Building Science Corporation

December 8, 2023

No-Burn ThB Spray Seal™ as a Class II Vapor Retarder, Thermal Barrier, and Ignition Barrier

Spray Foam Guidelines & Application Examples

Overview

Spray foam insulation has significant advantages over other insulation systems due to the spray foam ability to provide continuity of the water control, air control, vapor control and thermal control layers necessary for environmental separation. Using spray foam results in low exterior air leakage that provides significant energy efficiency and significant sound attenuation. Using spray foam results in excellent vapor control and thermal efficiency.

Walls

The most common residential wall is a wood frame wall with wood based sheathing. The wood based sheathing has a water control layer installed on its exterior surface. A cladding is installed over this water control layer. An air gap is provided between the cladding and the water control layer to provide drainage of rainwater that penetrates the cladding. The cavity insulation can be low density open cell or high density closed cell spray foam. Both foam types work in all climates. As long as spray foam is sprayed to the minimum depth classified as an air impermeable insulation, the foam does not need to completely fill the cavity. In the International Energy Conservation Code (IECC) Climate Zones marine 4, 5 and higher, high density closed cell spray foam qualifies as a Class II vapor retarder at 1.5". Low density open cell spray foam can be utilized with an interior vapor retarder to control condensation. This interior vapor retarder should be a spray applied vapor retarder such as No-Burn ThB Spray Seal™ (Figure 1). The water control layer can be a housewrap, a building paper, a fluid applied membrane, a fully adhered synthetic membrane, or it can be a coating that comes on the wood based sheathing from the manufacturer. The water control layer in this type of wall should not be a vapor barrier – it should be semi vapor permeable – greater than 5 perms. Interior vapor barrier coatings on the gypsum board such as vinyl wallcoverings, oil or alkyd paints should be avoided. The air gap behind the cladding can be provided by using a textured housewrap, a drainage mat or furring strips at least 3/16 inch thick. Sill gasket is an effective furring strip.

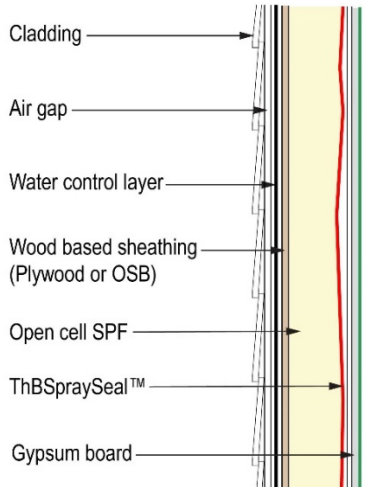

Figure 1

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Roofs

The most common residential roof is an attic that is wood framed, typically using trusses. It can be either an unvented conditioned attic or a vented unconditioned attic. Unvented conditioned attics are common in warm climates where basement construction is not common. The absence of basements typically results in mechanical systems and ductwork being located in attic spaces. Locating mechanical systems and ductwork in vented unconditioned attic spaces is a large thermal penalty, and in hot humid and mixed humid climates results in significant condensation issues. Vented unconditioned attics are common in cold climates where basement construction is typical. Mechanical systems and ductwork in cold climates are typically located in basements and interior floor framing rather than in attics, avoiding associated large thermal penalties.

Unvented conditioned attics can be constructed by installing low density open cell or high density closed cell spray foam directly to the underside of the roof deck. Both foam types work in all climates. In IECC Climate Zones 5 and higher low density open cell spray foam can be utilized with an interior vapor retarder (Class II) to control condensation. This interior vapor retarder should be a spray applied vapor retarder such as No-Burn ThB Spray Seal™ (Figure 2). Note that in many jurisdictions a thermal and ignition barrier coating may also be required. No-Burn ThB Spray Seal™ also satisfies this requirement.

