Foam Shrinks, and Other Lessons: Correction

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And then it contracted. And then expanded again. And it did this over and over again. A simple title "Foam Shrinks" has opened up a can of worms that need to be addressed.

Gaps opened up in between the sheets of rigid expanded polystyrene (EPS). This would have also been the case if the rigid insulation had been extruded polystyrene (XPS), or foil faced polyisocyanurate (which was the insulation used in the rebuild).

All foams experience dimensional changes due to their chemistry and manufacturing process. Some are "aged" so that they are for all purposes and intents "stable". EPS is known to shrink immediately on manufacture and is typically aged a few days to account for this. Polyisocyanurate expands as it experiences inward diffusion of air and outward diffusion of blowing agents. The changes are either accounted for in manufacturing or negligible from a practical perspective.

So what happened with my barn? Foams, all of them, expand and contract due to temperature as do pretty much all materials. Some materials even expand and contract due to moisture changes – who knew? Anyway, when foams are hot they get bigger. When they are cold they get smaller. All of them. I think I mentioned that already. The EPS foam in my barn had been aged – almost a year – and was "dimensionally stable" from a manufacturing perspective. The foam sheets were butted tightly together when they were installed. They then expanded and contracted thermally as you would expect them to do. When they expanded they pushed against one another – "smushed together" is the technical term. Under this thermal expansion the edges of the boards deformed "plastically" creating a small permanent unrecoverable dimensional change. When the boards subsequently contracted thermally a gap opened up. This happens with XPS and with polyisocyanurate boards as well.

This was first noticed by the roofing industry with polyisocyanurate board insulation. The solution? Use two layers of rigid insulation with the joints offset horizontally and vertically. Duh! Thank you roofers. I did not do this in my barn roof or my barn walls for reasons that are still a professional embarrassment.

What if you only have one layer of rigid insulation on your walls? Well, nowadays we have tapes and sealants and membrane strips that can withstand the movement. This is a big change over the past twenty years. When I did my barn the first time I tried to deal with the joints with a mastic. That particular mastic did not work. Today, there are all kinds of mastics that can work and in fact do work.

So, bottom line, all foams move. All of them have joints that open up. All of this can be addressed by using a flexible material to handle the movement at joints or by using multiple layers with offset joints or by a combination of both. The approach I used in my second renovation was a combination of both. Nothing wrong with redundancy.

All buildings move. All building materials move. We knew that twenty years ago. We still know that today. What has changed is that we have gotten better at dealing with the movement. Experience matters. That is the most important lesson learned.