Batt Insulation for Existing Exterior Walls

Last Updated: 06/15/2018

Scope

If installing batts in the walls of an existing home, meet RESNET Grade 1 quality installation standards and meet or exceed code for the insulation level R-value requirement.

Unfaced fiberglass batt insulation is properly installed to completely fill the wall cavities and is sliced to fit around wiring, piping, and other obstructions in the wall cavities.

See the U.S. Department of Energy Standard Work Specifications for additional guidance on installing batt insulation in walls.

For guidance on working in walls, see the Pre-Retrofit Assessment of Walls, Windows, and Doors.

See the Compliance Tab for related codes and standards requirements, and criteria to meet national programs such as DOE’s Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.
Description

Fiberglass or mineral wool batt insulation is not likely to be installed as an upgrade to an existing home, unless an addition is being added or perhaps in the case of a gut rehab where drywall is removed and replaced. If batt insulation will be installed, install the insulation in a manner that meets the Grade 1 standards of the Residential Energy Services Network (RESNET) in its Home Energy Rating System Standards (RESNET 2013). Grade 1 Installation requires that insulation material should uniformly fill wall cavities, filling each cavity from side to side and top to bottom, without substantial gaps or voids (Figure 1). The batt insulation should be cut to fit around any wiring or piping installed in the wall cavities (Figure 2). For more information, see the Building America Solution Center guide, *Insulation Installation Achieves RESNET Grade 1*.

![Figure 1. Batt insulation should be cut to fit around wiring or pipes in walls cavities (Source).](image1)

![Figure 2. This fiberglass batt is incorrectly installed; the batts should be sliced to fit around wiring (Source).](image2)

There are many factors to consider when installing batt insulation from either the interior or exterior. *Understanding Vapor Barriers* is a good primer on what needs to be considered regarding vapor retarders.

There are other insulation materials that might be considered for retrofit applications where the drywall will not be removed. These could include blown fiberglass or cellulose that is installed from the exterior of the wall using the “drill and fill” method as described in the guide *Blown Insulation for Cavities of Existing Exterior Walls*, or rigid foam, also typically installed on the exterior, which might be chosen as part of a home re-siding project as described in the guide *Rigid Foam Insulation for Existing Exterior Walls*.
Spray foam might be considered for existing walls where either drywall or exterior cladding and sheathing will be removed. Each of these methods has its own advantages and disadvantages; see the referenced guides for more information when selecting a retrofit approach.

**How to Install Batt Insulation in Walls in Existing Homes**

1. Consider the scope and goals of the project to determine the best insulation product for the job.
2. If using batt insulation, select the appropriate size for your wall cavities and the right R-value for your project.
3. Remove drywall and any old insulation from wall cavities.
4. Air seal any gaps around penetrations and any seams in sheathing.
5. Install batts in accordance with the RESNET Grade 1 standard: the batt insulation should uniformly fill the wall cavities, filling each cavity from side to side and top to bottom, without substantial gaps or voids (Figure 1).
6. Cut or slice batt insulation to fit around any wiring or piping installed in the wall cavities (Figure 2).
7. Install, mud, and tape new drywall.
**Ensuring Success**

Visually inspect the batt installation to verify that the installation meets RESNET Grade 1 quality standards.
Climate

The exterior wall assembly should be designed for a specific hygrothermal region, rain exposure zone, and interior climate. The climate zones are shown on the map below, which is taken from Figure C301.1 of the 2012 IECC.

The insulation levels should be based on the minimum requirements for vapor control in the current adopted building code and the minimum requirements for thermal control in the current energy code. Additional insulation can be added above these minimums to create high R-Value exterior wall assemblies. The table below provides the minimum thermal resistance (R-value) requirements for exterior walls specified in the 2009 IECC (ICC 2009b) and the 2012 IECC (ICC 2012b), based on climate zone.