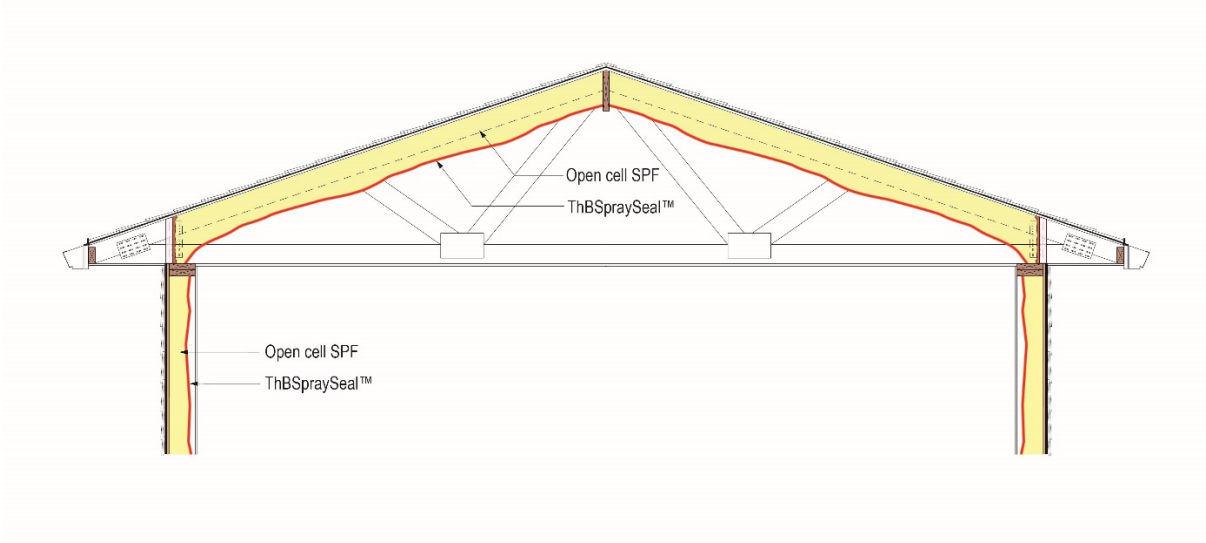

Figure 2

Foundations

Basement foundations are best insulated on the interior thereby avoiding issues with respect to insects such as ants and termites, issues with respect to protecting exterior insulation during the construction process, and protecting exterior insulation above grade during the life of the building.

Spray foam insulation can be directly applied to the interior of concrete foundation walls. High density closed cell spray can be used in all IECC climate zones. Low density open cell spray foam can be utilized in all climate zones with an interior vapor retarder (Class II) to control condensation. This interior vapor retarder should be a spray applied vapor retarder such as No-Burn ThB Spray Seal™.

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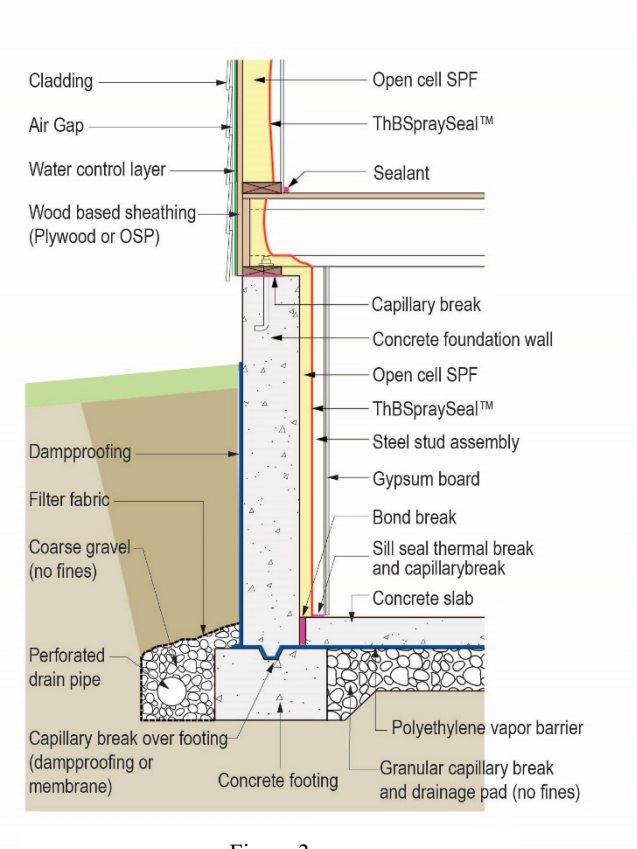

Figure 3

There are two common crawlspace foundation approaches - the crawlspace is either "vented" and "not conditioned" and connected to the "outside"…or…the crawlspace is "not vented" and "conditioned" and connected to the "inside". Of the two approaches, the most energy efficient is the not-vented conditioned approach. However, not all sites are compatible with not-vented conditioned crawlspaces such as areas with high water tables, swamps and flooding concerns.

