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1979

Energy Sense: Insulation Materials

Cooperative Extension South Dakota State University

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Recommended Citation

South Dakota State University, Cooperative Extension, "Energy Sense: Insulation Materials" (1979). *SDSU Extension Fact Sheets*. 784.

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insulation materials



Cooperative Extension Service
South Dakota State University
U.S. Department of Agriculture



insulation materials

Any material that reduces the passage of heat through the walls, ceilings, floors, or roof of a building is insulation. Insulation does not heat or cool, but it does restrict the flow of heat out of areas one is trying to keep warm or into areas one is trying to keep cool.

Thermal insulation is any one of a variety of materials designed and installed in a structure for the sole purpose of reducing heat conduction.

Fuel supplies are limited and expensive, so properly selected and correctly installed thermal insulation is one of the best energy-saving investments a homeowner can make. It is a one-time investment and pays dividends in the form of reduced fuel bills.

Insulation R-Values

A good thermal insulating material is dry, fire resistant, economical, easy to install, and, most important, contains many small pockets to trap air and resist heat conduction. The resistance of insulation to heat passing through it determines

its effectiveness or its resistance value (R-Value).

The higher the R-Value, the more effective the insulating material. For example, 1" of glass fiber insulation has an R-Value equal to about 40" of concrete. Therefore, when purchasing insulation, always buy according to the R-Value, not by thickness. Industry standards require that R-Values be printed clearly on insulation wrappers or containers.

Insulation Materials

Flexible materials include glass fiber or mineral wool batts or blankets. Batts are usually 4' long; blankets come in long rolls and are cut to length by the installer. Batts and blankets are commonly available in 15" and 23" widths to fit standard wood framing. They are sold with or without a kraft paper or foil vapor barrier. Both are flame and moisture resistant and are easy to install.

Loose-fill insulating materials are available in glass fiber, mineral wool, cellulose fiber, and vermiculite. Loose fill is sold

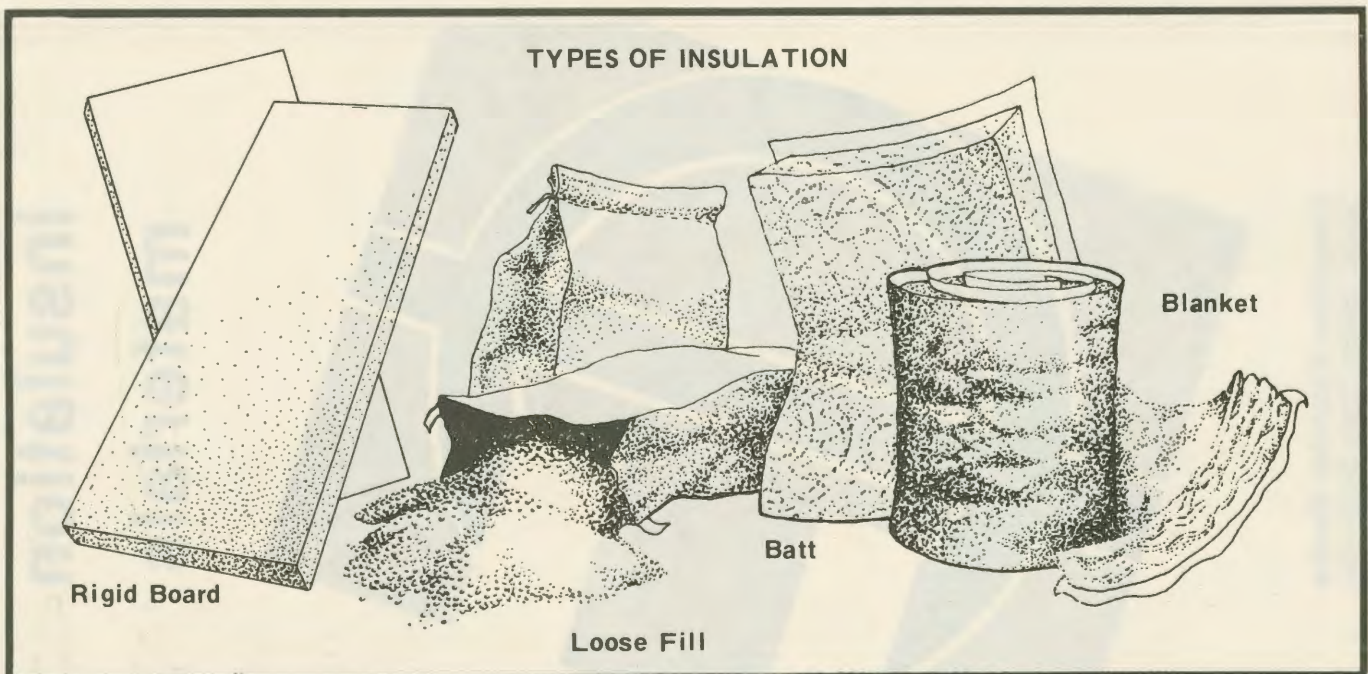
by the bag or bale. A vapor barrier should be added to keep moisture from the insulating materials.

