



# AGRICULTURAL ENGINEERING NEWS LETTER

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## INSULATING MATERIALS FOR FARM BUILDINGS

The use of various materials for insulating purposes is not a fad, nor is it something new. Prehistoric man is said to have used the bark of the cork oak tree to insulate his crude hut, and the early Romans used this same material to insulate their beehives. The use of blankets, hay, or straw to prevent plants from freezing and the use of sawdust in ice houses are examples of the application of insulating materials to farm needs. Any material that retards heat losses and heat gains has some insulating value, but it is only during recent years that we have come to appreciate the superior insulating values of certain materials and to realize the added comfort and economy that they give us.

All building materials have some insulating value ranging from very little in dense substances to a high degree of efficiency in loose fibrous or granulated materials. The value of practically all insulating materials is dependent upon the number and size of the air spaces within the insulating material. The greater the amount of air trapped and the smaller and more numerous the cells in which the air is enclosed, the higher the insulating value. If this trapped air is replaced by water, the insulating value is greatly reduced. Insulating materials should not be allowed to absorb moisture.

All air spaces within the walls and other structural units of a building have some insulating value, but this value is not proportional to their thicknesses as air is a good insulator for conducted heat but not for radiated or convected heat. A three-fourths inch air space gives maximum insulation for air spaces and is equivalent to about three-tenths inch of average insulating material. The insulating value of wide air spaces can be increased by partitioning them into two or more spaces.

### Need for Insulation

The need for insulating buildings is greatest in climates where there is considerable fluctuation in the daily temperature. Insulation makes the temperature changes within the building more gradual and prevents extreme highs and lows.

There are many reasons for controlling temperature changes in farm buildings. The maintenance of proper temperatures in homes and livestock shelters brings comfort to the occupants, saves on feed for livestock, and reduces heating costs. The increased comfort to dairy cows and poultry from proper insulation and ventilation helps to maintain or increase the yield of dairy products and eggs.

The use of insulating materials aids

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materially in the proper ventilation of animal shelters. Without insulation it would, in many cases, be impossible to allow the proper circulation of air on cold days without undue cooling of the shelter. With good ventilation the problems of condensation, paint failures, and decay of building materials is largely eliminated.

### Properties of Insulating Materials

The most important property of any insulating material is its resistance to the transfer of heat. However, there are other properties which add to or detract from its value as a building material. A good insulating material should also be: fireproof or fire-resistant, vermin proof, moisture resistant, devoid of disagreeable odors, resistant to deterioration or decay, easy to apply, and reasonable in price. Structural strength should be an added property if the insulation is used to replace structural members. A material that fulfills the first requisite, that of efficiently retarding heat losses and heat gains, will be light in weight and will not easily settle or pack.

Some insulators will meet practically all of the mentioned specifications while others may have only a few of these properties. The first cost of the various materials should not unduly influence the final choice, but rather all the factors should be considered in relation to the particular purpose of the insulation.

### Types of Insulating Materials

Flexible insulation is composed of vegetable fibers, hair, or mineral products arranged in the form of a blanket or quilt which fits into the space between rafters, studs, and joists. The material is sometimes covered with a moisture resistant paper. Common thicknesses of this material are from one-half inch to 2 inches. It is usually sold in rolls from which the desired lengths can be cut. A common error in the use of this type of insulation is to apply a one-half or 1-inch thickness and expect to get the same insulating value as is obtained with a 3- or 4-inch fill type of insulation. For equal thicknesses, the best flexible and the best fill types of insulation have approximately the same insulating value.

Fill insulating materials are composed of vegetable or mineral products in a fibrous, powdered, or cellular form. They are sold in bulk or loose form and in bats. The bats are usually wall thickness (3 $\frac{1}{2}$  inches) and of a width to fit between framing members. The lengths vary from 18 to 48 inches. The bulk

type is poured or blown into place. When used in walls, it fills the entire space between members and when used between joists, it is usually applied to a thickness of 3 or 4 inches.

Rigid insulation is made of wood or plant fibers which are bonded and compressed into panels of various sizes. Common thicknesses are one-half, three-fourths, and one inch. The panels are usually 4 feet wide and the lengths vary from 6 to 12 feet. The panels can be nailed in place in stock sizes or they can be sawed to size. Rigid insulation provides structural strength and is used as a plaster base, sheathing, and interior trim. It has about three times as much insulating value as lumber, while the fill and flexible types are about four times as efficient as lumber.

Reflective insulation consists of a metallic sheet with or without backing material. Unlike the other types of insulating materials, it does not depend upon air cells or thickness for its insulating value. It insulates by reflecting the radiated heat which strikes its surface. To be effective it should be used in connection with air spaces in order also to retard conducted and convected heat. Aluminum foil is frequently used as a reflective type of insulation. Aluminum foil placed in the center of a 3 $\frac{1}{2}$  inch wall space has an insulating value equivalent to about 1 $\frac{1}{4}$  inches of rigid insulation.

Home or non-processed insulating materials such as sawdust, planer shavings, crushed corn cobs, shredded corn stalks, buckwheat and cottonseed hulls, straw, and moss have considerable insulating value. If these materials are dry when placed in the building and kept dry, they will not deteriorate. Unless they are chemically treated, there is always danger of vermin infestation. Moisture resistant paper should be used to protect these materials or the buildings as well as the insulating material may decay. There is no practical method of fireproofing these materials.

The use of insulating materials in building construction should not be considered as a substitute for good workmanship in making the walls and roofs as tight as possible. No insulating material will be particularly effective unless heat losses through glass are retarded by using double glazing or storm sash. All openings around doors and windows should be made as tight as possible. Storm doors, weather stripping, and windproof paper over joints and cracks are important factors in making an insulating material really effective.