# INSULATION: A Definition For the Expert

**By John J. Bucholtz, P.E. Plaster Info. Ctr., San Jose, Ca. 95124**

Insulation?

The definitions are simple.

1. To cover or surround with nonconducting material; 2. to separate conductors by the interposition of a nonconductor in order to prevent or reduce the transfer of electricity, *heat,* or sound. 3. to place in an isolated situation or condition; segregate. (from Latin: insulat(us) = made into an island.)

Where there's heat flow, such as from a building to the outside and the heat comes from some source such as electricity or natural gas (or anything else that is an energy source), two things generally happen: First, much of the energy is wasted, and bills to pay for the energy increase annoyingly.

## IMPORTANT INSULATING TERMS

1 BTU - (British Thermal Unit) warms 1 pound of water 1 degree Fahrenheit. To put it more simply, think of 1 BTU as the amount of heat given off by burning one individual kitchen match.

K-Factor or "Thermal conductivity Factor."

K-Factor = BTU's per hour transmitted through 1 sq. ft. of material 1" thick or K-Factor = BTU's/hour/square foot/ F/inch.

C-Factor or "Thermal Conductance" is the measure of heat transmitted under the same conditions as above, but at a specified thickness other than 1 inch.

C-Factor = BTU's/hour/square foot/F. (Note here that the 1 inch designation has been dropped.)

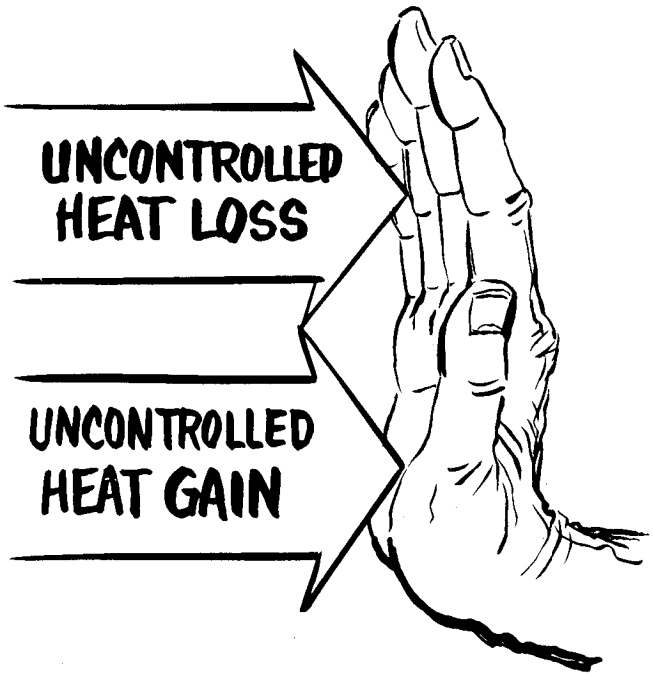
U-Factor or "Overall Coefficient of Heat Transmission" is used to describe a structure composed of more than one insulant.

U-Factor = BTU's transmitted per hour per square foot per degree F. from the air on one side of the entire structure to the air on the other side.

U-Factor = BTU's/hour/square foot/F.

R-Factor or Thermal Resistance Factor" is the reciprocal of any of the other factors.

R-Factor may be added arithmetically. Therefore it is quite easy to determine the heat conductance of any insulating structure consisting of more than one insulant.




We usually think of energy wasting as that kind involving flow of heat from inside the building to the cold air outside (all flow is from the hot to the cold). However, in some areas were 90° F. is a "cool day" and air conditioning equipment is in operation to cool the interior of a structure, the flow is from outside to inside. In this case, the concern evolves with higher costs of air conditioning.

So insulation (preventing as much as possible an uncontrolled heat flow) is an essential of energy conservation. Aware of energy dissipation by "business as usual," many agencies are now trying to educate the public to the extreme value of insulation. As the definition notes, insulate means "make into an island." One's imagination can visualize those things that can "make into an island" the interior environment that depends on energy sources.

**Most Common**

The most common insulation is the fiber glass, or mineral wool batt. There's also fiber glass and mineral wool units for blowing into areas that help create the "island." Among other insulators are expanded urethane (an excellent insulator), expanded polystyrene, silica aerogel (loose fill), insulating sheathing, expanded vermiculite, perlite, and others.