**Table 1. Wall Insulation Requirements per the 2009 and 2012 IECC (same for 2015 and 2018 IECC).**

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Wood Frame Wall Minimum R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009 IECC</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>4 except Marine</td>
<td>13</td>
</tr>
<tr>
<td>5 and Marine 4</td>
<td>20 or 13+5*</td>
</tr>
<tr>
<td>6</td>
<td>20 or 13+5*</td>
</tr>
<tr>
<td>7 and 8</td>
<td>21</td>
</tr>
</tbody>
</table>

* First value is cavity insulation, 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.
Training

Right and Wrong Images

Display Image: ES_TESRC_2.2_PG52_17c_102811_1.jpg
CAD
None Available
Compliance

The Compliance tab contains both program and code information. Code language is excerpted and summarized below. For exact code language, refer to the applicable code, which may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

ENERGY STAR Certified Homes, Version 3/3.1 (Rev. 09)

National Rater Field Checklist

Thermal Enclosure System.

2. Fully-Aligned Air Barriers. At each insulated location below, a complete air barrier is provided that is fully aligned as follows:

Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8.

Footnote 6) For purposes of this Checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers. Open-cell or closed-cell foam shall have a finished thickness ≥ 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise. If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads ≥ 1 in. diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft paper, paper-based products, or other materials that are easily torn. If polyethylene is used, its thickness shall be ≥ 6 mil.

Footnote 8) All insulated vertical surfaces are considered walls (e.g., above and below grade exterior walls, knee walls) and must meet the air barrier requirements for walls. The following exceptions apply: air barriers recommended, but not required, in adiabatic walls in multifamily dwellings; and, in Climate Zones 4 through 8, an air barrier at the interior vertical surface of insulation is recommended but not required in basement walls or crawlspace walls. For the purpose of these exceptions, a basement or crawlspace is a space for which ≥ 40% of the total gross wall area is below-grade.

Please see the ENERGY STAR Certified Homes Implementation Timeline for the program version and revision currently applicable in your state.

DOE Zero Energy Ready Home (Revision 07)

Exhibit 1 Mandatory Requirements.

Exhibit 1, Item 1) Certified under the ENERGY STAR Qualified Homes Program or the ENERGY STAR Multifamily New Construction Program.

Exhibit 1, Item 2) Ceiling, wall, floor, and slab insulation shall meet or exceed 2015 IECC levels and achieve Grade 1 installation, per RESNET standards. See the guide 2015 IECC Code Level Insulation – DOE Zero Energy Ready Home Requirements for more details.

Exhibit 2 DOE Zero Energy Ready Home Target Home.

The U.S. Department of Energy’s Zero Energy Ready Home program allows builders to choose a prescriptive or performance path. The DOE Zero Energy Ready Home prescriptive path requires builders to meet or exceed the minimum HVAC efficiencies listed in Exhibit 2 of the National Program Requirements (Rev 07), as shown below. The DOE Zero Energy Ready Home performance path allows builders to select a custom combination of measures for each home that is equivalent in performance to the minimum HERS index of a modeled target home that meets the requirements of Exhibit 2 as well as the mandatory requirements of Zero Energy Ready Home Exhibit 1.

Exhibit 2, Insulation and Infiltration) Whole house leakage must be tested and meet the following infiltration limits:

- Zones 1-2: ≤ 3 ACH50;
- Zones 3-4: ≤ 2.5 ACH50;
- Zones 5-7: ≤ 2 ACH50;
- Zone 8: ≤ 1.5 ACH50;
- Attached dwellings: ≤ 3 ACH50.

Footnote 12) Building envelope assemblies, including exterior walls and unvented attic assemblies (where used), shall comply with the relevant vapor retarder provisions of the 2015 International Residential Code (IRC).

Footnote 23) Envelope leakage shall be determined by an approved verifier using a RESNET-approved testing protocol.

