

## U.S. Department of Energy - Energy Efficiency and Renewable Energy

### A Consumer's Guide to Energy Efficiency and Renewable Energy

# Crawl Space Insulation

If you properly insulate your crawl space—in addition to air sealing and controlling moisture, you will save on energy costs and increase your home's comfort.

Before insulating or deciding whether to add insulation to your crawl space, first see our information about adding insulation to an existing house or selecting insulation for new home construction if you haven't already.

How to insulate a crawl space depends on whether it's ventilated or unventilated. Traditionally, crawl spaces have been vented to prevent problems with moisture; most building codes require vents to aid in removing moisture from the crawl space. However, many building professionals now recognize that building an unventilated crawl space (or closing vents after the crawl space dries out following construction) is the best option in homes using proper moisture control and exterior drainage techniques. There are two main reasons for this line of thinking:

- Ventilation in the winter makes it difficult to keep crawl spaces warm
- Warm, moist outdoor air brought into the crawl space through foundation vents in the summer is often unable to dehumidify a crawl space. In fact, this moist outdoor air can lead to increased moisture levels in the crawl space.

## Insulating an Unventilated Crawl Space

If you have or will have an unventilated crawl space, then your best approach is to seal and insulate the foundation walls rather than the subfloor. The advantages of insulating the crawl space are as follows:

- You can avoid the problems associated with ventilating a crawl space.
- Less insulation is required (around 400 square feet for a 1,000-square-foot crawl space with 3-foot walls.)
- Piping and ductwork are within the conditioned volume of the house so they don't require insulation for energy efficiency or protection against freezing.
- Air sealing between the house and the crawl space is less critical.

The disadvantages of insulating a crawl space include the following:

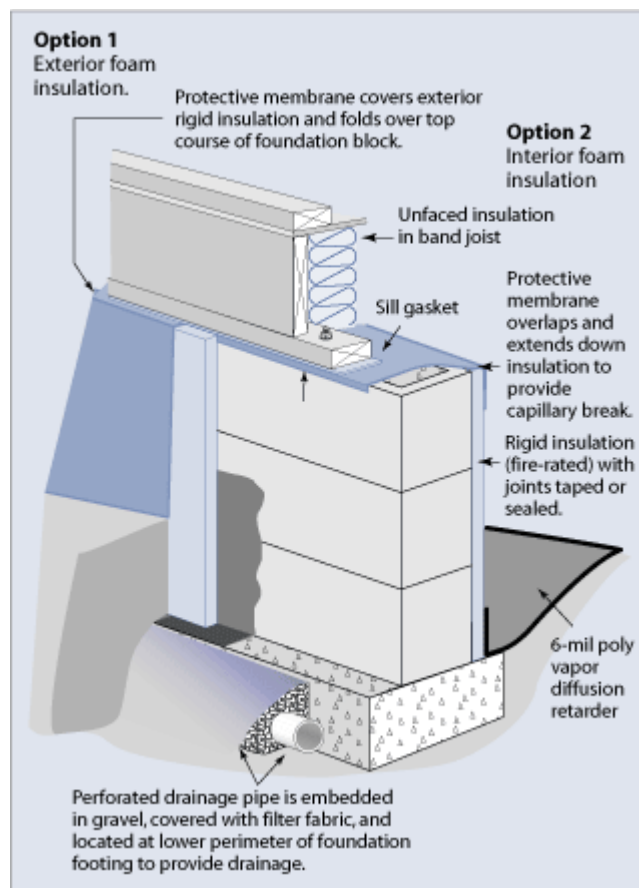
- The insulation may be damaged by rodents, pests, or water.
- A radon mitigation system will require ventilation of the crawl space to the exterior. Not planning for radon-resistant construction may necessitate air sealing the floor to mitigate the radon through ventilation.
- The crawl space must be built airtight, and the air barrier must be maintained.
- The access door to the crawl space must be located inside the home through the subfloor unless an airtight, insulated access door in the perimeter wall is built and maintained.

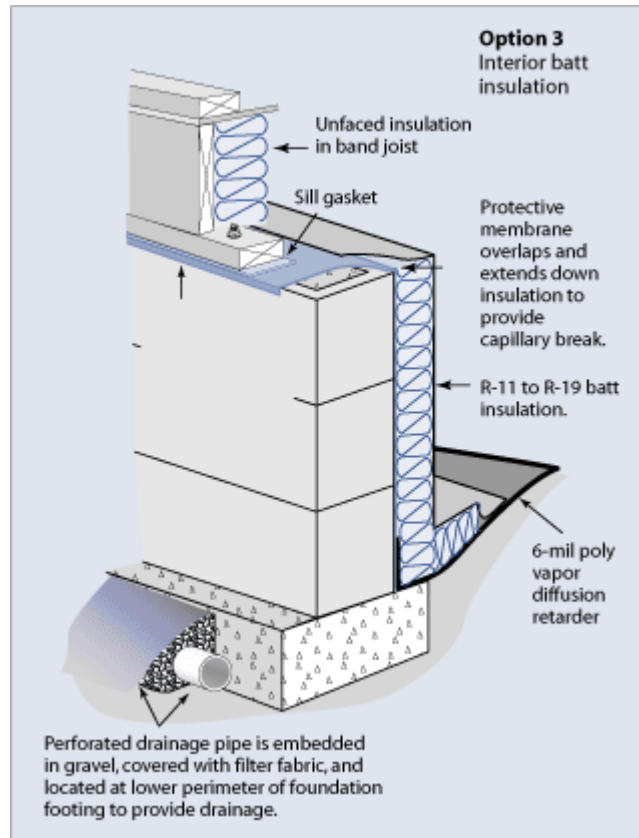
## Steps for Installing Crawl Space Wall Insulation

