Changes Coming in Metal Building Insulation for Roofs and Walls

Prescriptive Requirements

By Brad Rowe

The U-factors for metal building insulation assemblies have been a hot topic in the recent code development cycles within the American Society of Heating, Refrigeration and Air-Conditioning Engineers, based in Atlanta, and International Code Council, Washington, D.C. As the construction industry leans toward the desires of the market to build more energy-efficient buildings, it is inevitable that the prescriptive requirements to insulate metal buildings will change with the next publication of both codes, Standard 90.1-2010 and IECC 2009.

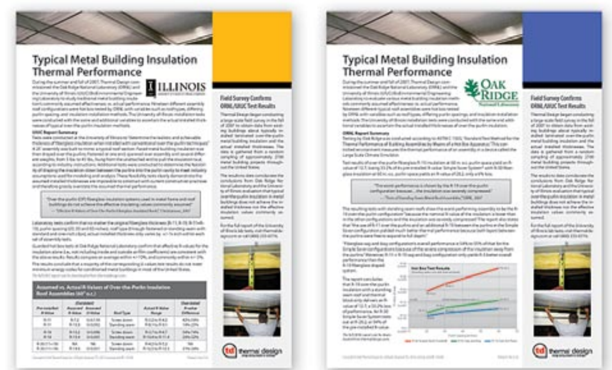
The ASHRAE 90.1 Standard, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, is typically published every three years. The next publication, Standard 90.1-2010, is targeted to achieve a 30 percent energy savings over the 90.1-2004 Standard. One area that the Building Envelope Committee is relying on to reach this goal is metal building insulation for roofs and walls.

Since 2004, buildings that are categorized "Insulation Above Deck" have increased in insulation stringency by nearly 30 percent; "Attic & Other" buildings have increased by more than 40 percent. Metal buildings R-values, however, have stayed unchanged since 1999. The committee is considering modifications that show about 20 percent lower U-factor (higher installed R-value) averaged throughout climate zones 2 to 8 for conditioned buildings for 90.1-2010. There is also a possibility that the U-factors may become even lower than the current modifications because the committee is evaluating various insulation systems available on the market today.

ICC is also committed to save more energy in the next version of its code, IECC 2009. In fact, at the IECC Code Development Hearings held in February, IECC committee members heard a proposal by the Metal Building Manufacturers Association, Cleveland, to increase the stringencies for metal buildings in hopes to achieve approximately the same 20 percent U-value reduction as ASHRAE 90.1-2010.

It is yet to be determined what insulation assemblies will be described in the codes to achieve the new U-factors, however, the traditional method will not meet the new thermal performance requirements for conditioned spaces. This method uses single-layer fiberglass rolls installed perpendicularly over the purlin—compressing the insulation when the metal panels are installed—negating the effects of using greater pre-installed thicknesses. The prescriptive approach would most likely require the equivalent of two layers of uncompressed fiberglass installed in the roof and continuous insulation in the walls, in addition to the existing single laminated fiberglass rolls.

Members of the ASHRAE's 90.1 committee and IECC committee have recently questioned the validity of "traditional" metal building insulation performance from installation methods. The



The Oak Ridge National Laboratory standing-seam hot box testing report summary and University of Illinois typical over-the-purlin installed thickness study summary are available at www.thermaldesign.com.

U-factors and the insulation assembly descriptions that both code standards use are supplied by the North American Insulation Manufacturers Association, Alexandria, Va., and have been used in the ASHRAE Standard 90.1 since 1999. These U-factors are listed in NAIMA's publication "ASHRAE 90.1 Compliance for Metal Buildings (MB304)" and are derived from a finite element analysis report completed in the late 1990s.

Unfortunately, the only documentation remaining is a summary report of the analysis that lacks the calculations and thickness assumptions from which the report was generated. Apparently this crucial information does not exist and is not subject to peer review. A recent report published by Oak Ridge National Laboratory, Oak Ridge, Tenn., using the ASTM C1363 Hot Box Apparatus testing method, shows its latest over-the-purlin test results contradict NAIMA's MB304 values by about 20 percent (www.thermaldesign.com/results/). This leaves an enormous gap between reality and published performance values of assemblies currently embedded in both energy codes.

To achieve the thermal performance (U-factors) of the insulation assemblies listed within each code, one must first quantify how well the insulation is performing and what nominal thickness needs to be achieved after installation so the insulation can perform as expected. There is little guidance from NAIMA about the thicknesses required throughout the purlin cavity and no instruction how to install the over-the-purlin insulation to achieve the desired thicknesses required to achieve the advertised performance. NAIMA's publication "Recommendations for Installing Fiber Glass Insulation in Metal Buildings (MB316)" is limited and confusing when it comes to details regarding "over-the-purlin" methods.

MB316 mentions keeping tension on the insulation when rolled out perpendicular over the purlins while the roof deck is attached. This prevents excessive drape between the purlins that could result in large voids between the insulation and roof deck. However, these recommendations also state: "Do not overstretch the insulation. This can result in over-compression and reduced R-value." There is apparently a fine line between tension and compression. These instructions are vague and confusing enough to put the burden of interpretation on the contractor. NAIMA needs to guide designers, contractors, erectors and professional organizations, such as MBCEA, by clearly defining the installed over-the-purlin insulation thickness required across the various purlin cavities after typical installation and to provide practical instruction of achieving those thicknesses.

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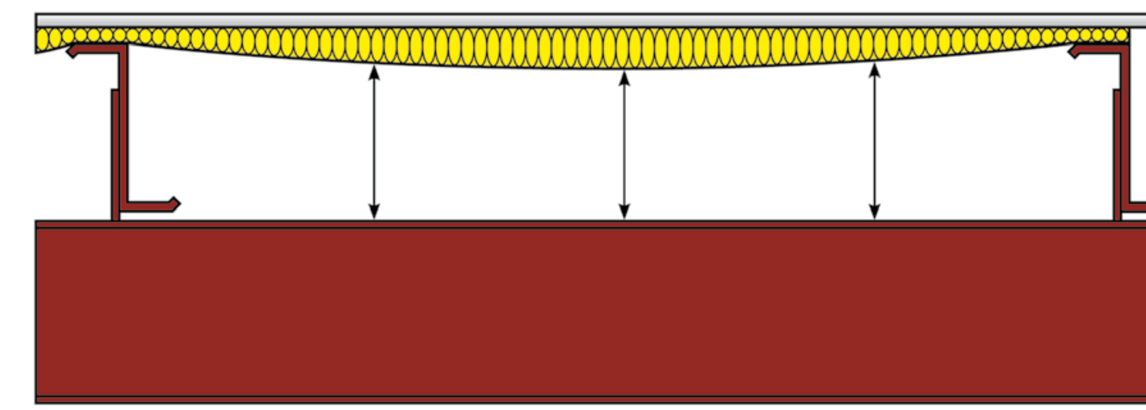
All project insulation specifications should reflect the installed assembly R-value (overall U-factor) intended for the building. If the installed insulation does not have verified performance values based on field verification and hot box testing or modeling based on hot box testing of field representative assemblies, those projects may not meet current energy code levels. The misleading and ineffective nature of the over-the-purlin method is an excellent opportunity for the building community to explore other options available on the market today. Consider the installation processes for the products you are specifying, realizing that certain installation methods will not deliver the intended performance and not meet minimum code requirements. MBD



A cross section of typical over-the-purlin insulation with arrows showing the center- and quarter-points of the purlin cavity. Along with a pin probe test at the purlins, these points aid in measuring the average insulation thickness.

A typical over-the-purlin insulation installation photo, taken for a field measurement survey.

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