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ZbD: Notes From the Field

Insights in High-Performance Construction



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The Nuance of Spray Foam: Part 2

By: Jon Haehnel

We talked about why spray foam installation is challenging last month. This month we will see what can happen when foam processing goes awry. First, a reminder that most foam processes just fine even if there are small mistakes in application. The foam failures I am going describe are painful, but rare. Also, note these foam failures relate to closed-cell or 2 lb. foam. Open-cell, or 0.5 lb. foam, is much more forgiving although it has about half the R-value of closed cell foam.

1. Cold substrates: Foam sprayed on substrates that are too cold often delaminate from the substrate. Every foam system has a minimum substrate temperature that it can be sprayed onto. For most versions, it is 50°F and for some winter versions it is as low as 10°F. High mass substrates like brick and concrete are much harder to maintain above the minimum temperature in the winter than wood or exterior gypsum sheathing.
2. Hot substrates: Foam sprayed on substrates that are too hot form large bubbles (cells) as it cures. In order for foam to be dimensionally stable (read: it doesn't expand or contract with temperature changes) it needs to be made up of small tight cells. Most foams have an upper substrate limit of 130°F although I think it is risky to install anywhere near that. The insidious thing about this type of foam failure it that I may not show up until the first cold weather when the foam, with its large cells, contracts in the first cold weather and literally "pops" as gaps and cracks are formed. That can be months after the application when the foam is covered by sheetrock.



Foam peeling off a foundation wall, in this case it came off as one big sheet.

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This foam sample has large cells in it on the right side.

3. Foam not mixed properly, or off ratio: If the foam processing machine (proportioner) is malfunctioning or if the gun is not clean it can mix the chemicals out of proportion. This results in crispy, glassy, or gummy foam, none of which is any good as an insulator. This is also the most common cause of foam that smells bad. Most of the time, off-ratio foam can be visually identified before it gets sprayed too far.

4. Foam component materials not stored properly: If the liquid raw materials that make up the foam are not stored at the proper temperature, typically around 60°F, the results can range from having a poor yield, (stored too hot) to the symptoms of being off ratio (stored too cold). If the liquid chemicals are a month or so beyond their 6-month shelf life they may be fine, but

the further and further beyond shelf life the riskier the application.

5. Foam sprayed too thick: Most foams are designed for a maximum pass thickness of 2" although some foams are approaching 4" now. If you need 6" total thickness of foam it will have to be installed 2" at a time with a wait period to allow the foam to cool (the foam reaction is exothermic) to 100°F (38°C) degrees before installing the next layer. The symptoms of being sprayed too thick are similar to those where foam is sprayed on a substrate that is too hot. The cell structure is too large and the dimensional stability is poor. This is probably the most common "mistake" given the pressure that is often imposed to get the job done.

If foam is sprayed really thick there is slight risk of it catching on fire. The exothermic reaction makes the core of the foam really hot. Fortunately, the installers know this and stay clear of really thick passes.

The next two failures I'll describe have nothing to do with the processing, but with mistakes that can be made by trusting the foam to do something that it cannot. When people see spray foam hit the wall and expand and fill the way it does it can be easy to believe that this "expand and fill" process can make up for careful application. It can't.

6. Uneven sealing when coating 3 dimensional surfaces: On a 3D surface like a recessed light or a duct penetration it can be easy to assume that the foam blob will grow together just before it cures and seal all around the object. Sometimes the foam cures before it can reach other planes of expanding foam leaving gaps.

7. Blind pockets and cavities: When foam is shot into a pocket the assumption is that the foam expands its way all the way to the back of the cavity before it cures. Unless special care is taken to get that shot as deep into the cavity as possible it often does not fill all the way to the back leaving an uninsulated void that is impossible to detect without an infrared camera.

Closed-cell spray foam is a great insulator, air barrier, and vapor barrier that we think has multiple applications in modern construction. But, like many products, it takes expertise and care to install properly.



The location marked in red paint shows where foam was sprayed over an electrical box but did not grow together to completely seal over the box.

A New Addition to Our Team



In October, Mike LaCrosse and his wife, Alicia, welcomed their little girl, Madelyn Brooke LaCrosse.

Madelyn was born on October 16 at 7:17 am. She weighed 7lbs. 8oz. and was 20-3/4" tall.

We hope Mike and Alicia are enjoying their venture into parenthood complete with lots of dirty diapers and sleepless nights!



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