WORDS WORTH KNOWING

R-Value *(insulation and surfacing materials)*

A measurement of a material's ability to resist heat transfer. Insulation products are rated according to the R-value. The higher its R-value, the greater the product's ability to resist heat flow will be.

Some materials are more resistant to heat transfer than others, giving them higher R-values. One of the best ways to enhance the product's R-value is to increase the amount of gas (including air) inside or immediately surrounding it. For instance, the glass of a single-pane window has virtually no R-value, but the thin film of air that normally exists on either side of the glass gives the window an R-value of about 0.83. Adding a second pane of glass and sealing the space between the panes will increase the thickness of one of the insulating gas layers, thereby more than doubling the window's R-value.

Another example of how the presence of *dead-air* spaces affect a product's R-value can be seen with wood. Hard woods, like oak, typically have an insulating value of R-1 per inch of thickness. However, softer woods, such as pine, might have R-values twice as high due to their greater number of air-filled pores.

Products developed especially for impeding unwanted heat transfer are called insulation. Insulation can be made of a variety of materials, including old newspapers and wood fibers, glass fibers, and synthetic foams. It can also come in a variety of configurations, including soft blankets, rigid boards, or fluffy granular loose-fill, but what they all have in common, is their abundance of air-filled pores or pockets.

The actual R-value of insulation products can vary greatly, depending on their composition and form. The least resistant and least common are perlite and vermiculite loose-fills, at R-2.2 to R-2.7 per inch of thickness; the most resistant are polyisocyanurate rigid boards, at R-7 per inch of thickness. Fiberglass blankets and cellulose loose-fills, two of the most common residential insulation types, have R-values of 3.1 to 3.7 per inch.

The R-value tells how much heat flows through a material in a given amount of time:

Example:1 Btu takes 1 hour to pass through 1'sq of R-1 material at a one (1) degree temperature difference.

1 Btu takes 19 hours to pass through 1'sq of R-19 material at a one (1) degree temperature difference

Temperature Difference (Delta T)
The greater the difference in temperature between the cooler and warmer sides of a material surface, the faster the heat will flow.
Example:
1 Btu/hr passes through 1'sq or R-1 material at (1) degree temperature difference.
19 Btu/hr passes through the same square foot of R-1 material at a 19-degree temperature difference.

Area
The larger the surface area, the greater the potential for heat loss by conduction.
Example:
1 Btu passes through 1'sq of R-1 material with 1 degree temperature difference.
19 Btu/hr passes through 19'sq of R-1 material with a one (1) degree temperature difference.

U-Value (windows) **The measurement of how readily heat can flow through glass, brick, drywall and other building materials. U-values, which are expressed in decimals, are the opposite of R-values. The higher the U-value, the less efficient the building material will be.**

To determine the R-value of a product for which the U-value is given, you first convert the U-value to its equivalent fraction and then invert it. For instance, the equivalent fraction of U-0.166 would be 166/1000 or 1/6. This inverts to 6/1 or 6, giving you an R-value of 6. For most consumers, U-value is likely to be of concern only when shopping for new windows, where efficiency is frequently stated in terms of U-value rather than R-value.

Btu (British thermal unit): a measurement of the energy in heat. It takes one Btu of heat to warm one pound of water by 1° Fahrenheit. Btu can be used either to define an air conditioner's cooling capacity (*i.e.*, the number of Btu of heat that can be **removed** by the system) or a furnace's heating capacity (*i.e.*, the number of Btu of heat that can be **supplied** by the system).

Conduction: the transfer of heat through solid objects such as glass, dry wall, brick and other building materials. The greater the difference between the outdoor and indoor temperatures, the faster conduction can occur and the more home a building can gain or lose.

Convection: the transfer of heat to or from a solid surface via a gas or liquid current. Where home heat loss and gain are concerned, heat convection is caused by air (gas) currents that carry heat from your body, furniture, interior walls and other warm objects to windows, floors, ceilings, exterior walls and other cool surfaces.

Internal Heat Gain: the accumulation of heat produced by a building's energy systems and appliances and occupants. Depending on the number of occupants and the type and number of energy systems used during the day, it's not unusual for internal heat gain to account for 20% of a home's total summer cooling load.

Vapor barrier: a material designed to resist the migration of moisture through a wall or other building component. As water vapor in the air moves from a warmer to a cooler part of the building it can settle and condense on cooler building components, such as rafters, beams and walls, eventually causing those components to mildew, rust or rot. Vapor barriers, which are impermeable to water vapor migration, help to protect against this possibility. The most common vapor barriers are made of plastic, but other materials, including oil paint, can also serve the purpose.

Watt: a unit of electric power. The amount of power required by electric appliances is expressed in watts.

Watt-hour: a unit of electric energy, equal to one watt used over a period of one hour.

Weatherstripping: a product designed to seal the cracks that exist between two moving parts or one moving and one stationary part of windows, doors and other movable building components. Weatherstripping is used to improve a building's energy efficiency by preventing the unintentional entry of unconditioned outdoor air.