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Flash and batt (FAB) hybrid systems:
What you need to know before you install.

By John Bartlo, President of Energsmart Foam Insulation

Energsmart and our partners often field questions regarding flash and batt (FAB) or so-called hybrid insulation systems. The general concept with FAB is to install a thin layer of closed cell spray polyurethane foam (CCSPF) to the exterior wall sheathing to act as an air barrier and then install an R-13 to R-15 fiberglass batt in the cavity to reach the required R-value. The purpose of this paper is to explain why we're seeing this so much lately and what you should know before using it in your home.

The FAB system will work much more efficiently than fiberglass alone. Fiberglass' biggest drawback compared to spray foam is the degradation of its rated R-value after it is installed. Fiberglass allows air currents and wind to freely move through it; robbing you of comfort and energy (read: money). Before using such a method we urge you to understand some of the building science at work with such a system.

Western New York is a mixed climate, but has many more heating days than cooling days. As such, for a majority of the year, moisture will want to move from the inside of the home to the outside. Because of this, a poly vapor barrier is typically installed on the inside of the insulation. Since a FAB system has a vapor barrier on the outside of the insulation layer (the CCSPF) it's backward to begin with for our relatively cold climate. When a vapor barrier is used, it should be on the side of the insulation from which most of the vapor drive is coming, which for our climate is the inside of the home.

Interface Temperature

To lessen the risk associated with the FAB system, enough closed cell foam must be installed to prevent the temperature on the inside surface of the foam from reaching the dew point (the temperature at which moisture vapor condenses into water). The temperature of the inside surface of the foam, or "Interface Temperature", has to be above the dew point temperature, or liquid water will form. The Interface Temperature is calculated as follows:

Interface Temp = Indoor Temp - [(Indoor Temp – Outdoor Temp) X (Fiberglass R / Total R)]

For example: Say it was a 30 degree day outside and you have your thermostat set to 70 degrees. Your wall has 1" (R-6) of CCSPF and an R-13 fiberglass batt. The interface temperature THAT DAY would be:

70 – [(70-30) X (13/19)] **OR** *70 – (40 x .6842)* **OR** *70 – 27 OR 43 degrees*

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This seems complicated, but it's common sense. If you had R-20 of any insulation in an air tight cavity, the temperature at the midway point of that insulation will be halfway between the inside and outside temperatures.

In designing a wall system for our climate we use the average temperature of the three coldest months of the year. For Buffalo, NY those months are Dec (29.1), Jan (23.6), and Feb (24.5). Various indoor temps and R-values can be plugged in to this formula to reach a conclusion for your specific conditions.

The dew point temperature is a big complicated formula that we won't get into here, but it's basically a function of indoor temperature and relative humidity. The easiest thing to do for purposes of this exercise is go to the Internet and find a site where you can punch in temperature and humidity and it spits out an answer for you like www.dpcalc.org

The table below represents several scenarios we could see in the Buffalo climate and the minimum foam thickness needed to keep the interface temperature above the dew point. The highlighted rows are most typical for our region in winter.

Indoor Temperature	Relative Humidity	Dew Point Temperature	Interface Temperature	CCSPF Required
75	50	55	55.6	3.2"
75	45	52	55.6	2.4"
75	40	49	55.6	1.9"
75	35	45.5	55.6	1.5"
70	50	50.5	52.6	2.7"
70	45	47.7	52.6	2.1"
70	40	44.6	52.6	1.6"
70	35	41	52.6	1.1"
65	50	45.9	49.5	2.3"
65	45	43.1	49.5	1.8"
65	40	40	49.5	1.3"
65	35	36.7	49.5	1.0"

This table assumes fiberglass R-value of R-13 and an "aged" R-value for CCSPF of 6.2 per inch. These are typical. Also keep in mind that putting more than 2" of CCSPF would require a 2x8 cavity since a 2x6 is 5.5" deep and an R-13 fiberglass batt is 3.5" thick.