Loose fill can be poured between the joists in an unfinished attic floor by the homeowner. It can be blown into an attic space or wall cavity by a contractor or by the homeowner with rented equipment. Loose fill is good to use above flat ceilings if joist spaces are irregular or obstructed. Follow the manufacturer's instructions for the amount required to meet the desired R-Value.

Loose-fill glass fiber, vermiculite, and mineral wool are fire resistant.

Cellulose fiber is fire and moisture resistant, but its long-term properties are not known. High attic temperatures may vaporize fire-retardant chemicals. Cellulose fiber has about 20 percent higher resistance to heat and conduction than glass fiber or mineral wool. This is an important factor if space for insulation is limited.

Vermiculite has an R-Value about 70 percent that of glass fiber or mineral wool and can be



poured into small or tight areas. It is commonly used to insulate masonry blocks.

Rigid board materials are used for the insulation of basement walls, the perimeter insulation of floor slabs, and in new construction. A thin sheet of rigid board insulation offers a high R-Value. Extruded polystyrene and urethane need no vapor barrier; bead board and glass fiberboard do. To meet fire code requirements, all types of foamed plastic insulation must be covered with 1/2" gypsum board or its equivalent.

Foamed-in-place insulation includes sprayed-on urethane and urea formaldehyde. Because special equipment and skills are needed, a highly qualified insulation contractor should do the installation.

Foam insulation is a new technique and, to date, its effectiveness has been inconsistent. Urea formaldehyde shrinks 1-3 percent and is considered non-combustible. If urea formaldehyde is foamed into a structure when the outside temperature is below 55°F, it may not cure properly. Fumes from the mate-

rial can then create strong odors in the home.

Sprayed-on urethane is combustible and is not permitted by some insurance companies.

One in a series of home energy conservation fact sheets. Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the USDA. Hollis D. Hall, Director of CES, SDSU, Brookings. Educational programs offered without regard to age, race, color, religion, sex, handicap, or national origin. An Equal Opportunity Employer.

File: 18.3-9—5,000 printed at estimated 4.4 cents each—7-79mb—4374A

INSULATION MATERIALS. R-VALUES. AND USES

Material	"R" per inch thickness*	Where Used
Flexible		
Cellulose fiber with vapor barrier	3.20-4.00**	unfinished attic floors; open sidewalls; heating ducts; crawl spaces; underside of floors; rafters
Glass fiber or mineral wool	3.00-3.40**	
Loose Fill		
Glass fiber and mineral wool	2.80-3.40	finished and unfinished attic floors; finished frame walls
Cellulose	3.50-3.70	
Vermiculite, expanded	2.13	
Rigid Board		
Polystyrene, extruded	5.26	basement walls; new construction; floor slab perimeter
Expanded urethane, preformed	5.80-6.25	
Glass fiberboard	4.00	
Polystyrene, molded beads	3.57	
Foamed-in-Place		
Expanded urethane, sprayed	6.25	finished frame walls; finished and unfinished attics; finished frame walls
Urea formaldehyde	5.00***	

*Determined from ASHRAE Handbook, 1972

**Varies according to density and fiber diameter

***From manufacturers' specifications

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ENERGY SENSE:

FS 735

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