American Society for Testing Materials (ASTM) E1677-11

Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls. This specification covers minimum performances and specification criteria for an air barrier material or system for framed, opaque walls of low-rise buildings. The provisions are intended to allow the user to design the wall performance criteria and increase air barrier specifications for a particular climate location, function, or design.

International Energy Conservation Code (IECC) and International Residential Code (IRC) Minimum Insulation Requirements:
The minimum insulation requirements for ceilings, walls, floors, and foundations in new homes, as listed in the 2009, 2012, 2015, and 2018 IECC and IRC, can be found in this table.

### 2009 IECC

Table 402.4.2 Air Barrier and Insulation Inspection Component Criteria, Air barrier and thermal barrier: Exterior wall insulation is installed in substantial contact and continuous alignment with the air barrier. Air permeable insulation is not used as a sealing material.

### 2012 IECC

Exterior insulation for framed walls is in substantial contact and continuous alignment with the air barrier. Table R402.4.1.1 Air Barrier and Insulation Installation, Air barrier and thermal barrier: A continuous air barrier is installed in the building envelope including rim joists and exposed edges of insulation. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.

### 2015 IECC and 2018 IECC

Table R402.1.2 Insulation and Fenestration Requirements – meet or exceed the insulation levels listed in this table.

Table R402.4.1.1 Air Barrier and Insulation Installation. Walls: Insulation in exterior framed walls is in substantial contact and continuous alignment with the air barrier. General requirements: A continuous air barrier is installed in the building envelope; breaks and joints in the air barrier are sealed. Air-permeable insulation is not used as an air-sealing material. Section R402.4.1.2 Testing. The building should be tested for air leakage in accordance with ASTM E 779 or ASTM E 1827 (or RESNET/ICC 380 in 2018 IECC) and should have an air leakage rate of ≤ 5 in CZ 1 and 2 or ≤ 3 in CZ 3-8.

**Retrofit:** 2009, 2012, 2015, and 2018 IECC

Section R101.4.3 (Section R501.1.1 in 2015 and 2018 IECC). Additions, alterations, renovations, or repairs shall conform to the provisions of this code, without requiring the unaltered portions of the existing building to comply with this code. (See code for additional requirements and exceptions.)

### 2009 IRC

Table N1102.4.2 Air Barrier and Insulation Inspection Component Criteria, Air barrier and thermal barrier: Exterior wall insulation is installed in substantial contact and continuous alignment with the air barrier. Air permeable insulation is not used as a sealing material.

### 2012 IRC

Exterior insulation for framed walls is in substantial contact and continuous alignment with the air barrier. Table N1102.4.1.1 Air Barrier and Insulation Installation, Air barrier and thermal barrier: A continuous air barrier is installed in the building envelope including rim joists and exposed edges of insulation. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.

### 2015 IRC and 2018 IRC

N1102.4.1.1 Air Barrier and Insulation Installation. Walls: Insulation in exterior framed walls is in substantial contact and continuous alignment with the air barrier. General requirements: A continuous air barrier is installed in the building envelope; breaks and joints in the air barrier are sealed. Air-permeable insulation is not used as an air-sealing material.

**Retrofit:** 2009, 2012, 2015, and 2018 IRC

Section N1101.3 (Section N1107.1.1 in 2015 and 2018 IECC). Additions, alterations, renovations, or repairs shall conform to the provisions of this code, without requiring the unaltered portions of the existing building to comply with this code. (See code for additional requirements and exceptions.)

Appendix J regulates the repair, renovation, alteration, and reconstruction of existing buildings and is intended to encourage their continued safe use.

### National Electrical Code (NEC)

Article 394.1: If a home has knob and tub wiring, insulation should not be applied to touch or surround the wiring.

