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So You're Going to Insulate! What Are the Choices?

Suzanne Badenhop
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COOPERATIVE EXTENSION SERVICE
PURDUE UNIVERSITY, WEST LAFAYETTE, INDIANA
<table>
<thead>
<tr>
<th>Insulation</th>
<th>Where Used</th>
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<tbody>
<tr>
<td>R-11</td>
<td>walls, including basement; crawl spaces; heating ducts</td>
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<tr>
<td>R-13</td>
<td>floors over unheated spaces; walls in very cold climates; heating ducts</td>
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<tr>
<td>R-19</td>
<td>ceilings; floors in very cold climates</td>
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<tr>
<td>R-30</td>
<td>ceilings (if walls are poorly insulated)</td>
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SO YOU'RE GOING TO INSULATE!
WHAT ARE THE CHOICES?

Suzanne Badenhop, Extension Housing Specialist

Once you have decided to insulate your home many questions arise. Which type of insulation do I need? How much should I install? How can I compare one type with another? This bulletin will help you to select the right insulation.

R-Values

The R-value indicates the insulation material's ability to resist the movement of heat. All insulation materials are rated by an R-value which should be printed on the product label. The higher the R-value of an insulating material, the better insulator it is. Ratings are usually given either per inch of thickness or for the total thickness of the material. Know which rating you are getting. When shopping for insulation the R-value of the insulation should be as important a consideration as cost.

R-values are "additive." This means the total insulating value of a wall or ceiling is the sum of the R-values for various structural materials — (wallboard, insulation, sheathing and exterior siding). The individual R-values of these four major parts (plus R = 0.85 for inside and outside surface air film) are added to give the total R-value of that wall.

When insulation is added to an existing ceiling or floor, the new R-value will equal the former R-value plus the R-value of the new material. If your ceiling was R = 19 and you add insulation with R = 11, the new insulating value of the ceiling will be R = 19 + 11 = 30. When insulation is added to an existing wall cavity, the R-value of the existing air space (R = 1.0) should be subtracted because the added insulation fills that space.

Individual manufacturers can, in producing their product, create a different R-value than another brand of the same insulating material. Usually these differences are small. Be sure you use a material that will provide a satisfactory total R-value for the building component (wall, ceiling, etc) you are insulating.
Table 1 contains R-values for common residential insulation materials.

<table>
<thead>
<tr>
<th>Table 1. Insulation Value of Materials*</th>
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<tbody>
<tr>
<td>R/\text{inch thickness}</td>
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</table>

<table>
<thead>
<tr>
<th>Blanket and Batt</th>
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</thead>
<tbody>
<tr>
<td>Fiberglass</td>
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</table>

<table>
<thead>
<tr>
<th>Boards</th>
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<tbody>
<tr>
<td>Extruded Polystyrene</td>
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<tr>
<td>Expanded Polystyrene Beads</td>
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<td>Polyurethane and Isocyanurate</td>
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<table>
<thead>
<tr>
<th>Loose Fill</th>
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<tbody>
<tr>
<td>Cellulose</td>
</tr>
<tr>
<td>Fiberglass</td>
</tr>
<tr>
<td>Rock Wool</td>
</tr>
<tr>
<td>Vermiculite, expanded</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Foam in Place</th>
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</thead>
<tbody>
<tr>
<td>Urea Formaldehyde</td>
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</table>

*from ASHRAE Handbook of Fundamentals 1977

Types of Insulation

Insulation materials are discussed according to the form in which they are sold. Basically your choices fall into four categories: (1) batts or blankets, (2) rigid boards, (3) foams and (4) loose fill. The type you choose will be partially determined by where the insulation will be used, how easy it is to install and how much you want to spend.

Batts (or blankets) of insulation are usually placed into stud cavities or between ceiling joists. The term “blanket” refers to a long roll of insulation and “batts” are similar except that they come in 4 ft. or 8 ft. lengths. Blankets are ideal for long, unbroken applications (e.g. between ceiling joists in an attic). Both batts and blankets are manufactured in widths that fit into normal 16 inch or 24 inch framing spaces. Some come with a vapor barrier face and some do not. Always place the vapor barrier (foil, heavy paper) next to the warm side of the insulated space. When adding new insulation on top of existing insulation use a batt having no vapor barrier.

While batts/blankets are not useful for adding insulation to the wall cavity of an existing home, they are flexible and make installation over curves and into irregular shaped air spaces easy in new
construction and existing open areas. This type of insulation can be used to fill smaller openings by cutting strips from the batt with scissors or a razor blade and fitting them in.

The vapor barrier has a flange or an overlap for stapling the batt to the studs on each side of a wall cavity. In a ceiling space the batts can be laid in position without stapling.

**Rigid board** insulation generally comes in several thicknesses and in standard 2 ft. by 8 ft. or 4 ft. by 8 ft. building sizes. Rigid board is most easily installed in new construction. It can be easily installed in existing ceilings, crawl spaces, foundation walls or open areas. Boards are designed to be installed on the exterior of wall studs as sheathing. They can also be installed on the interior of the studs. In addition, they can be applied to ceilings, floors and foundation walls.

**Foams** are applied by spraying a frothy substance on the interior or exterior of a rigid structure or into a wall cavity. The foam reaches into all air spaces and can give better coverage that other types of insulation. Some foams shrink during the curing (or drying) process and leave air leaks. The shrinkage spaces can sometimes be filled with a second application. Select an experienced and reliable installer. Foams can be installed easily in new and existing structures.

