

## **Appendix C Insulation basics**

Insulation works by trapping air or a gas such as Argon that is used in high-efficiency windows. The fibers or foam hold onto small pockets of air and, because air is such a poor conductor, the flow of heat is slowed down but not stopped. The R-Value is the resistance to heat flow. The R-Value only affects the conduction of heat, it does not represent heat transfer from radiation (infrared rays) or convection (air movement).

The R-Value of the insulation is based on its thickness and density. A 5-inch thick R-19 batt that is stuffed into a 2x4 wall cavity will deliver only about an R-13 because the compression of the batt has squeezed the air out. In fact, tightly rolled batts should be fluffed up to their full thickness before being placed in wall cavities.

Even though air is an insulator, the movement of the air should be restricted. When air is trapped, it has an R-Value of about R-1 per inch. If the air is circulating (convection) in a cavity, it is actively transferring heat from one surface to another. It is important to seal all leakage areas prior to insulating and to install insulation so that convection cannot occur.

### **Issues with insulation**

Insulation comes in a variety of colors and types. There are pros and cons for every type of insulation, and there are important differences that distinguish one insulation type from another.

Here are a few insulation facts:

- Batt and loose-fill ceiling insulation do not air seal.
- Batt insulation, if done very carefully, can work. The issue is that proper and careful installation is required in combination with good air sealing.
- Foam insulation not only air seals but also vapor seals.
- R-Values for different products are slightly different. Even products from the same manufacturer with the same thickness have a different density and R-Value.
- Dry cellulose (ceiling) settles; however, wet-blown (typically applied to walls) does not settle.

Suppliers or manufacturers typically state the R-Value of their products. If not available, use the default values below.

R-Values for Ceiling, Wall, Floor or Slab

Insulating values of typical insulating products	R-Value
3-1/2" low density Fiberglass batts	11
3-1/2" med. density Fiberglass batts	13
5-1/2" low density Fiberglass batts	19
5-1/2" med. density Fiberglass batts	21
8" med. density Fiberglass batts	30
9-1/4" low density Fiberglass batts	30
10" med. density Fiberglass batts	38
12" low density Fiberglass batts	38
3-1/2" Cellulose	13
5-1/2" Cellulose	20.4
8" Cellulose	30
10" Cellulose	37
12" Cellulose	44.4
14" blown glass (pink or yellow)	30
14" blown glass (white)	33
3/8" R-Board tm	2.7
1/2" R-Board tm	3.6
3/4" R-Board tm	5.4
1" R-Board tm	7.2
1/2" Fiberboard (blackboard)	1.3
1" Polystyrene foam (blue or pink)	5
1" Styrofoam tm (beadboard)	4