Air Barriers, Vapor Retarders, & SIPs

INTRODUCTION

Different building envelope systems have unique characteristics and SIPs are no different. In the case of air infiltration and water vapor diffusion control, the properties integral to SIPs provide an opportunity to simplify the envelope design.

AIR INFILTRATION

All new, climate controlled buildings must be designed to control & limit air infiltration so energy consumption can be controlled and reduce the risk of durability problems. This is one of the great strengths of SIPs and a property we've worked hard to improve and make robust.

Intuitively, one can see that the rate (volume per time) air leaks through a solid block of plastic foam is very small. Testing has confirmed that, in architectural applications, the air infiltration rate through the middle of a SIP is so small that it can be safely be neglected. Predictably, the air-infiltration-control steps that must be taken for SIP envelopes revolve around the joints between SIPs and other materials and between the SIPs themselves.

All of the typical Foard Panel SIP joinery details have been intentionally developed to effectively prevent air leakage while also being easy to assemble correctly in the field. As you can imagine, these two goals don't always fit together easily. While an amount of care must be taken with any air sealing process, blower-door-testing and dozens of on-site investigations have confirmed that properly installed SIPs can easily function as the buildings only air infiltration control mechanism (in the SIP-only sections of the envelope, of course).

We haven't been able to document any improvement in air infiltration performance when an additional air control membrane is installed in SIP envelopes. In heating climates, an interior-side air control layer won't hurt anything, but is generally redundant. Exterior-side air control membranes (in heating climates) actually increase the risk of durability problems on any low-heat-loss building by reducing the exterior sheathing's ability to dry. This research is part of what informed our recommendation of old-school tar paper.

WATER VAPOR CONTROL

The most permeable SIP we make with any regularity (4.5” EPS SIP) is 0.58 perm[1] All panels thicker than 4.5” and/or with XPS, Neopor, & polyiso cores are noticeably less permeable.

As one would expect, the permeance of the panel joinery can't be ignored. SIP-to-SIP connections with surface splines (no wood penetration through the core's thickness) maintain these same perm values because the sealant we use is less permeable than EPS and, when installed properly, penetrates nearly to the full thickness of the core.

1 Calculated from the ASTM E96 values of the individual components. Core permeance data is listed on Foard Panel Data Sheets. OSB permeance data is available in J450 (APA, The Engineered Wood Association, Feb. 2009)

The permeance of other types of SIP joinery that involve full-depth lumber are controlled by the OSB skins and the lumber itself. The interior 7/16" OSB SIP skin alone has a permeance of less than 2.5 under typical indoor, winter conditions[1]. As can be seen in our details, the joint between the lumber and SIP core are sealed with very low-perm materials and, depending on the type of wood used in the joint (often engineered lumber) the structural spline contributes to lowering the permeance of the joint. Finally, depending on the project, we often specify air and vapor resistant tape be applied over the interior side of structural-spline-joints as an additional safeguard against the risks of air infiltration and water vapor diffusion.

CONCLUSION

Adding air control layers and/or vapor control membranes to a Foard Panel SIP envelope is generally redundant and, in the case of cold-side layers, can actually reduce the durability of the building. If there are any questions regarding a particular project or assembly, please feel free to contact me or any Foard Panel project manager.

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1 APA-The Engineered Wood Association, document J450, Feb. 2009, Figure 1.