

Insulation Introduction

EVALUATING INSULATION

Insulation is the most important element in making a home comfortable and energy-efficient. Attic and wall insulation are the best energy investments for many homes.

Insulation is rated by R-value, which measures thermal resistance. Each type of insulation has a particular R-value for each inch of thickness. The International Energy Conservation Code (IECC) requires that new homes have R-values of at least R-38 in attics, R-19 in walls, R-13 in basement walls, and R-30 in floors above crawl spaces.

Insulation Types and Choices

Fiberglass batts are the most common insulation found in existing homes. Many homes have fiberglass batts in both wall cavities and attics.

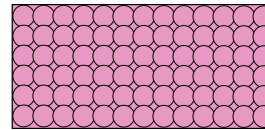
Loose-fill insulation can also be blown into walls. The blown blanket has no voids or edge gaps, if installed properly, and is usually more thermally resistant than fiberglass batts. Blowing insulation comes in two common varieties: fiberglass and cellulose. Both fiberglass and cellulose settle after they are installed. Cellulose settles 15 to 20 percent and fiberglass settles 3 to 5 percent. Settling isn't much of a problem in attics as long as a customer plans for it by adding more insulation in the first place.

Plastic foam insulation, like polystyrene and polyurethane, is available in 4-foot by 8-foot or 2-foot by 8-foot sheets of various thicknesses. Plastic foam insulation is a moisture and air barrier, unlike fibrous insulation. Foam sheets can be used to insulate masonry walls or to insulate the interior or exterior of frame walls.

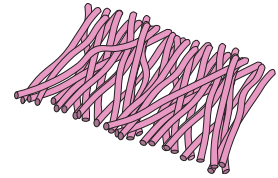
by professional crews with truck-mounted equipment although spray foam is also available in small

Building Science How Insulation Works

Insulation traps air within fibers or plastic cells. The small air pockets contain still air. Heat must conduct through the still air, which is a slow process compared to conducting through a solid material or traveling by convection or radiation.

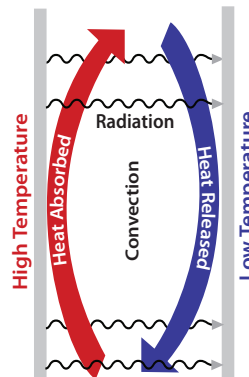


foam insulation

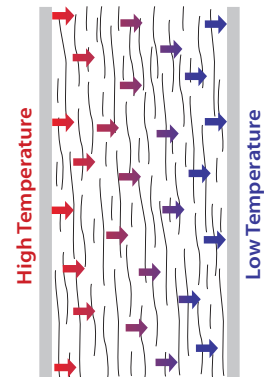


fibrous insulation

Heat convects and radiates through an empty wall cavity, which is a rapid process compared to heat traveling through insulation.



Heat convects and radiates across an empty



Heat conducts through the air pockets, trapped

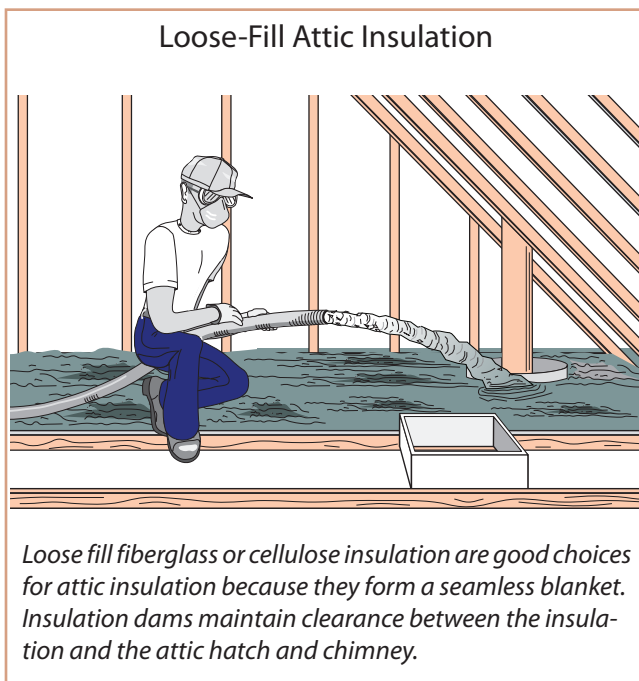
Sprayed polyurethane foam is sometimes used to insulate walls, foundations, or roofs. This sprayed foam is costly to install, but worth its higher price when adhesion, moisture-resistance, air-sealing ability, and structural strength are important. Sprayed polyurethane insulation is usually applied and large containers.