### Sealing and Insulating Existing Exterior Walls - Code Compliance Brief

**Overview:**

The intent of this brief is to provide code-related information about sealing and insulating existing walls in existing residential buildings to help ensure that the measures will be accepted as being in compliance with the code. Providing notes for code officials on how to conduct plan reviews and field inspections can provide jurisdictional officials with information for acceptance. Providing the same information to builders, contractors, designers, and others is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

From a model code perspective, submittal of construction documentation, permitting, plan review, and field inspection may
be required depending upon specific details of renovating exterior walls of an existing home. Several different approaches can be taken to seal and insulate existing exterior walls during a renovation project. For example, insulation can be installed by filling the wall cavities with spray foam insulation from the outside/exterior side of the wall, while keeping the wall sheathing, house wrap, and cladding intact. Insulation can be installed from the interior where the renovation has exposed the interior wall down to the framing members (removal of gypsum board and/or sheathing). The following Plan Review section provides the code sections for alterations followed by the details of inspecting the alteration under the Field Inspection section regarding sealing and insulating existing exterior walls. Refer to the Technical Validation/Resource Materials section of this brief for the resources on technical validation on the different methods that exterior walls can be insulated, best practices, and measure guidelines on techniques to ensure sealed and insulated exterior walls.

Plan Review:

This section lists the applicable code requirements followed by details that will be helpful for plan review regarding the provisions associated with sealing and insulating existing exterior walls.

Per the 2015 International Energy Conservation Code (IECC)/International Residential Code (IRC), Section R103.3/R106.3 Examination of Documents, the code official/building official must examine or cause to be examined construction documents for code compliance.

Construction Documentation. Review the construction documents for details describing the renovation of the exterior walls, insulation and sealing materials, installation, and construction techniques.

- **2015 IECC/IRC, Section R103.2/N1101.5 Information on construction documents.** Construction documents should include:
  - Details associated with the exterior wall(s) renovation (e.g., water/moisture damage, water control layer, and drainage)
  - Insulation material(s) and their R-values with the wall(s) and any openings in the walls
  - Details indicating how the insulation is to be installed to the existing wall(s) or the interior and/or exterior of the existing wall(s) and/or stud cavity
  - Air sealing details.

- **2015 IECC/IRC, Section R501.1.1/N1107.1.1 Alterations – General.** Alterations to an existing building or portion of a building should comply with Sections R502/N1108, R503/N1109, or R504/N1110. Unaltered portions of the existing building are not required to comply.
  - R503.1/N1109.1 General. Alterations to any building or structure should comply with the requirements of the code for new construction. Alterations should not negatively impact conformance of a building or structure to the provisions of this code; that is, code conformance should be the same as existed for the building or structure prior to the alteration. Alterations should not create an unsafe or hazardous condition or overload existing building systems. Alterations should be such that the altered building or structure uses no more energy than the existing building or structure prior to the alteration.
  - R503.2/N1103.2 Change in space conditioning. Any non-conditioned or low-energy space that is altered to become conditioned space must be brought into full compliance with this code. (This means not only the altered assembly must be brought into compliance but the entire space or building would need to be brought into compliance.)
  - R503.1.1/N1109.1.1 Building Envelope. Building envelope assemblies that are part of the alteration must comply with Sections R402.1.2/N11102.1.2 (Insulation and Fenestration Table) or R402.1.4/N11102.1.4 (U-factor Alternative), and Sections R402.2.1/N11102.2.1 through R402.2.12/N11102.2.12, R402.3.1/N11102.3.1, R402.3.2/N11102.3.2, R402.4.3/N11102.4.3 and R402.4.4/N11102.4.4.
    - Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:
      - Existing wall cavities exposed during construction, provided that the cavities are filled with insulation
      - Construction where the existing wall cavity is not exposed.