Conditioned crawlspaces should be constructed as "mini" basements and completely connected to the house (Figure 4). Low density open cell spray foam can be utilized in all climate zones with an interior vapor retarder (Class II) to control condensation. This interior vapor retarder should be a spray applied vapor retarder such as No-Burn ThB Spray Seal™. Note that in certain jurisdictions such as Georgia a termite inspection strip (or gap) must be provided (Figure 5).

Conditioning is provided by air change between the crawlspace and the house or by dehumidification.

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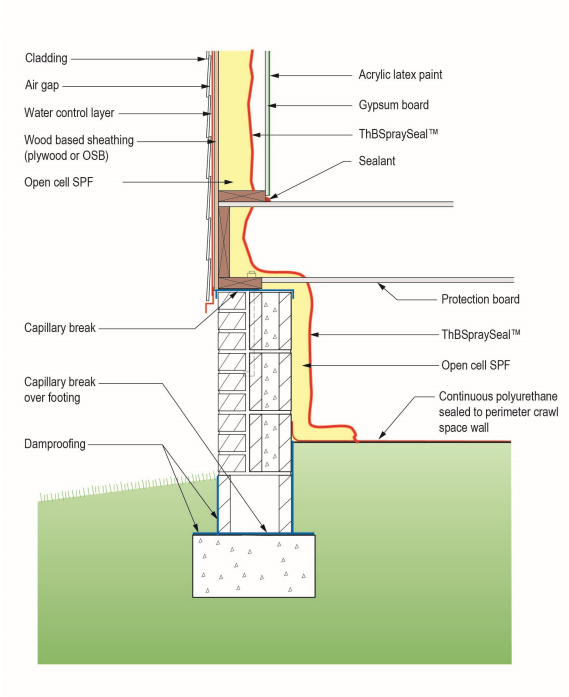

Figure 4

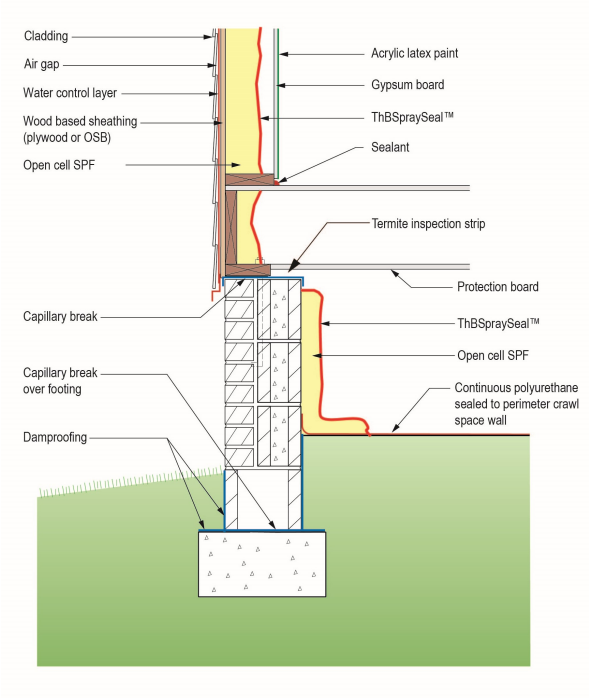

Figure 5

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Conclusion

Interior spray applied vapor retarder such as No-Burn ThB Spray Seal™, as a result of testing, product evaluation, and observations can serve as a Class II vapor retarder, and Class II vapor retarder with thermal barrier or ignition barrier protection all in one application, depending on the need.

Joseph Lstiburek, Ph.D., P.Eng.

Notes for Figures

Figure 1: Common residential wall using low density open cell spray polyurethane foam (SPF).

Figure 2: Unvented conditioned attics can be constructed by installing low density open cell or high density closed cell spray foam directly to the underside of the roof deck.

Figure 3: Spray foam insulation can be directly applied to the interior of concrete foundation walls. Where low density open cell spray foam is installed an interior Class II vapor control layer is required .

Figure 4: Conditioned crawlspaces should be constructed as “mini” basements and completely connected to the house.

Figure 5: Crawlspace termite inspection strip or gap.

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