Retrofit Attic Insulation

Loose-fill insulation is blown into attics using an insulation-blowing machine. It is inexpensive and easy to install. If your customer's ceiling has less than 6 inches of insulation (about R-25), adding insulation to a total of 14 to 16 inches (or about R-49) is an excellent investment.

Many lumber yards and rental businesses rent small insulation-blowing machines to their customers. If a customer is handy and doesn't mind getting dirty, he or she can install the insulation.

Advise customers to seal air leaks in the attic are sealed before installing attic insulation.



Retrofit Wall Insulation

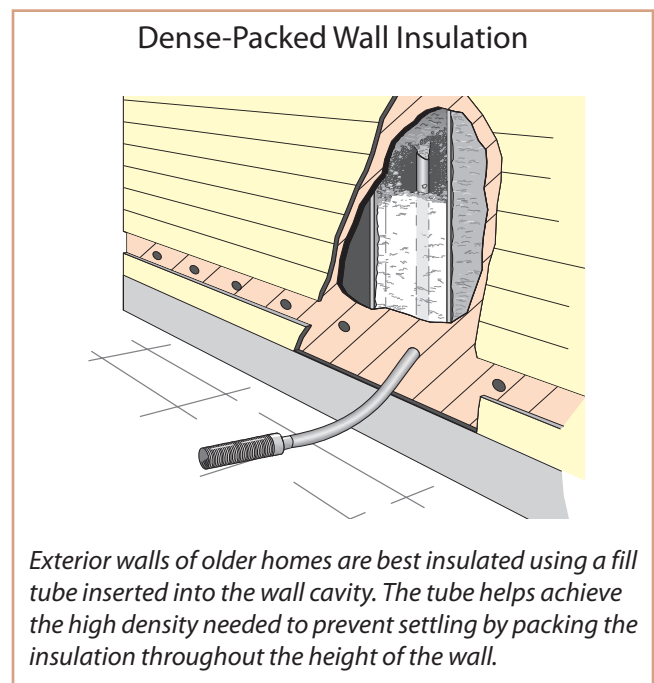
Many older homes were built with little or no wall insulation. Since a home's wall cavities are out of sight, it's hard to know how much insulation they contain. But if a customer's home is more than 30 years old, it's worth the effort to find out. One of the best ways is to remove the cover plate of an electrical outlet (be sure to turn the power off first). Use a flashlight to peer around the electrical box into the wall cavity. Another trick is to drill an

inspection hole in an inconspicuous place such as a closet. The wall cavity should be completely filled with insulation.

Wall insulation is usually blown into the wall cavities of existing homes through holes in the interior or exterior wall surfaces of the exterior walls. Loose-fill insulation should be installed at sufficient density to avoid settling. The best insulation contractors ensure high density throughout the wall by blowing insulation through a tube that is inserted into the wall cavity, rather than through a nozzle that merely penetrates the cavity.

Customers planning to install new siding or to paint the interior or exterior have a good opportunity to blow insulation into uninsulated or partially insulated wall cavities at the same time. During painting or siding replacement, customers can reduce or even eliminate the cost of patching the holes need to install cavity insulation.

Insulating foam sheets can also be attached to walls if the old siding is removed and before a home is re-sided, adding valuable extra thermal resistance.