- **2012 IECC/IRC, Section R101.4.3/N11101.3 and 2009 IECC/IRC, Section 101.4.3/N1101.4.3 Alterations – General.** Alterations to an existing building or portion of a building should comply to the provisions of the code as they relate to new construction without requiring unaltered portion(s) of the existing building to comply with this code.
  - Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:
    - Existing wall cavities exposed during construction, provided that the cavities are filled with insulation
    - Construction where the existing wall cavity is not exposed.
• **2015 IECC/IRC, Section R402.1.2/N1102.1.2 Insulation Criteria.** The building thermal envelope must meet the requirements of Table R402.1.2/N1102.1.2, based on the climate zone specified in Chapter 3 of the code and the building assemblies associated with the exterior wall(s) that are considered part of the building thermal envelope.

• **2015 IECC/IRC, Section R402.1.3/N1102.1.3 or 2012 IECC/IRC, Section R402.1.2/N1102.1.2 R-Value Computation.** Insulation material used in layers, such as framing cavity insulation, or continuous insulation should be summed to compute the corresponding component R-value. The manufacturer’s settled R-value should be used for blown insulation. Computed R-values should not include an R-value for other building materials or air films. (2015 IECC/IRC new language added: “Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table R402.1.2/N1102.1.2, the manufacturer’s labeled R-value for insulated siding should be reduced by R-0.6.”)

An excerpt from the *Insulation and Fenestration Requirements by Component Tables* follows:

**2015 IECC/IRC, Table R402.1.2/N1101.1.2 or 2012 IECC/IRC, Table R402.1.1/N1102.1.1**

(R-values are the same for both versions, but, the footnotes have changed from 2012 to 2015 IECC/IRC)

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 Except Marine</th>
<th>5 and Marine 4</th>
<th>6</th>
<th>7, 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Frame Wall R-value</td>
<td>13</td>
<td>13</td>
<td>20 or 13+5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20 or 13+5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20 or 13+5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20+5 or 13+10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20+5 or 13+10&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>2015 IECC/IRC footnote: The first value is cavity insulation, the second value is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation.

<sup>a</sup>2012 IECC/IRC footnote: First value is cavity insulation, 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% of the exterior, continuous insulation R-value should 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.

• **2015 IECC/IRC, Section R402.1.4/N1102.1.4 or 2012 IECC/IRC Section R402.1.3/N1102.1.3 U-Factor Alternative.** An assembly with a U-factor equal to or less than that specified in Equivalent U-factor Tables should be permitted as an alternative to the R-value in Insulation and Fenestration Requirements by Component Tables of the IECC/IRC.

An excerpt from the *Equivalent U-factor Tables* follows:

**2015 IECC/IRC, Equivalent U-factor Table R402.1.4/N1101.1.4**

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 Except Marine</th>
<th>5 and Marine 4</th>
<th>6</th>
<th>7, 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Frame Wall U-factor</td>
<td>0.084</td>
<td>0.084</td>
<td>0.060</td>
<td>0.060</td>
<td>0.060</td>
<td>0.045</td>
<td>0.045</td>
</tr>
</tbody>
</table>

**2012 IECC/IRC, Equivalent U-factor Table R402.1.3/N1102.1.3**

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 Except Marine</th>
<th>5 and Marine 4</th>
<th>6</th>
<th>7, 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Frame Wall U-factor</td>
<td>0.083</td>
<td>0.083</td>
<td>0.057</td>
<td>0.057</td>
<td>0.057</td>
<td>0.048</td>
<td>0.048</td>
</tr>
</tbody>
</table>

An excerpt from the *2009 IECC/IRC Insulation and Fenestration Requirements by Component Table 402.1.1/N1102.1* follows:

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Frame Wall R-value</td>
<td>R-13</td>
<td>R-13</td>
<td>R-13</td>
<td>R-13</td>
<td>R-20 or 13+5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>R-20 or 13+5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>R-21</td>
</tr>
</tbody>
</table>

<sup>a</sup>“13+5” means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers <= 25% of the exterior, insulated sheathing is not required where structural sheathing is used. If structural sheathing covers > 25% of exterior, structural sheathing should be supplemented with insulated sheathing of at least R-2.

