Insulation Systems: Understanding the Differences

By Casey Harkins

Not all so-called "filled cavity" assemblies are equal

Increased stringency in energy codes is effectively requiring insulation installation techniques that fill the cavity in metal building roofs with insulation. Not all so-called "filled cavity" assemblies are equal.

The most popular and frequently specified method for filling the cavity with insulation is the liner system. These systems feature a continuous vapor retarder fabric made to fit an entire bay, which is installed entirely below the purlins, isolating them from the conditioned space. Unfaced insulation is installed atop the fabric, filling the cavity between the fabric and roof panel.

Another system often described as a filled cavity system is the long tab or banded system. This system utilizes laminated insulation installed parallel to the purlins with extra long facing tabs which must be adhered to the tops of the purlins, suspending the insulation in the cavity between the purlins, leaving the purlins themselves exposed to the conditioned space. Both of these systems nominally fill a cavity; however, there are substantial differences between these systems which are important to understand.

Performance Values

While there are thermal performance values offered in the industry that suggest similar performance between these systems, these values assume the long tab systems are in perfect contact with the purlins, preventing conditioned air from circulating around the purlin. In reality, gaps between the facing and the purlin will substantially degrade its thermal performance. Citing an ISO Standard relating to partially ventilated cavities, the ASHRAE SSPC 90.1 committee has taken the position that the performance of the long tab assembly will begin to drop when a gap exceeds 2-mm and will drop substantially when a gap exceeds 10-mm. Rafter flange bracing, purlin lap bolts, conduit or other attachments to the purlin webs will create gaps exceeding this threshold, significantly degrading the performance. For an R-19+R-11 system in a standing seam roof with a thermal spacer block, a liner system has been shown to perform at U-0.035, while a realistic long tab system will perform around U-0.046, roughly 25 percent worse than the liner system with the same nominal R-value.

Current generation codes prohibit insulation from being substantially compressed by bracing. In a liner system, unfaced fiberglass can easily be cut to fit around between purlin bracing. In the long tab system, proponents argue that installers must pull the insulation entirely below the bracing in order to cut the fiberglass to fit around the bracing without cutting through the facing itself. The exact procedure for this is unclear, but the proponents insist if it is not installed in this manner, it is not being installed correctly.

Sizes

Using a single continuous piece of fabric in the liner system limits field sealing of the fabric to the perimeter of a bay. In a 100- by 25-foot bay with purlins spaced nominally 5-foot on-center, a liner system will require 250 feet of fabric to be sealed on-site. A long tab system requires two tabs to be handled for the entire length of each purlin in addition to the perimeter and any insulation butt joins. A long tab system in the same bay will require 1,050 feet of facing tabs to be handled in addition to the 250-foot perimeter, over 500 percent more than the liner system.

Both systems are supported by steel strapping perpendicular to the purlins, with optional strapping running parallel to the purlins to form a strapping grid. In the liner system, the strapping supports the fabric which in turn supports the insulation, allowing a much wider spacing of straps. The long tab system requires a narrower strap spacing to support the insulation directly, leading to more straps and more fasteners attaching those straps to the purlins. In the 100- by 25-foot example bay, a liner system supported by three straps would require 300 feet of strapping attached using 66 fasteners. A long tab system supported by nine straps 30 inches on-center would require 900 feet of strapping attached using 198 fasteners, 300 percent more than the liner system.

OSHA Regulations

OSHA regulations prohibit walking on the purlins for the purposes of installing insulation, regardless of whether fall protection is being used. This makes it impractical to install the long tab insulation from the leading edge while the roof panels are being installed, instead requiring the insulation to be installed from a lift or temporary bridging spanning the bay. The fabric platform in a liner system allows insulation to be easily installed from the top side in conjunction with panel installation. Variations of the liner system are available that further offer fall protection after the fabric platform is installed.

While both the liner system and long tab assemblies fill a cavity with insulation, there are significant differences between these two systems. Understanding these differences is critical to making an informed decision on which system to use in your project. MCN

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Comparison Summary Chart:

	Liner System	Long Tabs/Banded System
Between Purlin Bracing:	Unfaced insulation can be cut from top side to fit around.	Faced insulation must be pulled below and the fiberglass cut to fit around the brace.
Field Sealing: (example 100' x 25' bay)	250 linear foot perimeter	1,050 linear feet of tabs + 250 linear foot perimeter
Strapping: (example 100' x 25' bay)	300 linear feet	900 linear feet
Fasteners: (example 100' x 25' bay)	66 fastening points	198 fastening points
Install From Leading Edge:	Yes	No
Thermal Performance: (U-factor & Installed R-value)	U-0.035 R-28.6	U-0.046 R-21.7
Roof Assembly:	R19 + R11 Standing Seam Roof with Thermal Spacer Block	

Liner system roof assembly (left) shows single piece vapor retarder encapsulating purlins versus long tab assembly (right) shows each vapor retarder sealed atop framing, leaving purlins exposed.