

# Reflective Insulation in Metal Building Systems

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**M**etal buildings are growing in popularity across the country because they are inexpensive, easy to install and provide a large, versatile space for commercial, agricultural or industrial use. Unfortunately these metal building systems are notoriously difficult to insulate because of the enormous amount of summer radiant heat gain emitting into the metal structure, trapping the heat in the building like a hot car, and enormous amount of radiant heat loss in the winter, which can never seem to be contained. It is no wonder that building owners are spending exorbitant amounts of money on insulation and HVAC systems while still unable to dramatically bring down the utility bills and improve the comfort level. The solution may seem 'space age' but reflective technology has been utilized for nearly 100 years.

Experts in the industry understand that heat travels in three forms: conduction, convection and radiation. Conductive heat is the heat that passes through solid objects, and only addresses the heat that moves along the roof and walls of the metal building once they are already heated. Convective heat, also known as hot air currents, plays practically no role in the summer heat gain, and only accounts for about 40 percent of the winter heat loss. The primary form of heat gain and heat loss is always radiant heat. In the summer, radiant heat represents all the heat bearing down directly on the roof and walls from the sun's rays. In the winter, it accounts for the infrared heat loss from any and all warm bodies to the colder outside air. It is this radiant heat gain and loss that is responsible for the excessively high heating and cooling bills in industrial and commercial buildings, and leads to animals' lower feed conversion ratios from temperature discomfort in agricultural buildings. Rather than packing the roof and walls with more and more traditional mass insulation, which is only designed to slow conductive and convective heat, reflective insulation can be used to reflect the source of the problem – radiant heat.



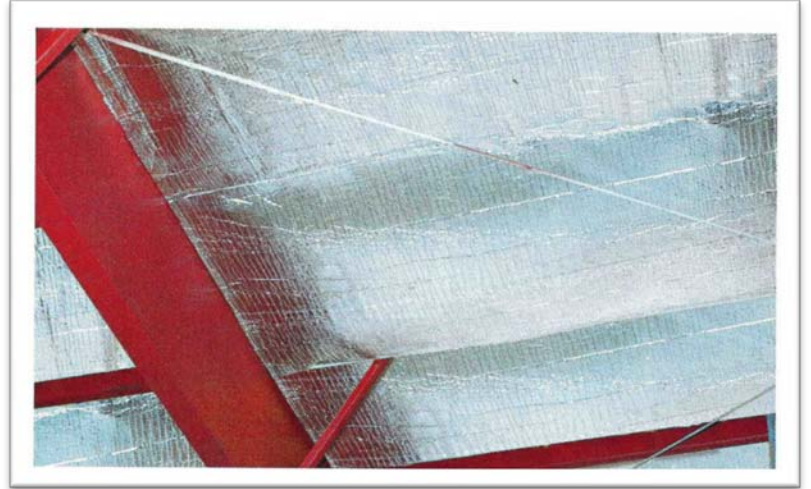
Reflective insulation comes in many different structures and forms, but they all have one thing in common: highly reflective aluminum surfaces that have been proven to reflect out 95- to 97 percent of the radiant heat, only emitting 3- to 5 percent through. These reflective surfaces not only block out the incoming heat in the summer to keep the building cooler, but also reflect back in the radiant heat that would typically be lost in the winter. Some reflective insulation products have reflective surfaces separated by one or more layers of bubble (like packaging bubbles but reinforced with nylon or polyester), or foam (like closed cell polyethylene). This interior layer of insulation adds reinforcement, adds insulation value, and helps maintain a thermal break.



Another form of reflective insulation includes layers of reflective aluminum (foil or film) laminated to a substrate like plastic or Kraft paper, which expands and "snaps" open to create pockets of dead air space. The exact insulation value of a reflective insulation system depends on a number of factors like the direction of heat flow and the number and sizes of the air spaces.

For a limited time, reflective insulation systems even qualify for a commercial building tax credit through the IRS. From now until the end of 2013, any owner of a new or existing commercial building can qualify for a tax credit up to \$1.80 per square foot of the property when a system is installed that can reduce the energy use of their building by 50 percent or greater. Incorporating reflective insulation into your metal building's insulation envelope would just be one component of a qualifying high-efficiency system. There are lesser deductions also available for improvements in lighting, heating and cooling, and water heating and HVAC separately. A lesser deduction of \$0.60 is allowed if the commercial building can save at least 10-percent energy. To see which deductions you may qualify for, and to estimate the exact savings of your particular building, see the U.S. Department of Energy's list of qualifying software programs at [http://www1.eere.energy.gov/buildings/qualified\\_software.html](http://www1.eere.energy.gov/buildings/qualified_software.html).

These insulation systems aren't just recognized by government agencies like the IRS and U.S. Department of Energy, but are even recommended to help builders and installers meet code requirements at a lower cost and in a smaller space. Current international buildings codes like IECC now require multiple layers of R-13, R-19 and R-5 thermal blocks, depending on the climate, to meet the minimum insulation requirements. One layer of reflective insulation can significantly contribute to these insulation requirements in both roof and wall systems. With just this single ¼-inch thin product, you can achieve up to an R-14 in roof systems and up to an R-6.3 in wall systems. In a hybrid system with a



layer of reflective insulation, R-19, and thermal block, you can achieve a better insulation value in terms of U Factor than the code requirements for all Climate Zones 1 through 7. A hybrid roof system with reflective insulation, like the one described above, can easily achieve over an R-30. For more information on hybrid systems and other reflective insulation techniques, see the Reflective Insulation Manufacturer's Association Technical Bulletin #107 at [www.rimainternational.org](http://www.rimainternational.org). Like any insulation products, you need to adhere to the manufacturer's instructions, but the Reflective Insulation Manufacturer's Association has some additional recommendations on how to achieve the optimal insulation values.

Reflective insulation has a rich history of nearly 100 years and is estimated to have the fastest growing demand over all other insulation products from 2002 to 2012, primarily due to their increasing use in metal buildings and other nonresidential structures. And it's no wonder reflective insulation is seeing such an explosion in demand, since the nominal ¼-inch thickness of this product coupled with its high thermal efficiency makes reflective insulation inexpensive to purchase, easy to install, and the best choice in insulation for your metal building systems.