Using Interior Radiation Control Coating Systems To Insulate Metal Buildings

LO/MIT-I IRCC Spray-Applied to Interior Metal Surfaces

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The green revolution finds the metal building professional (architect, engineer or erector) constantly bombarded with sales literature and technical articles concerning improved methods for insulating structures. Probably the most bewildering are the many paint products that claim to have insulating qualities. ASTM and RIMA (Reflective Insulation Manufacturers Association) have tried to clarify the many claims made by some of these products by setting standards for, and classifying these products as interior radiation control coatings if they meet the criteria of ASTM C1321-04, "Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction"; having an emittance of 0.25 or lower. RIMA has recently made a survey of coatings that claim to be radiant insulators and this is a good place for the metal building professional to start before choosing a product. The results of the survey are available at the RIMA website, www.rima.net (click on Technical Info-IRCCS Survey).

The key number here is the emittance or the ability of a surface to reflect infrared radiation. The IRCCS standard of 0.25 or less means that an IRCCS will block 75% or more of the radiant heat transfer. In most cases, paint does an excellent job of covering a surface, but it isn't very effective at blocking radiant heat transfer if the emittance is above 0.25. Most paint products, including aluminum pigmented coatings, have emittances in excess of 0.65. IRCCS paints are generally silver in color and formulated to produce a low emissivity surface when applied to solid substrates. such as building walls and roof decks. Aluminum foil or metallized film radiant barrier products have emittances in the range of 0.03 to 0.06, and are more effective in reducing radiant heat transfer. In many cases, though, the cost of installing the foil products is several times that of spraying an IRCCS. The cost of installed IRCC products is generally 0.25 to 0.40$/ft^2 for new construction and 0.40 to 0.70$/ft^2 for retrofit projects. If the installed cost of a foil radiant barrier product is 30% or more higher than the IRCCS, the IRCCS is probably the better investment. Extensive testing of an IRCCS product at the Florida Solar Energy Center

(FSEC) has shown that it was able to reduce radiant heat flow about 75% as effectively as the standard foil radiant barrier.

Metal buildings present excellent opportunities for the use of an IRCCS. They have large expanses of non-porous wall and roof deck assemblies where excellent coverage rates can be obtained. Some utilities offer rebates for using an IRCCS and the State of Florida Energy Code includes a separate credit specifically for interior radiation control coatings. There are many reasons to use an IRCCS in metal buildings. Ease of installation is the most obvious. Generally, one operator using standard airless spray equipment can install 1,000 to 2,000 sq. ft. per hour. The most effective use of an IRCCS is on the underside of uninsulated roof decks since they work best when applied to the hottest surface in the building. