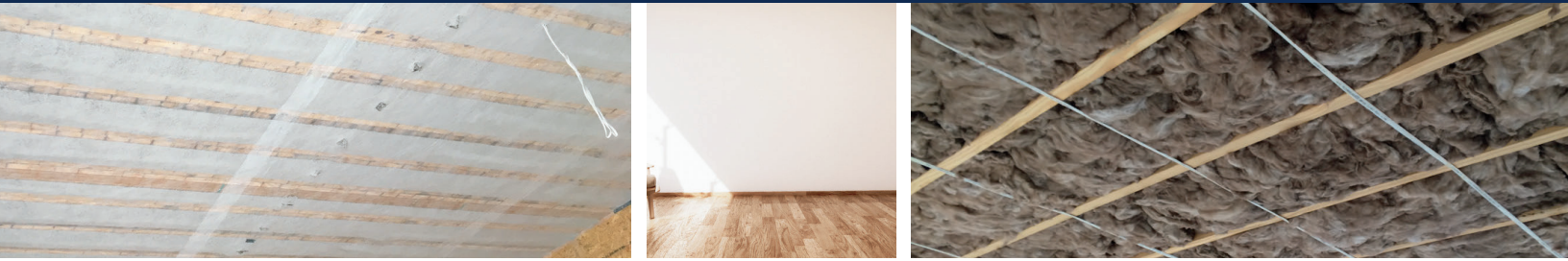


Floor Insulation Strategies

2021 VRC/VECC Update Guide



Three Options for Insulating Framed Floors

With the 2021 code update, R-19 floor insulation remains the minimum required across most of Virginia (climate zones 3 and 4), but R-30 is now the minimum for climate zone 5 jurisdictions. Section N1102.2.7 (R402.2.7) adds specificity for three options when insulating floors over unconditioned spaces such as vented crawlspaces, garages, and cantilevers.

Option 1: Insulation must be installed to “maintain permanent contact” with the floor above and to “maintain required R-value or readily fill the available cavity space.”

- Spray foam insulation applied to the underside of the subfloor thick enough to achieve the required R-Value would work well for this option. With trusses or I-joists that present openings and irregularities in cavity shape, a loose-fill or liquid-applied insulation is necessary for providing even, continuous thermal coverage.
- While commonly used to hold up batt insulation, wire stays wedged between framing members compress batts (reducing R-Value), do not provide even suspension of insulation, and routinely fall out within a few years.



Figure 1: <https://basc.pnnl.gov/resource-guides/floor-above-garage#edit-group-description>



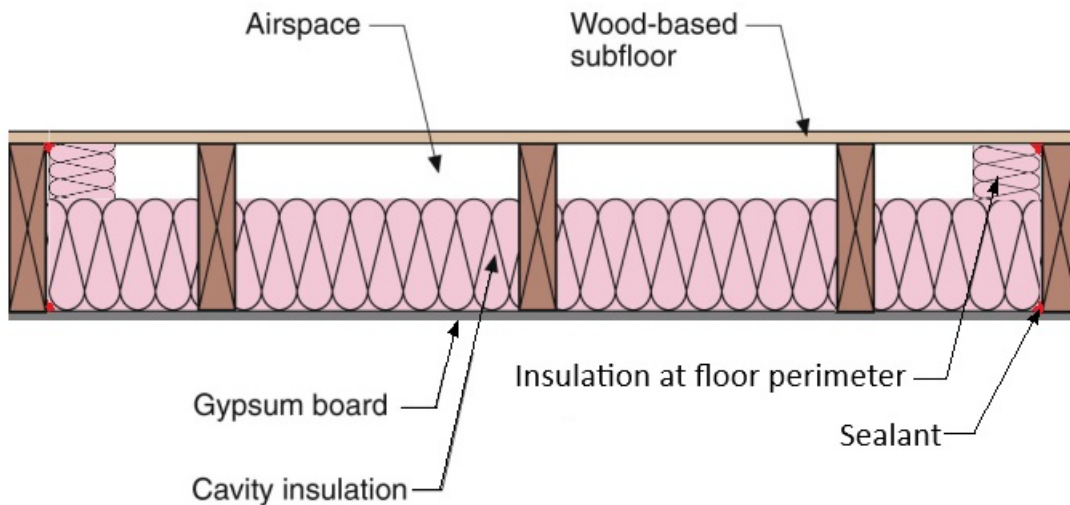
Figure 2: Traditional wire stays compress batts, support irregularly, and fall out - Insulated floor over vented crawl in 8-month-old Virginia home. Photo: Viridiant

Option 2: Airtight framing cavity plus perimeter insulation

- This option allows leaving an airspace between the insulation and the subfloor above – perhaps for installing ductwork. Below that, cavity insulation is installed to achieve the minimum R-

