

BY STEVE EASLEY

## Pros and Cons of Closed and Open Cell Spray Foam Insulation

**A builder from the Midwest asks, "I'm getting a fair amount of requests from my customers to use spray foam insulation. What is the difference between open and closed cell spray foam?"**

That's a good question. There are significant differences between the two families of products, the most notable being type and performance.

While many different manufacturers make these products, the two basic families of spray foam are typically classified as either open cell spray foam or closed cell spray foam. Closed cell spray foam is similar in consistency to the cans of foam such as Great Stuff that builders often use to seal around pipes and electrical penetrations, and so on.

Both product families are good for insulation but I prefer closed cell spray foam products because of its superior properties.

Below is my checklist for selecting insulation. I consider:

- What is the insulation R-value per in.?
- What are the air barrier properties/effective R-value under a wind load?
- Does it trap or store water?
- Does it have low permeability?
- Does it add structural value to the building?
- Does it maintain its R-value over a wide range of temperatures?
- Does it settle or lose its insulation properties?
- Does it control sound?
- What is the mess factor/clean up?

To understand the differences between these two spray foam product families, it's important to understand what makes traditional insulation such as fibrous, cellulose, and open cell spray foam resist heat flow. Those items work because of their ability to trap air. The

greater the number of air pockets, the higher the R-value.

What makes closed cell spray foam superior is that in addition to trapping air, it also prevents air from flowing through it, and therefore reduces the heat scavenging effects of wind-washing. It's like putting a windbreaker over a sweater.

When it comes to spray foams, their performance is governed by:

- The number of bubbles or pockets
- The size of the bubbles
- What the bubbles are filled with

Spray foam costs more than traditional insulation but it can be a very cost effective way to build high-performance homes and meet stricter energy codes. ➤

Left: An example of closed cell spray foam.

Right: To save costs, some builders use a hybrid insulation system called flash and batt where 1 in. of closed cell spray foam is applied to the wall first, and then a standard fiberglass batt is installed over the spray foam.



In open cell spray foam insulation, the bubbles are cross-linked or connected by air pockets and typically have R-values around 3.5 per in., about the same as fiberglass.

Closed cell spray foam uses blowing agents that create millions of tiny bubbles that are filled with gasses less conductive than air. The result is an aged R-value of around 6 to 6.5 per in. The gas inside the closed cell foam works on the same principle as the inert gases used between the panes of glass on a high-performance window.

If you've ever used Gorilla Glue, that polyurethane-based glue is from the same family as closed cell spray foam insulation.

Like Gorilla Glue, closed cell spray foam is from the same polyurethane family, is very strong and has a much higher compressive and tensile strength than do open cell foams. Some studies have shown that closed cell spray foam insulation increases the racking strength of walls as much as 300%. Essentially, by using closed cell foam, you are glu-

ing a house together with high R-value insulation that is highly water-resistant. In fact, closed cell spray foam has been used on the top of roof decks of flat roof commercial buildings for more than 50 years since it absorbs almost no water and does not allow moisture vapor to pass through it.

Closed cell spray foam, to my knowledge, is the only FEMA-approved insulation typically used for cavity insulation in hurricane areas. This is because it does not store water.

Open and closed cell spray foams often look alike and it can be difficult to visually differentiate between the two. Both types come in a variety of colors. If in doubt, simply squeeze a sample and examine it. Open cell spray foam will compress very easily, something like angel food cake. By comparison, closed cell spray foam is difficult to crush. In fact, there are some closed cell spray foams that you can actually stand on.

In summary, if I were building a home, I would use closed cell spray foam because it has the highest R-value; it seals to reduce air infiltration; it is highly water-resistant, and it does not store water. The product also makes a home more storm-resistant.

Closed cell spray foam is also a great product for hard-to-insulate areas such as living spaces over garages, cantilevered floors over non-conditioned spaces, and knee walls, as well as band joist areas. Insulating these areas is also an important part of the New Energy Star Homes Program. ■

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