CENTRIA
EXPERT ANALYSIS

Date: 10/30/19
Memo # EA 19-04
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Insulated Metal Panels, Continuous Insulation and the Energy Code

Overview

Insulated metal panels (IMPs) are not considered continuous insulation. Continuous Insulation is defined by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1-2016 as "insulation that is uncompressed and continuous across all structural members without thermal bridges other than fasteners and service openings." There are not any IMPs on the market today that will meet this definition due to the product's formed sidejoint that encroaches into the foam thickness. IMPs, by code, are not even considered insulation. According to ASHRAE 90.1-2016, IMPs are considered a building material.

> **Building Material:** any element of the building envelope, other than air films and insulation, through which heat flows and that is included in the component U-factor calculations.

CENTRIA IMPs provide a complete barrier wall while functioning structurally, as well as thermally.

The Path to Code Compliance

The ASHRAE definition for "Building Material" is useful to understanding the path to code compliance using IMPs because there are common misconceptions that continuous insulation is required to meet code or that IMPs are considered continuous insulation. Continuous insulation is not a code requirement. Referencing ASHRAE 90.1-2016, Section 5.5.3, code compliance can be demonstrated using two methods:

a. "Minimum rated R-value of insulation for the thermal resistance of the added insulation in framing cavities and continuous insulation only…"
b. "Maximum U-factor, C-factor, or F-factor for the entire assembly…"

Using the Prescriptive Building Envelope Option, specifically Maximum U-factor, we can show that IMPs alone can be used to show energy-code compliance. CENTRIA publishes U-factors for each IMP based on ASTM C1363 testing in accordance with ASHRAE 90.1-2016 Section A9.3.2.

Table 5.5-5, herein Figure 1, from ASHRAE 90.1-2016 provides an example of building envelope requirements for climate zone 5. This table provides assembly maximum U-factors and minimum R-values for cavity insulation used in combination with continuous insulation. The required maximum U-factor for IMPs is listed under "Steel Framed," when installed over coldformed metal studs, and "Mass," when installed over cold-formed subgirts over masonry. Either option can be used to show energy-code compliance.

Table 5.5-5 Building Envelope Requirements for Climate Zone 5 (A,B,C)*

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**	**Assembly Maximum**	**Insulation Min. R-Value**
Roofs						
Insulation Entirely above Deck	U-0.032	R-30 c.i.	U-0.032	R-30 c.i.	U-0.063	R-15 c.i.
Metal Building[a]	U-0.037	R-19 + R-11 Ls or R-25 + R-8 Ls	U-0.037	R-19 + R-11 Ls or R-25 + R-8 Ls	U-0.082	R-19
Attic and Other	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
Walls, above Grade						
Mass	U-0.090	R-11.4 c.i.	U-0.080	R-13.3 c.i.	U-0.151[b]	R-5.7 c.i.[b]
Metal Building	U-0.050	R-0 + R-19 c.i.	U-0.050	R-0 + R-19 c.i.	U-0.094	R-0 + R-9.8 c.i.
Steel Framed	U-0.055	R-13 + R-10 c.i.	U-0.055	R-13 + R-10 c.i.	U-0.084	R-13+R-3.8 c.i.
Wood Framed and Other	U-0.051	R-13 + R-7.5 c.i. or R-19 + R-5 c.i.	U-0.051	R-13 + R-7.5 c.i. or R-19 + R-5 c.i.	U-0.089	R-13
Wall, below Grade						
Below Grade Wall	C-0.119	R-7.5 c.i.	C-0.092	R-10 c.i.	C-1.140	NR

