General information on Polyurethane Spray Foams

FOAM TYPES

Polyurethane spray foam is often categorized as either "open cell" or "closed cell." There are several major differences between the two types, leading to advantages and disadvantages for both, depending on the desired application requirements. Spray foam is an extremely versatile material that is available in a variety of physical properties and densities, making it necessary for the end-user to have an understanding of the differences in order to choose the spray foam system that is best suited for a particular project.

Closed Cell Foams: These products are the "standard" for high quality insulation, and are among the most efficient insulating materials commercially available. Closed cell foam incorporates an insulating gas that is retained within the foam's cells, which leads to its highly efficient insulating properties. Closed cell products are ideal because they provide, in addition to the highest R values, a vapor barrier, an air infiltration barrier, and structural strength to building assemblies. Closed cell foams are the only insulation products that are FEMA approved for moisture and water control. Closed cell foams are usually characterized by their rigidity and strength, and studies have shown that wall racking strength can be doubled or tripled when closed cell foam is applied. Years of research and experience has shown that the 1.75-2.25 lbs/ft. density range provides the optimum insulating and strength characteristics for most building applications.

Open Cell Foams: These products have different characteristics from closed cell foams, including a softer, "spongier" appearance, as well as lower strength and rigidity than closed cell foams. The small cells of the foam are not completely closed. They are open and air fills all of the tiny pockets in the material. These products are usually found in densities ranging from 0.4 to 1.2 lbs/ft. Open cell foams have a lower per-inch R value (slightly more than half of that of closed cell foams), the permeability rating is higher, and these products require a vapor barrier. They provide no structural strength and are not FEMA approved. When installed to a greater depth, some of the open cell foams meet the air barrier requirement, but not the vapor barrier requirement. Open cell foams are incredibly effective as a sound barrier. While they can be used on exterior applications, their shortcomings compared to the closed cell foams make the small price difference between the two products insignificant.

BLOWING AGENTS

Decades ago, the blowing agent in foams was Freon, which was bad for the ozone. About 15 years ago, the blowing agent in the foam changed to a product that was almost totally ozone friendly. Two years ago, the United States led the way in mandating a 100% ozone friendly blowing agent. Most of the world, including Canada and Mexico, still use the older blowing agents. The new blowing agents were not a simple chemical formulation change and required reformulations of the foam products. Many foam manufacturers went out of business as their products did not work. The new blowing agent, called "Enovate", or 245fa, created many advances in the industry. The change which affects the insulation industry the most is the R value rating of the product. The old Freon foams had an R value of about 7.2 per inch. The second generation of blowing agents had an R value of about 6.5 per inch.
Some spray foams use water instead of a chemical blowing agent, and are referred to as "water blown". These products use water in a chemical reaction to create carbon dioxide and steam, which expands the foam. All open cell foams are water blown.

APPLICATIONS

Spray foams are manufactured in-place, on the jobsite. The application process for each brand of foam varies slightly according to the manufacturer's recommendations. The "A" and "B" component barrels must be kept heated for proper

viscosity. The product is pumped into the spray machine where it is further heated, metered and pressurized. The "A" and "B" components travel through separate hoses, and a chemical reaction takes place as the two sides are mixed as they are sprayed through the gun.

PERFORMANCE

Not all foams perform the same application-wise. Some foams are not stable or do not work well at our altitude. Just as a baker makes dozens of different breads using water, yeast, and various flours, different spray urethane foam systems are created using similar ingredients, only in different "recipes". The major differences in foams are in how these materials or "ingredients" are formulated. When a foam product is specified to use on a project, that product may or may not perform as expected. Using foams that are proven to work will provide a quality job compared to "specialty" foams that may be advertised as "green" or soy. Often these specialty foams do not work well in our unique climate of cold weather and high altitude, even though they are installed according to the manufacturer's specifications.

Spray foam is formulated by a chemical reaction that is exothermic, meaning that it creates heat. The whole process must be carefully controlled, so that the foam rises fully before it hardens into its rigid form. Both ambient and substrate temperatures can greatly affect the overall quality of the foam's performance. If spray foam is applied to a cold substrate, that cold surface will "suck" out the heat, which can compromise the foam's physical structure and cause improper adhesion to the surface. In addition, in cold weather conditions, quick cooling of the foam as it cures can cause thermal shock, causing the foam's cell structure to shrink and crack.

CODE REQUIREMENTS & CERTIFICATIONS

Residential spray foams are rated for flame spread and smoke developed. Building codes require a Class 2 foam or better. A Class 2 foam is rated as a flame spread of 75 or less and a smoke developed of 450 or less (ASTM E84). Class 1 foams are rated as a flame spread of 25 or less. The flame spreads are somewhat misleading. Many build products, such as wood, have higher flame spreads than urethane foam. The concern with the flammability of spray foam is the volume of the product. There is a lot of fuel content in the foam, and if exposed to a fire, it will add a substantial amount of fuel to the fire.

Building code is very specific about any plastic insulation, spray foams or rigid boards, being protected from fire. Walls require a drywall finish. Ceilings require either drywall or tongue and groove wood. Crawlspaces and attic spaces require an ignition barrier over the foam if the areas are used only for the service of utilities. Rim joists are not required to be covered as long as the foam does not exceed 3 ½" in depth.

NON-VENTED CEILINGS

Building code requires that all non-vented ceilings be mostly insulated with an air-impermeable insulation. Only foam insulations meet this requirement. The bulk of moisture movement in buildings comes from the movement of air. By using an air-impermeable insulation, the chances of condensation in the ceiling assembly are greatly reduced.

GREEN BUILDING

All insulation is "green" in that it saves energy. An owner may have an interest in one aspect of green building only, which may focus on recycled or bio-content, energy performance, or transportation considerations (shipping and packaging, etc.). Foam insulations simply out perform other insulation products. While they may not contain a high recycled or bio-content, the long-term energy savings resulting from their use reduces green house gas emissions, and reduces the need for more power generation plants (which are generally coal burning). Additionally, foam insulations provide a more comfortable house. Several spray foam products are Green Guard Certified for indoor air quality.