from 0.30 to 0.25.
In climate zone 2, the maximum window U-factor changes from U-0.65 to U-0.40, while the maximum SHGC changes from 0.30 to 0.25.

In climate zone 3, the maximum window U-factor changes from U-0.50 to U-0.35, while the maximum SHGC changes from 0.30 to 0.25.

In climate zone 4 (except Marine), window SHGC is regulated for the first time. The maximum permissible SHGC is 0.40.

In climate zone 5 and Marine 4, the maximum window U-factor changes from U-0.35 to U-0.32.

In climate zone Marine 4 and zones 5, 6, 7, and 8, the maximum window U-factor changes from U-0.35 to U-0.32.

There are no restrictions on SHGC in climate zone Marine 4 and zones 5, 6, 7, and 8. In these climates, a high SHGC is usually desirable, especially on the south orientation.

Prescriptive requirements for glazing U-factor and glazing SHGC are found in Table 402.1.1 of the 2012 IECC; the table is reproduced on this page as an image (below).

### Cold-climate builders will need exterior foam sheathing

In Table 402.1.1, the 2012 IECC ratchets up minimum prescriptive insulation levels in several climate zones:

In climate zones 2 and 3, the minimum ceiling R-value has been increased from R-30 to R-38.

In climate zones 4 and 5, the minimum ceiling R-value has been increased from R-38 to R-49.

In climate zones 3 and 4 (except zone Marine 4), the minimum R-value for above-grade walls has been increased from R-13 to R-20 (or R-13 with an additional layer of R-5 continuous insulation).
In climate zone Marine 4 and zone 5, the minimum basement wall and crawl space wall R-value has been increased from R-10 continuous to R-15 continuous.

In climate zones 6, 7, and 8, the minimum crawl space wall R-value has been increased from R-10 continuous to R-15 continuous.

However, the most earth-shaking changes found in Table 402.1.1 are the wall insulation requirements for climate zones 6, 7, and 8—an area that includes Wyoming, Montana, North Dakota, South Dakota, Minnesota, Wisconsin, Vermont, New Hampshire, and Maine. In these zones, the 2012 code calls for above-grade walls to have at least “R-20+R-5” insulation or “R-13+R-10” insulation.

The table includes the following footnote explaining the wall R-value requirements that include a “plus” sign, including the requirements for climate zones 6 through 8: “(The) first value is cavity insulation, (the) second is continuous insulation or insulated siding, so ‘13+5’ means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.”

Most builders in these climate zones will find that the easiest compliance option will be to include R-5 or better foam insulation on the exterior of a 2x6 wall, or R-10 or better foam insulation on the exterior of a 2x4 wall. To meet R-5, builders will need at least 1.5 inch of EPS, 1 inch of XPS, or 3/4 inch of polyisocyanurate. To meet R-10, builders will need at least 3 inches of EPS, 2 inches of XPS, or 1.5 inch of polyiso.

Note that all of these code requirements are minimum requirements. In many climates, the minimum code requirement for the R-value of the continuous insulation (usually rigid foam) is not enough to keep OSB or plywood wall sheathing above the dew point in winter. Builders in Vermont who choose to install R-5 foam on a 2x6 wall will eventually discover that their OSB stays damp and begins to mold. For more information on this subject, see Calculating the Minimum Thickness of Rigid Foam Sheathing.

The code makes no mention of double-stud walls, so builders who choose this method of construction will need to convince their local building official that a double-stud wall complies with the code. Here’s one way to make the argument:
To comply with the R-20 plus R-5 requirement, some of the insulation — at least R-5 worth — must be continuous. That means you need at least 1.5 inch of cellulose between the two rows of studs, implying that a double-stud wall needs to be at least 8.5 inches thick.

Since 8.5 inches of cellulose has an R-value of R-31.5, the total R-value of the wall exceeds the R-20 plus R-5 requirement.

In conclusion, any double-stud wall that is at least 8.5 inches thick appears to comply with the R-20 plus R-5 requirement.

Prescriptive insulation requirements for ceilings, walls, and floors are found in Table 402.1.1 of the 2012 IECC; the table is reproduced on this page as an image (below).

**New pipe insulation requirements**

The 2012 IECC includes new requirements for R-3 or better pipe insulation on most types of hot-water pipes. A full explanation of the pipe insulation requirements can be found in Improvements to 2012 IECC.

**What about enforcement?**

The 2012 IECC is a significant improvement over all previous U.S. energy codes. However, energy experts should probably refrain from popping any champagne corks. An improved energy code is all fine and good, but if the code is unenforced, its existence is largely irrelevant.

Unfortunately, in most jurisdictions, most provisions of U.S. energy codes have never been enforced. For the 2012 IECC to be meaningful, thousands of local building code officials will need extensive training, and the budgets of thousands of local building departments will need to be substantially increased. Considering the current political climate, however, these essential steps may never be taken.
MAKING SENSE OF COMPLICATED BUILDING CODES AND STANDARDS IS NOW DOWN TO A SCIENCE.

It’s a fact: building and energy codes that impact the walls you build are changing and becoming more demanding. Higher air-leakage standards. Mandatory air infiltration testing. Increased R-value requirements as high as R-25 in some climate zones. These changes may have big implications for the homes you build. But the DuPont™ Building Knowledge Center can help you understand the new requirements and translate them into practical, science-based construction and weatherization practices. It starts with the new Cracking the Code e-brochure and the DuPont™ CodeSense™ Durable Wall Builder tool. Along with DuPont™ Tyvek® Weatherization Systems, they’re the keys to building more durable walls that meet the codes, your customers and your commitment to quality.

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