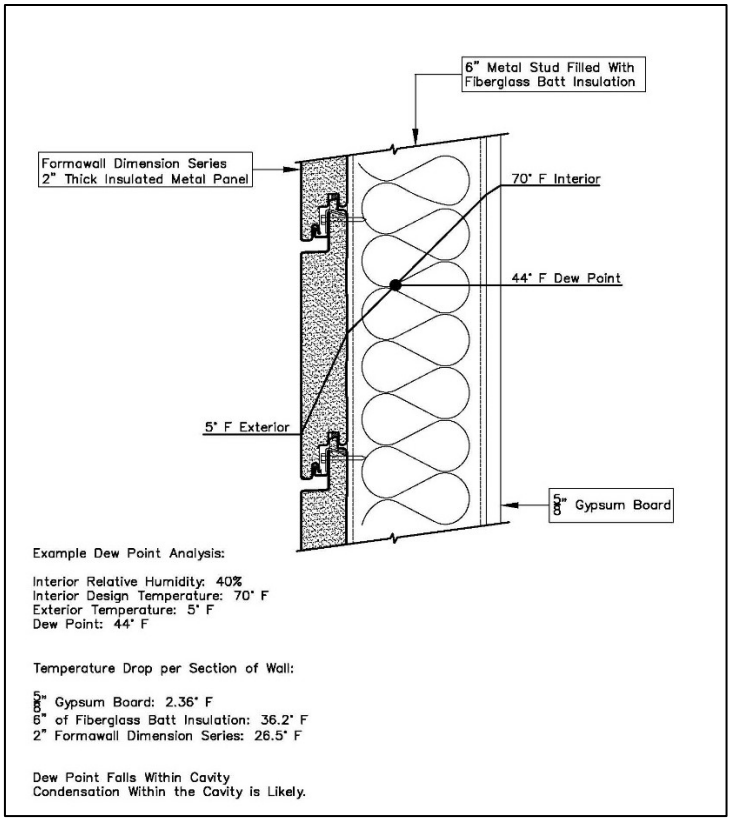
Figure 1

Design Concerns with Code Misconceptions

As noted, IMPs are not in strict compliance with the ASHRAE definition of continuous insulation because of the panel's side joint. CENTRIA IMPs are designed and detailed with this side joint to provide dimensional tolerance and to accommodate building movement. Without the side joint, the panel would not function properly as a building material.

The confusion with the code regarding continuous insulation can lead to poor wall section designs. When IMPs are mistakenly considered to be continuous insulation, typically batt insulation is added within the framing cavities. This additional insulation cools the interior liner side of the panel and, therefore, changes the location of the dew point. The dew point is the temperature at which condensation occurs.

The dew point falls within the IMP when no batt insulation is added within the framing cavity under normal building conditions. When the dew point falls within the panel, no condensation can occur because the closed-cell foam core is skinned with impermeable metal sheets. When batt insulation is added behind the panel, the dew point could potentially fall within the cavity and cause condensation resulting in issues such as reduced thermal efficiency due to wet insulation and potential mold growth.



The dew point location is a function of the design of the wall cross section, the climate of the building location, and interior design temperature and relative humidity. Adding insulation behind the IMP system not only increases construction costs but can lead to potential design problems. As a best practice, CENTRIA does not recommend additional insulation behind our IMPs. If insulation is included within the framing cavity behind an IMP, the project mechanical consultant must verify that the wall assembly dew point does not migrate into the framing cavity but remains within the IMP.

An example dew point analysis and diagram are provided in Figure 2 to illustrate the concern with adding insulation behind CENTRIA IMPs.

IMPs vs Continuous Insulation

A building can be energy-code compliant using IMPs alone or continuous insulation with cavity insulation. From a design and installation standpoint, which is better?

Building envelope design can be complicated. Wall assemblies must provide continuous water, air, vapor and thermal barriers to function effectively for the life of the structure. The location of the continuous barriers can also vary in multiple component wall assemblies, i.e. wall assemblies that use continuous insulation. The number of barriers may also vary depending on the climate where the building is located. Multiple component wall assemblies can be difficult to install considering that barriers at different locations will at some point need to integrate with other building elements and that multiple trades may be installing individual components of the wall assembly.

What about thermal considerations? Continuous insulation is typically installed using carbon steel thru-fasteners at 16” on center, in a grid pattern. Additionally, exterior cladding supports are then installed on the face of the insulation using more thru-fasteners to the structure beyond. It is not unreasonable to assume that the effective R-value of the building envelope is reduced significantly, especially when attaching to light-gauge steel studs.

With multiple component wall assemblies, barrier location, barrier tie-ins, and thermal bridging can be problematic. Many of the difficulties when using multiple component wall assemblies are eliminated or greatly reduced when using IMPs. With IMPs, the barrier locations are consistent. The water barrier is always located at the face of the panel. The air and vapor barriers are always located at the liner side of the panel. Barrier tie-ins are simple with IMPs when compared to multiple component wall assemblies. Additionally, a single manufacturer and installer are responsible for wall assembly performance.

IMPs may also present difficulties with thru-fasteners at the panel clip location. Thermal bridging with the panel fasteners, however, is minor when compared to continuous insulation. IMPs do not require a 16” grid of fasteners or additional thru-fasteners for cladding support. Additionally, CENTRIA IMPs are installed using stainless steel fasteners which are less thermally conductive when compared to carbon steel fasteners.

Conclusion

In summary, CENTRIA IMPs are thermally efficient building materials that can be used alone to meet energy code requirements for all climate zones within the United States. For wall assemblies utilizing IMPs, continuous barriers are easily created using standard details while installation time of a wall assembly is drastically reduced, when compared to multiple component wall assemblies. IMPs are truly an all-in-one-solution.

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Appendix

ASHRAE 90.1-2016