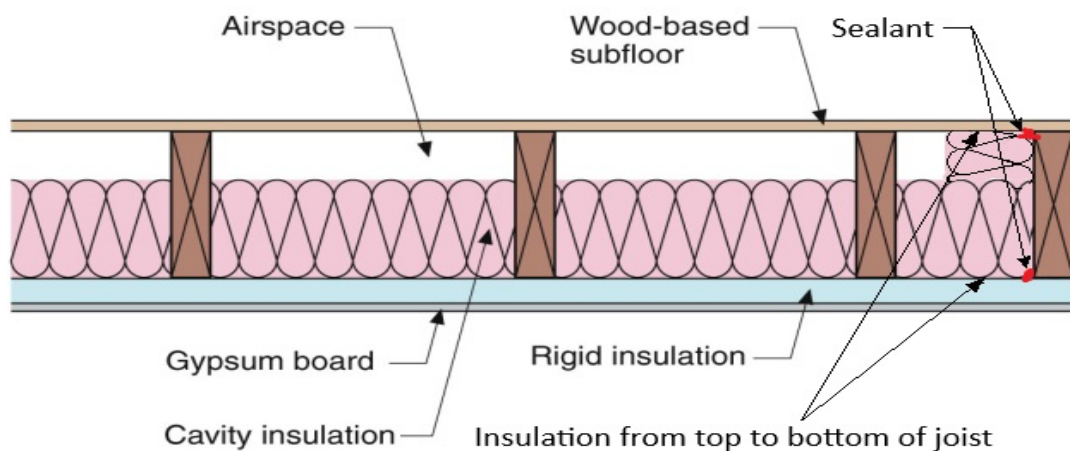
Value. The cavity insulation should be in direct contact with air-tight sheathing attached to the underside of the floor framing.

- To prevent that airspace from continuing to the building perimeter, the code requires that “insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed.”



Option 3: Airtight framing cavity with continuous insulation

- This option allows leaving an airspace between the insulation and the subfloor above – perhaps for installing ductwork. Below that, some combination of cavity and continuous insulation (insulated sheathing) is installed to collectively achieve the minimum R-Value. The cavity insulation should contact the continuous insulation.
- As in Option 2 above, to prevent that airspace from continuing to the building perimeter, the code requires that “insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed.”



Images adapted from: <https://basc.pnnl.gov/code-compliance/sealing-and-insulating-existing-floors-above-unconditioned-spaces-code-compliance>

2021 VRC/VECC Code References:

N1102.1.4 (R402.1.4) R-value computation. Cavity insulation alone shall be used to determine compliance with the cavity insulation R-value requirements in Table N1102.1.3. Where cavity insulation is installed in multiple layers, the R-values of the cavity insulation layers shall be summed to determine compliance with the cavity insulation R-value requirements. The manufacturer's settled R-value shall be used for blown-in insulation. Continuous insulation (ci) alone shall be used to determine compliance with the continuous insulation R-value requirements in Table N1102.1.3. Where continuous insulation is installed in multiple layers, the R-values of the continuous insulation layers shall be summed to determine compliance with the continuous insulation R-value requirements. Cavity insulation R-values shall not be used to determine compliance with the continuous insulation R-value requirements in Table N1102.1.3. Computed R-values shall not include an R-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Table N1102.1.3, the manufacturer's labeled R-value for insulated siding shall be reduced by R-0.6.

N1102.2.7 (R402.2.7) Floors. Floor cavity insulation shall comply with one of the following:

1. Installation shall be installed to maintain permanent contact with the underside of the subfloor decking in accordance with manufacturer instructions to maintain required R-value or readily fill the available cavity space.
2. Floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing separating the cavity and the unconditioned space below. Insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed.
3. A combination of cavity and continuous insulation shall be installed so that the cavity insulation is in contact with the top side of the continuous insulation that is installed on the underside of the floor framing separating the cavity and the unconditioned space below. The combined R-value of the cavity and continuous insulation shall equal the required R-value for floors. Insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed.

Definitions:

AIR BARRIER. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies.

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floors, ceiling, roofs and any other building element assemblies that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

CAVITY INSULATION. Insulating material located between framing members.

CLIMATE ZONE. A geographical region based on climatic criteria as specified in this code.

CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

CONTINUOUS AIR BARRIER. A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

CONTINUOUS INSULATION (ci). Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior, or is integral to any opaque surface, of the building envelope.

R-VALUE (THERMAL RESISTANCE). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($\text{h} \times \text{ft}^2 \times ^\circ\text{F}/\text{Btu}$) [$(\text{m}^2 \times \text{K})/\text{W}$].

