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Insulation for Your Home

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Insulation is an essential part of the heating and cooling system of a home. It adds to the comfort level in the home and reduces fuel costs.

A well insulated home will have lower fuel bills for heating and air conditioning than a similar home without insulation. Bills may be as much as 50 percent lower.

How Much Insulation?

The proper amount of insulation for a home is largely an economic decision. The cost of fuel savings is balanced against the cost of insulation to determine optimum levels. In Missouri, considering fuel cost and expected weather conditions, the following insulation is recommended.

Ceilings	**"R" = 30**
Exterior Walls	**"R" = 19**
Floors	**"R" = 13**
Floors over unheated crawl space	**"R" = 30**

"R" Value

The "R" value is a measure of a material's ability to resist the flow of heat. The higher the "R" value, the better the insulating qualities of the material.

"R" is an additive quality; 2 inches of a given material will have twice the "R" value of 1 inch. Also, the individual "R" values for all materials in a section of a structure can be added together to obtain a total "R" value.

Several years ago, most insulation material was either mineral wool or fiber glass. These materials have similar insulating properties, and it became common practice to specify insulation in terms of inches of thickness. Today, many different insulations are on the market, and each has its own characteristics. The only fair way to compare their insulating ability is to compare "R" values.

Table 1 contains a list of the more common insulating and building materials with their respective "R" values. These "R" values are for the material only. Some manufacturers quote "R" values on an *installed basis* which allows them to include assumed value for other components of the ceiling, wall or floor section. Be sure to compare values for insulation *only* when you start shopping.

Insulate Where Heat Flows

Insulation should be placed wherever you are trying to stop the flow of heat. Obvious places are in all exterior walls and the ceiling immediately below the attic area. Another large area is the floor over the basement.

When energy costs were low and supplies were plentiful, floor insulation generally was not recommended because heat loss through the floor helped keep the basement area warm and comfortable. This is still a good point if the basement is used continually for living area. If it will be used only occasionally, you save fuel dollars by heating it only when you use it.

TABLE 1. "R" value per inch of thickness for commonly used insulation and building materials.

Material	"R" Value 1" Thickness
Fiber Glass or Mineral Wool Batts	2.5-3.5*
Wood Fiber	4.00
Fiber Glass or Mineral Wool Fill	2.2-2.9
Vermiculite	2.27
Shredded Pulp or Paper Products	4.16
Expanded Polystyrene—Extruded	4.00-5.00
Expanded Polystyrene—Molded Beads	3.57
Expanded Polyurethane Foam	6.25
Insulating Sheathing Board	2.63
Poured Concrete	.08
Fir or Pine Boards	1.30
Plywood	1.26
Concrete Block	.24
Light Weight Concrete Block	.36

*R-value varies with fiber diameter.

Homes built on concrete slabs or homes with walk-out basements should have perimeter slab insulation. Concrete is an excellent conductor of heat, as can be seen from its low "R" value in Table 1. If no insulating barrier is between the concrete slab and the outside of the house, a considerable amount of heat will be lost. This raises fuel bills and results in an uncomfortably cool floor near the edge of the slab.

Figure 1 shows two common methods of installing perimeter slab insulation. Foam plastic insulation generally is used for this purpose because its insulating properties are not affected by moisture.

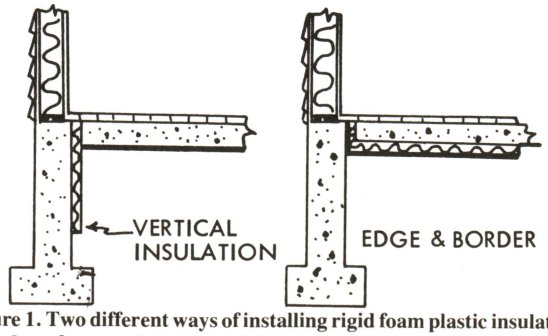

Figure 1. Two different ways of installing rigid foam plastic insulation at the edge of exposed concrete slabs.