There are some misconceptions about the insulation value of plaster (both interior and exterior). Insulation effectiveness is expressed with an "R" value. This means, coincidentally, "Resistance"—or, resistance of the item to heat flow. Thus if the "R" value is 4.00, then the insulator is great. If, however, the "R" factor

*(Continued on Page 20)*

# EXPERTS:

*(Continued from Page 16)*

is 0.10, obviously the effectiveness of whatever has that "R" factor is extremely poor and does little to keep heat where it belongs (for example, inside the building in the winter when the heaters are in operation; and outside the building in the summer when air conditioners are operating).

The "R" factor of stucco (Portland cement plaster) is 0.20 per inch. Stucco is applied, generally, to a thickness of 7/8". This means the stucco membrane has an "R" value of 0.175 for that thickness. This is very poor and keeps little heat where it belongs. Matter of fact, stucco is one of the best heat conductors. Where stucco is the only membrane component, the exterior wall obviously has a poor insulator. To conserve energy, then, some effective heat barrier is needed.

Gypsum plaster isn't any better. With sand as the aggregate, the "R" for gypsum plaster is 0.18 for an inch thickness. Since most gypsum plaster isn't an inch thick when applied, then the 0.18 can be cut into whatever proportion is needed to identify the thickness used. Add perlite to gypsum, and the efficiency goes up-but just a little. With perlite, a one-inch thickness yeilds an "R" value of 0.67. This means that the usual half-inch thickness turns in a 0.335 factor. Half-inch gypsum wallboard has an "R" of 0.45, and the enhancement is due to the paper which itself has a pretty hefty "R" value considering the thin layer involved.

**Get Involved**

*The wall and ceiling contractor is going to have to "get involved" today with "R" factors, "U" factors, "k" factors, and a lot of other terms heretofore the esoteric property of experts in the field of insulation. In other words, a wall and ceiling contractor, as expert as he may be, is going to have to become MORE expert.*

Producers of polystyrene and urethane, as well as old line manufacturers of glass fibers and mineral wool, are developing combinations of components that use their products as sheathings, or insulation in framing cavities. These manufacturers deserve attention. They are trying to share their knowledge of what goes into an efficient wall or ceiling. They have the facts and have made them readily available to the contractor who accepts the handwriting on the wall that he must today be informed more than ever on the value of various components as insulators.

**ASHRAE Values**

The values ("R" values noted in the foregoing, for instance) of insulation for different building materials are determined and set by the American Society of Heating, Refrigerating, and Air Conditioning Engin-

*(Continued on Page 30)*

## EXPERTS:

*(Continued from Page 20)*

eers (ASHRAE), which has no axe to grind with any segment of the building industry. So the first thing the wall and ceiling contractor has to do is to take a look at the facts and abandon the attitude that "someone is crazy because I KNOW plaster insulates." It does, when it has the right "associates" in the form of insulators that stop or retard heat flow. Same thing with wallboard.

A half inch of stucco, for instance, has the same rating as structural glass—0.10. (That's "R" factor.) Plywood, a popular item in some areas, is not an excellent insulator, a 3/8 inch thickness, for example, providing an 'R' factor of only 0.47.

Insulating sheathing (usually called "Celotex board") has a rating of 1.32 for a half-inch thickness. This is nearly three times the value of the plywood, but comes about because insulating sheathing has what is noted in the definition: conductors (particles) are separated by non-conductors (air spaces) and thus do not conduct heat with as much facility as other denser items.

An elementary course in identifying insulation values of various building components may be a great idea for some agency to set up. It's obvious that when such terms as kilowatt, megawatt, gigawatt, BPD, CFD, CFY, MBPD, Btu, and others are cited, the contractor who doesn't have at least a passing acquaintance with the terms is going to think he missed something somewhere. And from comments overheard in the lavatory, that's not a very enviable space which to find oneself. □

An area of concern for the contractor when a job calls for gypsum board over masonry exterior walls is the probability that foil backed board will be specified.

The use of this product is the least expensive way to bring this type of construction up to the required "R" value rating. The application of this product varies only in that a minimum of 3/4 inches air space must be maintained between the foil backing and any other surface except the furing strips.

This way the reflective quality can be utilized.

The men responsible for stocking and hanging should be instructed that this product must go on the exterior walls. It would be wasted on interior partitions.

This is a higher cost material but is less expensive than insulation (supplied by others) and regular gypsum board. In addition, there is no fire hazard created as there is when ridged foam insulation is used.