1. Review plans for this method of foundation insulation with pest control and local building officials to ensure code compliance.
2. Eliminate or seal the foundation vents.
3. Ensure that combustion furnaces and water heaters located in the crawl space are

sealed-combustion units equipped with a powered combustion system.

4. Seal all air leaks through the exterior wall during and after construction, including the band joist.
5. Locate the crawl space access inside the home or install an access through the perimeter that will remain airtight after repeated use.
6. Install rigid foam board or batt insulation—exterior foam, interior foam, or interior batt—to achieve complete insulation coverage. Insulate the band joist with batt insulation, as well as the crawl space access if it's located in the wall.
7. Install a continuous termite shield between the band joist and masonry foundation wall that covers the wall insulation and extends completely outside (or leave a 2- to 4-inch insulation gap at the top for termite inspection).
8. Install a supply outlet in the crawl space, relying on the leakiness of the floor to provide the return air path.





### Steps for Installing Underfloor Insulation

1. During the early phases of construction, the builder should inform all subcontractors (plumbing, electrical, HVAC, etc.) that they need to keep the space between the floor joists as clear as possible. Run drain lines, electrical wiring, and ductwork below the bottom of the insulation so that a continuous layer of insulation can be installed. For freeze protection, supply plumbing may be located within the insulation. The best approach is to run supply plumbing together in a few joist spaces. The insulation can be split and run around the plumbing.
2. Seal all air leaks between the conditioned area of the home and the crawl space. High-priority leaks include holes around bathtub drains and other drain lines, plenums for ductwork, and penetrations for electrical wiring, plumbing, and ductwork (including duct boot connections at the floor).
3. Insulation batts with an attached vapor barrier are typically used to insulate framed floors. Obtain insulation with the proper width for the joist spacing of the floor being insulated. Complete coverage is essential. Leave no insulation voids. The batts should be installed flush against the subfloor to eliminate any gaps, which may serve as passageways for cold airflow between the insulation and subfloor. The batts also should be cut to the full length of the joist being insulated and slit to fit around wiring and plumbing.
4. Insulate the band joist area between the air ducts and the floor as space permits. Use insulation hangers (wire staves) spaced every 12-18 inches to hold the floor insulation in place without compressing the insulation more than 1 inch.
5. The orientation of the vapor barrier depends on the home's location or climate. In most of the country, the vapor barrier should face upward. However, in certain regions of the Gulf states and other areas with mild winters and hot summers, it should face downward.

6. Insulate all ductwork in the crawl space.
7. Insulate all hot and cold water lines in the crawl space unless they are located within the insulation.
8. Close crawl space vents after ensuring that the crawl space and all the construction materials are dry.

For insulating truss floor systems, it's better to install netting or foam board insulation to the underside of the floor trusses. Then, fill the space created between the netting or insulation and subfloor with loose-fill insulation.

### **Insulating a Ventilated Crawl Space**

Here are some guidelines to follow for insulating a ventilated crawl space:

1. Carefully seal any and all holes in the floor above ("ceiling" of the crawl space) to prevent air from blowing up into the house.
2. Insulate between the floor joists with rolled fiberglass. Install it tight against the subfloor. Seal all of the seams carefully to keep wind from blowing into the insulation. Also, adequately support the insulation with mechanical fasteners so that it will not fall out of the joist spaces in the years to come. DO NOT just rely on the friction between the fiberglass and wood joists to secure it in place.
3. Cover the insulation with a house-wrap or face it with a vapor barrier. The orientation of the vapor barriers depends on the home's location or climate. In most of the country, the vapor barrier should face upward. However, in certain regions of the Gulf states and other areas with mild winters and hot summers, it should face downward.
4. Install a polyethylene vapor retarder, or equivalent material, over the dirt floor. Tape and seal all seams carefully. You may also cover the polyethylene with a thin layer of sand or concrete to protect it from damage. Do not cover the plastic with anything that could make holes in it, such as crushed gravel. Be sure the headroom of the crawl space meets local code regulations if you are considering pouring a concrete slab.

### **Other Considerations**

As mentioned above, when properly insulating a crawl space, you also have to consider moisture control measures and air sealing.

Finally, you need to consider radon resistance or control when installing any type of foundation. See the Learn More resources on the right side of this page (or below if you've printed it out) for more information about radon and radon-resistant construction techniques.