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Several areas are often neglected when a home is insulated. Some of the more common ones are:

1. Walls separating living area from the attached garage. Keeping a garage warm is nearly impossible because of air leakage around the garage door. Insulation in the wall between house and garage will reduce heat flow from the warm house to the cold garage.
2. Walls and ceiling of basement garages for the same reason as above.
3. Walls and ceilings of dormers. These exterior walls frequently are overlooked during the insulation process.
4. Sloping ceiling areas in upstairs rooms where the ceiling has been "clipped" to accommodate the roof rafters.
5. Narrow cracks around window and door framing. This represents a relatively small area of total exterior surface of a home; however, careful filling with insulation will reduce air leakage into the home.

Heat required to warm cold outside air which leaks into a home may represent up to half of your annual fuel bill.

Problems

Two major problems associated with insulation in the home are poor workmanship during installation and moisture.

Failure to properly cut and fit insulation into all areas where you want to reduce heat flow will decrease its effectiveness. You pay for this decreased effectiveness every time you purchase fuel for as long as you own the home.

The most frequent problem with today's home is moisture. All air contains moisture. Warm air can hold more moisture than cold air. During winter months, air inside the house is warmer than outside air, and we are adding moisture to it continually during normal household activities such as washing and cooking.

Water vapor in air behaves like heat; it moves from areas of high concentration (inside the house) to areas of low concentration (outside). If it encounters a cold surface during this migration, it will condense into free water.

When condensation occurs inside an insulated wall, insulation becomes wet; building materials start to decay, and the paint peels off the outside of the house. This can be prevented by using a vapor barrier material in conjunction with insulation. Vapor barriers are installed over the face of the studs or joists on the side closest to the inside surface of the home. The vapor barrier prevents moisture in the form of water vapor from getting to cold surfaces where it can condense.

The well insulated homes of today are often blamed for moisture problems when in fact poor quality construction and building materials are the causes. Older homes with their poor fitting windows and doors have so much air leakage that moisture never has a chance to build up inside the home. This is fine from the standpoint of moisture problems but is expensive in terms of fuel costs.

Moisture does not need to be a problem in your home if you recognize it as a part of the home environment and manage it accordingly. Additional information on moisture problems and their control can be found in UMC Guides 1704, 1708 and 1709, available through your county University of Missouri Extension Center.

Figure 2. Poor workmanship during installation is a major problem with insulation in today's home. The poor fit shown here leaves an uninsulated area of the wall which the homeowner will probably never see, but which will add cost to every fuel bill.

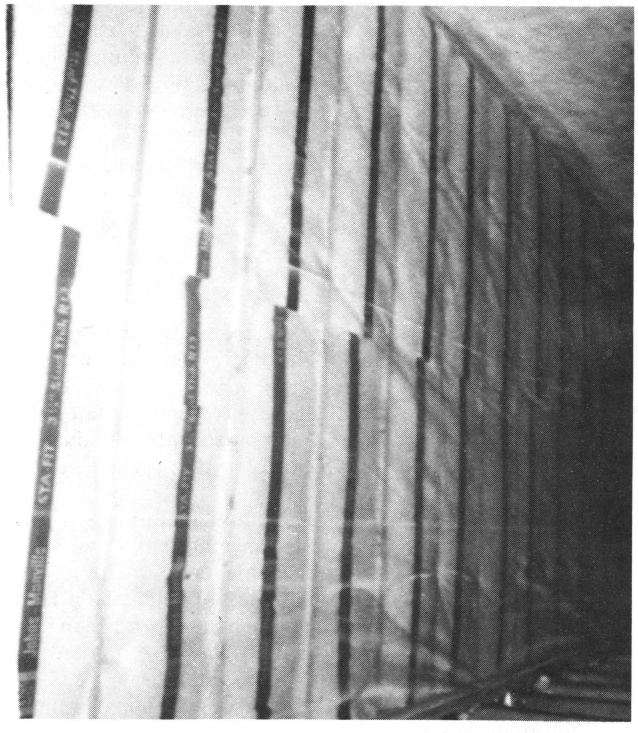

Figure 3. This well insulated exterior wall section contains 3½-inch-thick fiber glass batts. A clear polyethylene sheet has been placed over the batts to act as a vapor barrier. Clear polyethylene provides an excellent vapor barrier and has good transparency so carpenters or dry wall installers can see stud faces easily when they apply the interior wall covering. A one-inch thick expanded polystyrene sheathing board on the outside surface of the studs brings total R-value for wall insulation to 18.

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