Foundation Subfloor
Insulate Floor Systems in Basements and Crawlspace

**SKILL SET**
Be sure you have the experience needed for this job. If you are in doubt, hire a contractor.

**SAFETY**
These tasks require working in tight clearances and under task lighting. Use a dust mask/respirator, gloves, safety glasses and kneepads. Wear a long sleeve shirt and consider applying baby powder to exposed skin before installing fiberglass to minimize itching.

**TOOLS**
Utility knife, table or circular saw, caulk gun, measuring tape, lights, straight edge and markers

**MATERIALS**
Foam/caulk/construction adhesive/duct mastic
Insulation – cavity batts or rigid foam board insulation
Sheathing – OSB/plywood or code-approved foam board
Fasteners – screws with washers or button-capped nails

**COST BENEFIT**
Insulation, combined with air sealing in basements and crawlspace reduces heating and cooling costs and improves comfort and indoor air quality.

**PRIORITY LEVEL**
LOW  MED  HIGH

**SKILL LEVEL**
DIY  PRO

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**Floor Joists - Engineered or Dimensional Wood**

- Staves cut from rigid board insulation can rest on lip of l-beam and support insulation
- Engineered l-beams require a longer stave
- Wire staves support insulation
- Insulate rim joist
- Crawlspace or Basement

_A stave is a mechanical method of supporting insulation from the bottom-up. Placing extra wire staves may be required to ensure adequate contact of the insulation with the subfloor even if it results in more compression of the insulation. Whether the insulation is oriented parallel or perpendicular to the rim joist, make sure the rim joist has full height coverage. Consider removable insulation to allow for pest and termite inspection._

Air sealing and then insulating framed floor assemblies over basements and crawlspace represent one of two options on how to determine the thermal envelope at the foundation. The other approach is to condition or indirectly condition the basement or crawlspace and thus air seal and insulate the foundation walls.

**Subfloor Insulation Details**

Before insulating the subfloor, consult the Air Seal Foundation Subfloor recipe card. Remember, only after air sealing has been properly performed should insulation installation commence.

If the home has insulation under the subfloor it should be removed in order to air seal. One strategy is to carefully remove any existing insulation from an area, perform necessary air sealing and then neatly replace the old insulation. The condition of the existing insulation will need to be assessed to determine the viability of reuse.

Another approach is to remove all the old insulation, perform the air sealing and begin with new insulation. Many older homes have never received any underfloor insulation and after air sealing has been performed, should be insulated to code approved values.

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Extreme temperature variability, especially in warm seasons, can create moisture condensation issues in crawlspace. Proper air sealing between the living space and the crawlspace, plus a plastic vapor barrier over the crawlspace dirt, in addition to insulating the subfloor, helps to control temperature and moisture variations between the house and crawlspace.

Evaluate hazards and repair existing maintenance issues before proceeding including knob and tube wiring, exposed electrical junctions, asbestos, lead paint, radon, dust, mold, pest infestation and water infiltration. Always follow common-sense safety measures when working in tight crawlspace.
Spray-Applied Foam
The most effective underfloor insulation technique is spray-applied foam. Unfortunately, this approach is the most expensive and does not easily lend itself to a DIY project due to the high cost of equipment and training required for installers. The major benefits of underfloor spray-applied foam are that it air seals and insulates in one application and should stay in place and be durable in terms of moisture. Besides the high installed cost, other disadvantages are that insulated sections cannot be easily removed and replaced, and water piping below will need to be insulated for freeze protection. Spray-applied foam applications should be well ventilated and the homeowners may need to vacate the premises for 24-48 hours if they are sensitive to chemicals present in the foam.

Open-cell spray foam generally costs less per installed R-value and requires greater thickness to achieve a specified R-value compared to closed-cell. Generally 5-6" of open cell foam is required to achieve an R-19; often this is enough thickness to encapsulate and offer freeze protection for many water pipes. Closed cell foam offers higher R-value per inch (~3" yields an R-19) and acts as an enhanced vapor retarder due to its lower moisture permeability.

Insulation Batts
Batt insulation is the most common approach to underfloor insulation and can be done by most DIY-ers. The batts are usually fiberglass although other materials such as mineral wool, cotton, and cellulose have been produced as batts. The most important detail is to obtain complete coverage with minimal compression and in complete contact with the underside of the subfloor decking. Another important detail is to install batts securely so they will remain in contact with the subfloor air barrier and not fall down.

Wire staves (sometimes known as “lightning rods” or “tiger teeth”) are the most common means of holding a batt up against the subfloor. Wire staves should be spaced no more than 18” apart and not excessively compress the batt. However, it is more critical for a successful install to be secure and lasting by placing extra wire staves, even if it results in more compression of the insulation. Insulation should be cut to fit and not overly compressed in any cavity. A batt that fills the frame floor cavity is ideal.

Batts typically come in unfaced or faced with an asphalt-impregnated kraft paper which serves as a vapor retarder. Follow the manufacturer’s suggestions about locating the paper face – generally it will be up against the subfloor, known as the “warm-in-winter” side. Vapor retarders for floor insulation are not code required in warmer regions but are more useful in colder climate zones.

Installing batts on open web floor truss systems should generally be avoided. Open web trusses require too much custom fitting of wire staves for batt insulation in order to be a viable option. Spray foam is a better method for insulating under an open web truss floor.

Floor Insulation R-values - 2012 International Energy Conservation Code
Recommended R-values for floor insulation are as shown for each climate zone.

<table>
<thead>
<tr>
<th>Energy Code Climate Zone</th>
<th>1-2</th>
<th>3-4*</th>
<th>5-6</th>
<th>7-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor R-value</td>
<td>13</td>
<td>19</td>
<td>30**</td>
<td>38**</td>
</tr>
</tbody>
</table>

*Except Marine 4 (treat Marine 4 as Climate Zone 5-6)

**Or insulation sufficient to fill floor framing cavity, min. R-19

Consider using a spray foam insulation approach with web truss floor systems since the trusses provide a complex “puzzle” for insulating with batts.

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