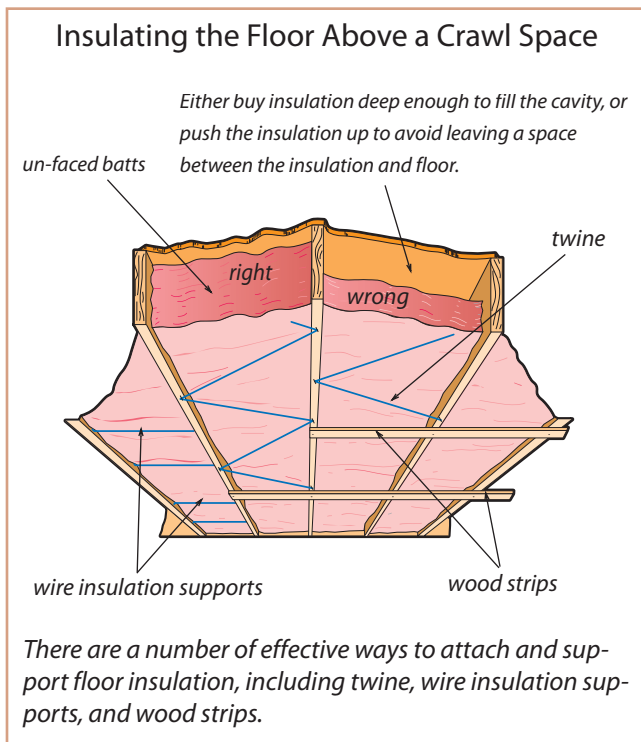


Retrofit Crawl-Space Insulation

When homes are built over crawl spaces, they should be insulated at either the floor above the crawl space or at the foundation walls around the crawl space. Many existing homes have no insulation in the floor or crawl space walls, resulting in a high percentage of the total heat loss occurring in and around the crawl space.

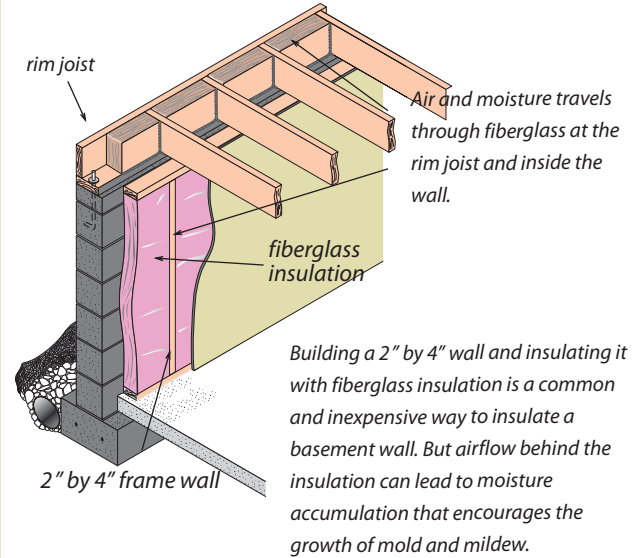
If the customer decides to insulate the floor above the crawl space, the insulation contractor should fill the floor cavity or insulate to at least R-30. This can be achieved with a 9¹/₂-inch un-faced fiberglass batt or blown fiberglass insulation. Fiberglass-batt floor insulation must have permanent support such as wood strips or wires. The insulation must be in continuous contact with the underside of the floor to be effective. Avoid the use of faced batts for floor insulation since faced batts tend to trap moisture.

Homeowners may also choose to insulate crawl space walls with foam insulation or fiberglass batts.