**Loose fill** insulation comes in bags and is usually blown into a wall cavity or ceiling space with a blower. Check the recommended square foot coverage on the bag label. Determine how many bags you need and do a bag count. Some installers "fluff" the insulation with the blower more than is recommended by the manufacturer and thus do not achieve the expected R-value. Loose fill insulation, if blown in at too low a density could settle over time creating some uninsulated space in a wall cavity. Loose fill insulation can also be poured onto an attic floor space. It is easily installed in new and existing structures.
Common Insulation Materials

Cellulose — is recycled cellulosic fiber (wood base), shredded wood pulp, newspaper rags, or waste paper products which are treated with a fire retardant.

Common form: Loose fill

Common uses: Attic insulation, filling wall cavities.

Advantages: Good for new attic insulation, or attic and wall retrofit. Higher R-value than most loose fill materials. Price is competitive with fiberglass and rock wool. Good sound absorbing properties.

Disadvantages: Some settling if not installed properly. Loses insulating properties when wet. Quality Control is difficult. Fire retardant and corrosive qualities vary with the manufacturer. Sodium sulfate (fire retardant) breaks down to sulphuric acid and corrodes metal building components. Borate fire retardants are considered the best.

Cautions: Know how much area each bag covers. Count the bags as the installation is being done. Buy from a reputable dealer. Avoid the supplier who manufacturers the cellulose in the back of a truck.
Fiberglass — is a mat of fine glass threads.

Common forms: Blankets, batts, loose fill

Common Uses: New construction-wall cavity, attics, under floors, sill boxes, heat ducts. Existing homes — attic space, crawl space, under floors, sill boxes and heat ducts.

Advantages: Does not support combustion. Good R-value for both batts and blankets. Good sound proofing properties. Easy to install. Price competitive.

Disadvantages: Loses insulating properties when wet. Transmits moisture easily. Low R-value for loose fill.

Cautions: Can cause eye and skin irritation when installing. Wear long sleeves and gloves when handling. When used as loose fill, caution for cellulose also applies.

Polystyrene — a thermoplastic plastic formulation that comes in two forms: (1) expanded plastic beads (bead board); and 2) extruded foam.

Common form: Rigid boards, with either butt edges or tongue and groove joints.

Common uses: Perimeter insulation in place of wood or wood fiber wall sheathing; under slabs, crawl space and basement walls.

Advantages: High R-value, high density products resist and absorb less moisture than other insulation materials, lightweight.

Disadvantages: Bead board is more susceptible to breakage and moisture absorption than the extruded foam. Polystyrene is combustible, but does contain a flame retardant to prevent accidental ignition from low temperature heat sources.

Cautions: Should never be left exposed, always cover.
Urea-Formaldehyde — plastic resins mixed on site and machine injected into place.

Common form: Foamed on site.

Common uses: New and existing wall cavity and masonry insulation.

Advantages: High R-value. Can fill hard to reach areas. Intended as a cavity filling insulation. Easily applied to new structures before closing the cavity. Has good sound absorbing properties. Fire resistant, non-toxic, resists moisture.

Disadvantages: Some shrinkage occurs during “curing” or drying process. This varies with product and installer. Slightly corrosive to steel. Residual formaldehyde odor for a time after installation.

Cautions: Buy from a reputable dealer. The manufacturer should be knowledgeable in plastic formulation techniques. Urea-formaldehyde is not recommended for ceilings or other horizontal surfaces. Ventilate the house well during and immediately after installation. Painting interior walls with an oil base paint helps reduce formaldehyde fumes.

Polyurethane and Isocyanurate — two similar foams, the isocyanurate has more stability and a lower flame spread rating than polyurethane.

Common form: Rigid Boards faced with foil, gypsum or perlite to form a flame shield. Also can be foamed in place.


Advantages: Best R-value available. (See Table 1)

Disadvantages: Loses small portion of insulation value when exposed to air. Continues to expand after foamed in place which could cause an existing wall to buckle, combustible.

Cautions: Should not be exposed. Cover with wallboard, paneling or other wall treatment.
Rock and Mineral Wool — a matted fibrous product produced from calcium magnesium silicate, has been largely replaced by fiberglass.

**Common form:** Batts, blankets, loose fill.

**Common uses:** Same as fiberglass.

**Advantages:** Same as fiberglass.

**Disadvantages:** Not moisture resistant.
Selecting a Contractor

- Determine where you want insulation and calculate square footage of area.

- Get estimates (bids) from well-established firms before making a decision. Get more than one bid. Each bid should state amount of materials to be used and the R-value to be achieved as well as the dollar cost.

- Ask contractors for the names of several customers whose homes have been insulated for several years. Then check out the references.

- Make sure all contracts, warranties and salesmen's promises are in writing. Read and understand the contract.

- Especially on a loose fill application, stay with the installer during installation (at least stay home) to count the bags of material (verify the amount) being used.

- Ask the insulation contractor or his representative if the installer has received factory-training in correct application procedure. Ask to see the installer's certificate or identification card verifying that he has received such instruction.

- Have a qualified electrician check the wiring circuits in the walls before adding foam or cellulose insulation. Replacing wiring is virtually impossible after adding these insulation materials. Overloaded wires within insulation may not be able to dissipate the heat generated possibly causing a fire.

- Recessed lights must not be covered with insulation and should not have insulation within 3 inches on the sides. Heat generated by recessed lights could cause a fire.
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