

INSULATION

by

David A. Wojcieszak, P.E., C.I.A.Q.P.

Wojcieszak & Associates, Inc., P.O. Box 2528, Stuart, Florida 34995

E-Mail: david@dwojo.com

(772) 286-8696

Insulation

Insulation is used in building construction to reduce heat gain into the structure during cooling cycles or reduce heat loss from the structure during heating cycles. Most insulation is selected based only on initial cost and the minimum AR@ value required to comply with local codes. Additional criteria that are equally important should be considered as follows:

- Infiltration rate
- Sound attenuation
- Life cycle energy analysis
- Installation

Serious problems can be averted when the insulation is selected based on all design criteria and not limited to cost and AR@ value.

Infiltration

Infiltration is a process where unwanted outside air enters a building through a variety of openings in the building envelope, such as doors, windows, cracks, and most importantly, ventilated attics. Infiltration in warm, humid climates requires special attention because of the air's high moisture content. The excess moisture load brought inside must be absorbed by the structure or eliminated through the air conditioning system which, in most

cases, does not have the capability to remove the excess moisture. High levels of relative humidity in a conditioned space can lead to mold and mildew growth. Therefore, it is critical to select an insulation that reduces the infiltration rate in warm, humid climates. A lower infiltration rate is more critical than a higher AR@ value. Proper selection of insulation can reduce the infiltration rate up to fifty percent, as well as reduce total energy consumption.

Sound Attenuation

All thermal insulation, with the exception of films, will attenuate sound. Some kinds of insulation are better than others. The less light that can be seen through the insulation, the better it can attenuate noise. Foam and cellulose insulation are good examples.

Life Cycle Analysis

Low initial costs of insulation can be more expensive in the long run compared to expensive insulation. The air conditioning system has to run for longer periods of time, consuming electricity. Better insulation will normally pay for themselves within three years because of lower energy costs.

Installation

Proper installation of any product is important to its performance and be compatible with the roof, wall, or floor assembly where it will be

installed. Certain insulation may be easier to install in various assemblies, however, initial material cost may be more. The labor to install the insulation and the construction cost of the assembly must be considered when evaluating the total insulation cost.

INSULATION TYPES

Films

The first reflective films were used as radiant barriers in attics. Later, similar films were installed in walls as insulation. These films are radiant barriers and are resistant to heat flow only when sunlight is present. The film is normally stapled to the furring strips just before the drywall is applied. The first generation of films had its problems. The film acted as a vapor barrier preventing exterior moisture from drying to the inside. Condensation occurred on the backside of the film. The water would then drip down to the baseboard providing conditions for rotting. The problem was solved when the films were perforated. When the film is used as wall insulation in warm, humid climates, it must be perforated. Fi-Foil is a major manufacturer of reflective insulations.

Loose Fill

Any type of insulation that is blown into a space not self-contained by a bag or kraft face is known as loose fill. The most common types are

fiberglass and cellulose. Fiberglass loose fill insulation must have mechanical barriers installed to prevent leakage, while cellulose is self-adhesive. Loose fill insulation does not contain a vapor barrier. These types of insulation have numerous suppliers.

Batts

Fiberglass batts are the most common insulation in the marketplace. They are inexpensive, easy to install, and work well when properly installed. In warm, humid climates, the vapor barrier should be directed toward the heated surface on the outside. Batt insulation in warm, humid climates, is usually installed backwards. Unfaced batts should be used where vapor barriers are not required, or cannot be installed in the proper location. Rigid batts are manufactured by Owens-Corning and Johns-Manville.

Rigid Boards

Rigid insulation is composed of various types of foams. The boards can be purchased in a variety of thicknesses with or without a vapor barrier. Rigid boards require a mechanical fastening system to attach them to the building structure. Vapor barriers should not be used on exterior walls. Rigid boards are manufactured by Owens-Corning, and Thermax.

Applied Foams

Applied foams can be purchased in two forms. Aerosol cans provide small quantities for patching or sealing holes. Larger quantities require specialized equipment to mix the two-part foam and apply it to the surface to be insulated. The new foams are water-based and environmentally sensitive. The foam is versatile and can be applied to many surfaces with any thickness

required. The foam is self-adhesive and provides very low infiltration rates. Icynene is the applied foam of choice.

INSULATION LOCATIONS

Building Envelope

All elements of the building envelope in warm, humid climates require some form of insulation. The only exception would be the concrete slab when installed directly on grade. A variety of insulation can be used in walls, roofs, and raised floors.

Roof

Proper construction of the roof/attic in warm, humid climates is extremely important. Non-ventilated attics should be constructed to reduce infiltration. Local codes dictate the insulation has to be installed in the upper chord of the attic truss when constructing a ventless attic. All forms of insulation can be used with varying degrees of difficulty. The film type insulation would not be considered insulation in the roof assembly, but a radiant barrier. The loose fill, batt, and rigid insulation will require some means to mechanically fasten the insulation to the underside of the roof deck. The top chord of the truss will also have to be a minimum of six inches deep to accommodate the required thickness of insulation. The applied foam is the only product which will self-adhere and provide the required insulation in a four-inch-deep top chord. It is the recommended product for ventless attic construction. The foam is more expensive; however, it substantially reduces infiltration and does not require additional supports.

Walls

All types of insulation can be used in walls. Heat gain through walls is

minor compared to the gain through glass, roof, and infiltration. Therefore, the type and AR@ value is not critical and should be installed to meet minimum code. Particular attention should be paid to the wall assembly and its permeability. Vapor barriers should not be installed in exterior walls in most cases. For this reason, wall insulation should be vapor permeable and installed without a vapor barrier.

Raised Floors

Raised floors in warm, humid climates are a case unto themselves. The AR@ value is not critical. However, the insulation must have very low infiltration properties, and be resistant to bugs and vermin. Two types of insulation exist which can provide these properties - applied foam and rigid board. Experience has proven other types to be a waste of time and money.