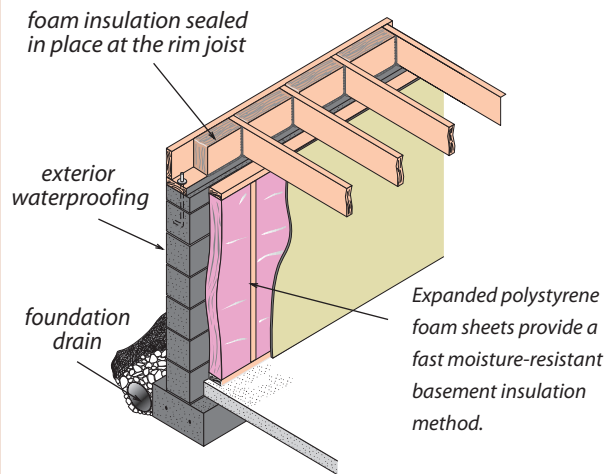


Crawl Space and Basement Insulation

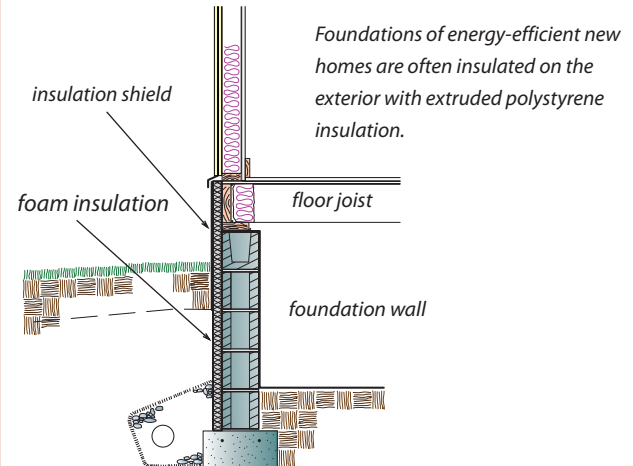
Standard Basement Insulation



Improved Interior Insulation



Exterior Basement Insulation



With either floor insulation or foundation insulation, the contractor must control moisture in the crawl space by installing a ground moisture barrier. Polyethylene sheeting makes a good ground moisture barrier over the bare soil. The contractor should seal the polyethylene's edges and seams with an appropriate sealant.

Moisture problems should be solved first, before insulating the floor cavity or foundation walls of a crawl space. If moisture accumulates in the crawl space or elsewhere in the home, it encourages the growth of mold, mildew, or rot. Insulation should never be installed in a wet crawl space. See *“Evaluating Moisture in Homes”* on page 34.

Foundation Insulation

When a house has a heated basement, the basement walls are usually insulated and the floor above the basement isn't insulated. The most common way to insulate basement walls is to build a framed wall against the foundation and fill it with fiberglass batts. The frame is then covered with drywall and, sometimes, a plastic vapor barrier. The vapor barrier creates a moisture trap, however, because moisture finds a path into the wall where it becomes trapped. Moisture accumulation in the wall encourages the growth of mold, mildew, and rot.

A better choice for basement wall insulation is polystyrene foam, installed in sheets that are either 2 or more inches thick. If installed at the exterior, as would be during new construction, use durable water-resistant insulation, such as blue or pink extruded polystyrene. The exposed foam needs protection from damage above ground level. Sheet metal, fiberglass panels, or troweled-on stucco can protect the foam installation. If foam board is installed at the interior, as is typical for retrofit applications, the foam must be covered with drywall to provide a fire barrier and a finished surface.

Whether a contractor insulates the floor or foundation wall, he or she should insulate the rim joist at the same time. Although fiberglass is most com-

monly used, foam insulation, or a combination of foam insulation and fiberglass, is better because moisture sometimes migrates behind the fiberglass and condenses on the cold rim joist, causing damage from mold or rot. Spraying polyurethane foam in the rim-joist area and even in the framed wall is very effective for both insulating and air-sealing.

Installing floor insulation slightly increases the probability of pipe freezing during very cold weather. The most common pipe-freezing locations are in crawl spaces where pipes travel near the foundation wall and especially near basement windows. Insulating the pipes or wrapping them with self-regulating heat tape may be necessary to prevent freezing in cold climates.

Insulating Values of Construction Materials	
Material	R-value per inch
Concrete	0.1
Wood	1.0
Fiberglass insulation, loose-fill or blown	2.8–4.0 ¹
Cellulose insulation	3.0–4.0 ²
Vermiculite insulation	2.2
Expanded polystyrene foamboard (white, known as beadboard)	3.9–4.3 ¹
Extruded polystyrene foamboard (usually blue, yellow, or pink)	5.0
Polyurethane or polyisocyanurate foam (spray application)	5.5–6.5 ³

1. Varies according to density.
 2. Varies according to density and quality.
 3. Varies according to age and formulation.