Controlling building envelope air leakage is an important but commonly misunderstood component of the energy-efficient house. Tightening the structure with caulking and sealants has several positive impacts. A tight house will have lower heating bills due to less heat loss and fewer drafts to decrease comfort. A tight house reduces the chance of mold and rot because moisture is less likely to enter and become trapped in cavities. Tight homes have better-performing ventilation systems and potentially require smaller heating and cooling equipment capacities. Air leakage is sometimes called *infiltration*, which is the unintentional or accidental introduction of outside air into a building. To minimize air leakage the energy code requires installation of an air barrier. The code includes a table that details how the air barrier is to be installed.

The energy code requires compliance with Table R402.4.1.1 *Air Barrier and Insulation Installation*. This table is often referred to as the air barrier checklist. The energy code also requires that air barrier effectiveness be tested with a blower door test. Passing a blower door test should help confirm that the air sealing requirements have been met. The energy code requires that the house pass the test with a result of 4 air changes per hour at 50 Pascals of pressure (ACH 50) or less. The blower door test result must be provided to the building code official, who may require that the test be performed by an approved third party.

Following are photos and diagrams that illustrate each of the air barrier installation details listed in the air barrier checklist. Table R402.4.1.1 *Air Barrier and Insulation Installation* includes details for both the air barrier and insulation. In this article the air barrier installation requirements are illustrated.
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.
**4** Windows, skylights and doors

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

*Source: ENERGY STAR New Homes*

*Source: Sprayfoam.com*

*Source: USDOE Building Energy Codes University*

*Source: ENERGY STAR New Homes*
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.

Air barrier installed at any exposed edge of insulation.
<table>
<thead>
<tr>
<th>7</th>
<th><strong>Crawl space walls</strong></th>
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| 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. | ![Image of vapor retarder installation]![Image of crawlspace walls]![Image of crawlspace walls with vapor retarder]!
Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.
9 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.

Source: ENERGY STAR New Homes

10 Garage separation
Air sealing shall be provided between the garage and conditioned spaces.

Source: USDOE Building America

Source: ENERGY STAR New Homes
| 11  | Recessed lighting | Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall. |

Source: Northwest ENERGY STAR Homes
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.

Source: Northwest ENERGY STAR Homes

Source: Northwest ENERGY STAR Homes
|   | Electrical/phone box on exterior walls | The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed. |

Source: ENERGY STAR New Homes
HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.
**Plan Review**

1. Verify that submitted construction documents identify location (warm side of wall) and details of continuous air barrier installation, including specification of how joints in materials will be sealed. The code required air barrier installation details are included in Table R402.4.1.1 Air Barrier and Insulation Installation.

2. Verify that the construction documents specify a tested envelope tightness of 4 ACH50 or tighter. The designer may specify a tighter envelope.

**Fireplace**

An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.
Field Inspection

1. Verify installation of continuous air barrier in accordance with Table R402.4.1.1 Air Barrier and Insulation Installation.
2. Verify that all joints and penetrations in the air barrier are sealed.
3. Verify that all air barrier materials are installed per manufacturer’s instructions.
4. Verify that the building envelope has been tested by an approved entity to a tightness of 4 ACH50 or tighter.

Code References

R202 General Definitions

Air Barrier. Material(s) assembled and joined together to provide a barrier to air leakage through or into the building envelope. An air barrier may be a single material or a combination of materials. (Note: A Montana amendment added the words “or into.” The intent of the amendment was that an air barrier is to be installed on the warm side of the exterior thermal envelope assembly and that is the correct interpretation.)

R402.4 Air Leakage (Mandatory). The building thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

- R402.4.1 Building Thermal Envelope. The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

- R402.4.1.1 Installation. The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer’s instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the code official, an approved third party shall inspect all components and verify compliance.

Resources
