

Foam Selection

Closed Cell or Open Cell?

Foams

Closed cell foam (2 lb.) products include the following: foam board (blue, gray, pink), foam board with foil coatings, some foam boards with plywood support (ISP), some insulated concrete forms (ICF) and spray in place foam.

Open Cell foam (1/2 lb.) products include some foam boards with plywood support (ISP), some insulated concrete forms (ICF), and spray in place, manufactured foam.

Environmental Concerns of Closed Cell

Foams

All foam products require a blowing agent which reacts with other chemical agents to form small bubbles. Closed cell foams use a refrigerant type gas (lighter than air) as a blowing agent. This creates foam with individual, distinct bubbles of blowing agent gas trapped within a solid plastic matrix. The blowing agent of closed cell foam products are changing as manufacturers work to make their products more environmentally friendly. That being said, they **do not** contribute to depletion of the ozone layer.

Long Term Thermal Performance of Foam Products

Closed cell foams are created using lighter than air gasses. They have an inherent uncertainty of stability. One only needs to think of a helium-filled balloon to understand this uncertainty. We all know what happens to a balloon after a few days. It drops to the floor as the helium escapes and is replaced with air. This phenomenon is something all closed cell manufacturers are seeking to control. Their quest is to make the closed cell plastic matrix strong enough to prevent the lighter than air refrigerant gasses from escaping.

Virtually all open cell foams such as NCFI use water as the blowing agent. The result of the chemical reaction is a cellular matrix with bubbles containing mostly carbon dioxide.

Carbon dioxide has a *similar density to air*. Foams which have bubbles containing gases similar to air do not create uncertainty of long-term thermal resistance. Open cell foam systems have long-term thermal consistency and do not require testing since there is no physical phenomenon which creates uncertainty.

What about Performance?

All foam products perform as specified during laboratory testing during the "short term" As previously mentioned, the long term thermal performance of closed cell foams is uncertain. Most new closed cell foam products (1-5 years) range in thermal performance from R5 to R7 per inch of thickness. Some high-density closed cell foam products exceed these values. Most open cell foam products range in thermal performance from R3 to R4.2 per inch of thickness. There are no high-density open cell foams known to Seal-It which exceed these values.

What about Moisture Migration?

Within a building assembly, moisture moves by two distinct mechanisms: *Diffusion* and *air transport*. Diffusion is molecular movement of moisture through a material. It is moisture moving through a material at a molecular level *driven by vapor pressure differences*. Vapor diffusion retarders have been designed to prevent moisture diffusion. There are now many different brands of vapor retardant drywall primers available. This is the only "vapor barrier" one needs to apply from the interior of the home.

Air transport moisture migration is the *movement of moisture with moving air*. As warm air moves within a building assembly, it carries moisture. When the warm air comes into contact with a cold surface, the moisture within the air condenses and deposits the water vapor contained in the air. This is often seen as a frost line inside a roof with a poorly air sealed attic floor. *An air barrier is required to prevent moisture migration due to air transport*. Several States including Massachusetts have started requiring air barriers in building specifications.

The Energy & Environmental Building Association (EEBA) states that in most cold climates, 100 times more moisture is transmitted by air movement than through diffusion¹; that is a big statement.

All foam products are air barriers and prevent moisture migration due to air movement which accounts for more than 98% of moisture movement in cold climates. Many closed cell foams are vapor diffusion retarders when applied at a thickness greater than 2". Therefore closed cell foams also prevent moisture migration due to diffusion. Open cell foams are not vapor diffusion retarders but are air barriers.

NOTE

Foam products are not liquid water barriers. Hydrostatic pressure (force of liquid water) is a powerful force. Foam products create a resistance to vapor forces but do not have a matrix which can withstand hydrostatic pressure forces. Other products and drainage system design are required to create liquid water barriers in building systems.

Decision Making Facts

Application location, building materials and cavity dimensions are the three most important factors when selecting foam.

Below ground level applications of foam such as concrete basement walls and crawlspaces, have a high vapor diffusion barrier requirement. Closed cell foams are best for most of these situations.

Wood is an open cell material, moisture can migrate through wood. When open cell foam is used with wood frame structures a similar cellular matrix is created. When closed cell foams are used with wood frame structures, moisture migration pathways are limited to wood members. Wood expands and contracts with season variations. Open cell foam is flexible and easily moves with the structure. Closed cell foams are rigid.

Small cavity depth restricts the usage of open cell foam when certain thermal resistance (R-value) is required. Metal buildings can use either open or closed cell foam.

Here at Seal-It we strive to provide our customers with the information and facts needed to make an informed and educated decision as to which foam is right for them. Seal-It can provide testing as well as many options and products that will provide you with the best and most energy efficient envelope for your home or business. These days, selecting an insulation system for your building can either save, or cost you thousands of dollars! The true science behind these products is proven and becoming more and more understood by both the homeowner and contractors alike. Knowledge is a good thing!