

Insulation and Infiltration

Insulation effectiveness is measured in R-Value (resistance to heat flow). It is dependent on the type and amount (thickness/density) of insulation, the type and age of the structure, the accessibility of areas needing insulation, and the installer's workmanship/attention to detail. Conduction, convection, infiltration and radiation will influence R-value. Insulation that is poorly/improperly installed (compressed, loosely fitted, voids, etc.) will increase infiltration opportunities and thus decrease insulation effectiveness or R-Value. Homes will lose on average 20-30% of its conditioned air through infiltration/air movement losses. This loss is comparable to leaving a standard window open year round.
(Review newsletter Energy Saving – Facts, Options & Resources for more information)

Fiberglass: (batt or blown)

- Good infiltration stopper in wall applications provided all 6 sides (edges and faces) are sealed/encapsulated/enclosed within building materials.
 - Vapor barriers will help but are not a substitute for physical encapsulation/sealing.
- Typically less effective in attics (not encapsulated/sealed on all sides).
- Air movement through the glass fibers (insulators) will increase with voids/compressed sloppy workmanship.
- Colder temperatures (20 degrees F or lower) will infiltrate the glass fibers decreasing overall R-Factor.

Cellulose: (blown)

- A heavier type of insulation that can be dense packed. If densely packed @ 3.5 lb per sq ft (psf) air movement/infiltration is decreased; R-Value and home tightness are improved.
 - Fiberglass materials typically do not dense pack well.
- Generally considered a better infiltration stopper when compared to fiberglass materials when installed at higher density levels.

Foam: (closed cell verses open cell)

- Foam insulation is typically applied by a professional using special equipment to meter, mix, and spray the foam into place. Polyisocyanurate is open-celled foam. Polyisocyanurate and polyurethane are closed-cell foams.
- Open-celled foam allows water vapor to move through the material more easily than closed-cell foam.
- Open-celled foam usually has a lower R-value for a given thickness compared to closed-cell foams.
- Expandable foam purchased through a hardware store is usually the open cell variety.

Extruded Polystyrene/Bead Board Insulation: (4' x 8' blue/pink/white panels)

- A good insulating product and infiltration stopper if properly sealed at all seams/edges.
- Some coated with a reflective coating to assist with energy savings.
- Flammability and location may require a fire rated covering, or restrict application altogether.
- When used on exterior of foundations, will require impact & UV protection.
 - Potentially may provide a pathway/desirable atmosphere for bugs/pests infestation.

Considerations

- Wood (joists/rafters) will occupy 20-30% of exterior wall/ceiling surfaces. Wall insulation placed between joists/rafters does not retard the heat flow (conduction/thermo bridging) that occurs through wood, thus reducing the overall R-Factor of the wall or ceiling. To assist in retarding this heat flow, ensure attic insulation covers the tops of all wood or metal joists/studs.
- On a new home, or remodeling an older home installing one inch rigid polystyrene insulation boards on all exterior wall surfaces will decrease conductive heat losses and reduce wind pressure through wall cavities. The exterior rigid foam must be properly sealed/taped on all edges to be effective. The details are very important.
- **Oak Ridge National Laboratory Summary: (real world conditions in a full scale attic simulator)**
Fiberglass products declined as much as 40% in R-Value as the temperature difference between conditioned (inside) air and ambient (outside) air increased.

Summary: When the temperature in the attic is 20 degrees F, the fiberglass insulation in the attic loses 40% of its R-Value. The researchers at ORNL recommended that attics with fiberglass insulation be covered with as little as 3 inches of cellulose to stop the loss of R-Value in the fiberglass.

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