**Air Sealing/Air Leakage Control**

• **2015 IECC/IRC, R402.4./N1102.4 Air Leakage.** The building thermal envelope should be constructed to limit air leakage.
- **R402.4.1.1/N1102.4.1.1 Installation.** The components listed in the Air Barrier and Insulation Installation Table should be installed in accordance with the manufacturer’s instructions and the criteria listed as the applicable method of construction. Below are the General Requirements and components from the table that are applicable to insulating and sealing exterior walls.

- **R402.4.1/N1102.4.1 Building Thermal Envelope.** Methods used to seal between dissimilar materials should allow for differential expansion and contraction.

- **2015 IRC/IECC, Air Barrier and Insulation Installation Table R402.4.1.1/N1102.4.1.1**
  - **Continuous air barrier.**[2] Confirm that construction documents specify a continuous air barrier for the building components associated with the insulation of the exterior wall(s). Breaks or joints in the air barrier should be sealed. Air-permeable insulation should not be used as a sealing material.
  - **Walls.** Cavities within corners and headers of frame walls should be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls should be in substantial contact and continuous alignment with the air barrier.
  - **Rim joists.** Rim joists should include the air barrier and be insulated.

- **2012 IECC/IRC, R402.4/N1102.4 Air Leakage.** The building thermal envelope should be constructed to limit air leakage.
  - **R402.4.1/N1102.4.1 Building Thermal Envelope.** Methods used to seal between dissimilar materials should allow for differential expansion and contraction.
  - **R402.4.1.1/N1102.4.1.1 Installation.** The components listed in the Air Barrier and Insulation Installation Table should be installed in accordance with the manufacturer’s instructions and the criteria listed as the applicable method of construction. Below are the components from the table that are applicable to sealing and insulating walls.
  - **R402.4.1.1/N1102.4.1.1 Air Barrier and Insulation Installation Table**
    - **Air barrier and thermal barrier.** A continuous air barrier should be installed in the building envelope (wall). Breaks or joints in the air barrier should be sealed. Air-permeable insulation should not be used as a sealing method.
    - **Walls.** The junction of the top plate and top of exterior walls should be sealed. Exterior thermal envelope insulation for framed walls should be installed in substantial contact and continuous alignment with the air barrier.
    - **Rim joists** – Similar language as the 2015 IECC/IRC.

- **2009 IECC/IRC, 402.4.1/N1102.4.1 Air leakage, Building Thermal Envelope**
  - The building thermal envelope should be constructed to limit air leakage. Methods used to seal between dissimilar materials should allow for differential expansion and contraction. Sources of infiltration (see listing below) should be caulked, gasketed, weather-stripped, or otherwise sealed with an air-barrier material, suitable film, or solid material:
    - All joints, seams, and penetrations
    - Rim joist junction
    - Other sources of infiltration.

Moisture Control

- **2015/2012 IRC, Section R702.7 Vapor retarders.** Class I or II vapor retarders are required on the interior side of frame walls in Climate Zones 5, 6, 7, 8, and Marine 4.
  - Class III vapor retarders are permitted where one of the conditions are met per the Class III Vapor Retarder Table R702.7.1

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[1] The term “building thermal envelope” is defined as the basement walls, exterior walls, floor, roof, and any other building elements that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

[2] The term “continuous air barrier” is defined as a combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

Field Inspection:
Per the 2015 IECC, Section R104, Inspections, construction or work for which a permit is required is subject to inspection. Construction or work is to remain accessible and exposed for inspection purposes until approved (in some instances, inspections can be difficult to examine especially if the insulation is drilled and filled on the existing exterior side of the walls). Required inspections include footing and foundation, framing and rough-in work, plumbing rough-in, mechanical rough-in, and final inspection.

Per the 2015 IRC, Section R109, Inspections, for onsite construction, the building official, upon notification from the permit holder or his agent, can make or cause to be made any necessary inspections. Further details are provided for inspections regarding foundation, plumbing, mechanical, gas and electrical, floodplain, frame and masonry, and final inspection. Any additional inspections are at the discretion of the building official.