R-Value Roulette

So now we get back to what Energsmart calls R-value roulette. You can see from the table above that the amount of CCSPF is all over the board. Realistically, most homes need in that

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1”-2” range. It may be tempting to install down toward an inch because of your current heating habits (and because it’s cheaper), but you should keep an eye on the future. Maybe your wife will turn your house into a greenhouse, or maybe you’ll get older and prefer a higher thermostat setting. At the end of the day, putting in less than 2” of CCSPF carries a risk that is not worth the money you’ll save on insulating your home. Some contractors who install a thin coat of CCSPF claim there is no moisture risk because they install a second vapor barrier (plastic sheeting) on the inside of the fiberglass, thus sandwiching the fiberglass with vapor retarders on both sides. This is allowed by most building inspectors, but is a disaster waiting to happen. In theory, it would work fine if the barrier was continuous, but in reality that’s not possible. Plastic sheeting isn’t made to fit your wall so it has to be cut to size and pieced together. Unless every one of these joints is taped, it provides a path for moisture. The plastic is stapled to the framing of the house creating more gaps. Finally, plugs and switches on the wall provide gaping holes in the plastic. It may not seem like much, but a simple 1”diameter hole has the ability to let 50 cups of water into a wall system per year! Once in the wall it will stay there because it will drive toward the relatively cool outer wall. A good way to think of this without getting too technical is to think of your wall system as a tea kettle. The interior of your home is like the inside of the tea kettle and a plug or switch is like the cap of the tea kettle. As air is heated in a home it will increase in pressure (Chemistry - Charles’s 2nd Law). The laws of thermodynamics take over at that point and warm/high pressure air will seek cooler/low pressure air. If the foam is thick enough in the FAB system you will have no problem, but if it’s too thin, you could be in for a lot of costly headaches. We have firsthand knowledge of this in our region (see the “Problems We Fix” area of our picture gallery)

Once CCSPF reaches the 2” depth in walls the thermal efficiency is almost maxed out, meaning adding additional Rs will make the building more efficient, just not that much. Any fiberglass installed over foam will also not have a proper fit since foam isn’t perfectly flat. For the cost of putting in an R-13 batt, you could buy another half inch of CCSPF and you could build with 2x4s. Your return on investment (ROI) will easily be higher.

Another good idea is to use 2x6 walls and fill them entirely with open cell foam (R-21). The cost of that insulation would be equal to the cost of the 2” closed cell and R-13 fiberglass combo. This approach is a flow through design that allows moisture to move in the appropriate direction depending on the season. It is a very effective and completely acceptable solution for our mixed climate.

So if the FAB approach isn’t the best solution, why is it offered by some companies? Good question, but an easy one to answer. The companies offering FAB packages are typically larger fiberglass companies relatively new to foam who have finally figured out that foam is here to stay. In the foam world they have trouble competing against high volume foam companies like Energsmart that only install foam. They’re the kings of fiberglass, but very ordinary when it comes to foam. The only way to offer what the market wants (foam) AND hold onto their market share, is to offer a combo system that keeps their dying product (fiberglass) around as long as they can.

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Conclusion

In conclusion, FAB systems are better than no foam at all, but make sure you hire someone that knows what they're doing or you'll regret it. Use the foam depth guidelines we discuss above. There are some companies out there that put a VERY thin coat of foam on because they focus on the air-sealing benefit of foam and disregard the conduction and moisture dimensions of the products in the FAB system. Although we at Energsmart feel that the FAB system is inferior to foam alone, we would be happy to quote that system for you; however, our quote will reflect adequate foam depths we discuss above such that we will not expose ourselves or our customers to foolish risks. If you decide to do a FAB system with others, just insist on using the guidelines above and make sure your contract has the specific depth of foam (in inches) and R-values expressed in "AGED" R-value terms.

A Note on Attics

When these hybrid systems are used on attic floors, they are much less risky than the wall systems. When installing foam on the floor of a cold attic system in conjunction with blown fiberglass or cellulose on top, moisture is not as much of a risk because the vapor barrier (foam) is on the correct side for our climate. It should be noted though that this system is less efficient than all foam because air currents in the attic (both in summer and winter) will freely circulate to some degree through the fiberglass or cellulose layer robbing you of expensive energy.

The FAB system can be used in the roofline, but similar to using it in walls, you must be careful that the interface temperature is not too low. The R-value of a roof assembly will presumably by higher than that of a wall, so 2" of closed cell would result in an interface temperature that is too low and could result in condensation. For example 2" of foam (R-13) and R-39 of fiberglass, on a 10 degree day would give an interface temperature of around 25 degrees, a temperature which would result in condensation in just about every home around here.

This is big time energy nerd stuff and is complicated, so don't hesitate to ask the professionals at Energsmart if you have any questions!

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