

Metal Building Insulation Design

What Happens to the R-value You Specify?

By Meghan Richards

It comes as no surprise that energy costs continue to rise. The great news is that some of the main topics of conversation in the construction industry today focus on energy efficiency and sustainable design. Architects are instrumental in helping contractors and building owners understand in-place R-values, the effects of thermal bridging and how insulation can effectively be used in metal buildings.

Specifying Insulation

Architects, contractors and builders can agree that insulation is a key element in making structures energy efficient. However, there are many times when a contractor is unsure of how to achieve the R-value that an architect specifies on a project. With increased R-values becoming commonplace in metal buildings, the contractor and building owner need to work closely with the metal building manufacturer to make sure the building is designed to accommodate the insulation system specified.

For example, if an R-38 (12-inch [305-mm]) insulation system is specified and the building manufacturer is figuring an 8-inch (203-mm) purlin and a screw down roof, the insulation will be compressed so much that the owner will not be getting the full value of the insulation purchased. There are several options at this point. The contractor can talk to the metal building manufacturer about increasing the depth of the purlin or changing the roof to a standing-seam roof with a stand-off clip. Either of these will significantly increase the building cost. Another option is to utilize an insulation system that has a lower layer that drops below the purlin cavity. This option has a two-fold benefit. First, it allows for the additional insulation to be added to the building without compromise to the R-value, and second, it covers the purlins so the cost of painting the purlins will not be incurred.

In-place R-values

A more recent issue that has come to the forefront of the insulation industry is the question of

in-place R-values. There are very few insulation systems that have been ASTM 1363 Guarded Hot-Box Tested, a process that verifies the in-place R-value of an insulation system. While architects are very aware and understand the significance of in-place R-values, it can easily be lost in translation in the specifications for a project. Contractors and building owners need to be aware that the stated R-value on the package of blanket insulation is rarely the same R-value when it is installed. For example, the R-value of a 6-inch (152-mm) blanket insulation laminated to a vapor retarder in the package is R-19. When it is installed in a building over the purlins and under the roof sheet, the in-place R-value turns out to be about a 10 because of compression.

Thermal Bridging

A very important element to understand in a metal building is thermal bridging. The main

thermal bridge in a metal building is the connection between the roof sheet and purlins/bar joists. Certainly in older structures and, unfortunately, in many metal buildings built today, insulation is compressed between the purlins and roof sheet. As discussed earlier, this severely compromises the thermal value of the insulation.

There are many insulation systems available that are a vast improvement compared to the over-the-purlin method. However, the insulation systems that fill the cavity between the purlins still do not completely isolate and stop the flow of heat and cold through the roof sheet and purlins into the building. A lower layer of insulation beneath the purlins/bar joists will eliminate nearly all the thermal bridging that occurs in a structure.

Energy Efficiency in Existing Buildings


The focus on "building green" has infiltrated the new construction market but has yet to find direction in the existing building sector. Much of this is because of a lack of understanding and knowledge about companies across the country that specialize in retrofit applications.

Owners of existing structures are more and more seeking the recommendations of their local construction companies or architects for information about how to add insulation, improve their lighting efficiency, improve their HVAC units to save on operating expenses



and to do their part in lowering dependence on nonrenewable resources.

Adding insulation is a cost-effective way for an existing facility to increase energy efficiency. To reiterate what was mentioned previously, the key is to not only find a company that specializes in retrofit insulation applications, but one that has a system that takes thermal bridging reduction into account. A retrofit insulation system that has a lower layer of fiberglass blanket insulation installed underneath the purlins and/or structural steel actually encapsulates the bottom of the purlins and eliminates the effect of thermal bridging in a structure.

Further incentive to make improvements in existing structures can be found in the Energy Policy Act of 2005, which allows tax deductions for improving the energy efficiency of the building envelope, lighting and HVAC. Many utility companies across the country are also offering rebates or distribution funds to building owners looking to improve the overall energy efficiency of their structures. Web sites, such as www.energystar.gov and www.dsireusa.org, are excellent resources. 

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