This section provides details for inspecting to the specific provisions for insulation and sealing of existing exterior walls where one or more specific types of inspection per the IECC or IRC may be necessary to confirm compliance. To confirm code compliance, framing and rough-in would be the typical type of inspection performed for new construction. However, since this document addresses existing residential exterior walls where framing already exists, the framing inspection would involve ensuring the wall(s) that have any sources of air leakage (exterior or interior) are sealed and the existing framing is acceptable (e.g., if load bearing is not compromised).

- Joints, seams, holes, and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- Ensure that the appearance of insulation of the interior/exterior wall, as appropriate, in the field matches what is on the approved construction documents.
- If the R-value or U-factor approach for compliance was used in the documentation, ensure that the insulation installed meets the minimum R-value or maximum U-factor required for the type of assembly and climate zone per the approved construction documents.
- Confirm that the continuous air barrier is properly installed. Confirm that the insulation for framed walls is installed in substantial contact and continuous alignment with the air barrier.
- If applicable, confirm that the vapor retarder is installed in accordance with approved construction documents.

Technical Validation(s):

This section provides additional related information and references to materials that are applicable to the provision.

- **2015 IECC—International Energy Conservation Code**
  Author(s): ICC
  Organization(s): ICC
  Publication Date: May 2014
  This code establishes a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems, and service water heating systems in homes and commercial businesses.

- **2015 IRC—International Residential Code for One- and Two-Family Dwellings**
  Author(s): ICC
  Organization(s): ICC
  Publication Date: May 2014
  This code for residential buildings creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy and electrical provisions for one- and two-family residences.

- **2012 IECC—International Energy Conservation Code**
  Author(s): ICC
  Organization(s): ICC
  Publication Date: January 2012
  This code establishes a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems, and service water heating systems in homes and commercial businesses.

- **2012 IRC—International Residential Code for One- and Two-Family Dwellings**
  Author(s): ICC
  Organization(s): ICC
  Publication Date: January 2012
  This code for residential buildings creates minimum regulations for one- and two-family dwellings of three stories or less. It brings together all building, plumbing, mechanical, fuel gas, energy and electrical provisions for one- and two-family residences.
- **2009 IECC—International Energy Conservation Code**
  Author(s): ICC
  Organization(s): ICC
  Publication Date: January 2009
  This code establishes a baseline for energy efficiency by setting performance standards for the building envelope (defined as the boundary that separates heated/cooled air from unconditioned, outside air), mechanical systems, lighting systems, and service water heating systems in homes and commercial businesses.

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Case Studies
None Available

References and Resources*

   **Author(s):** Baechler, Adams, Hefty, Gilbride, Love
   **Organization(s):** PNNL, ORNL
   **Publication Date:** May, 2013
   Document providing descriptions of the many insulation options available to homeowners, along with guidance on where, when, and how to install insulation throughout your house.

2. **How to Grade the Installation Quality of Insulation**
   **Author(s):** Bailes
   **Organization(s):** Energy Vanguard
   **Publication Date:** July, 2012
   Article describing RESNET’s insulation grading levels.

3. **Introduction and Overview: Proper Installation of Fiber Glass and Rock and Slag Wool Batt Insulation**
   **Author(s):** North America Insulation Manufacturers Association
   **Organization(s):** North America Insulation Manufacturers Association
   **Publication Date:** May, 2014
   Website providing builders with information about meeting RESNET Grade 1 criteria when installing insulation.

4. **RESNET Insulation Grading Criteria**
   **Author(s):** Cottrell
   **Organization(s):** RESNET, North American Insulation Manufacturers Association
   **Publication Date:** October, 2012
   Presentation describing RESNET grading criteria for insulation installation.

*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

Contributors to this Guide
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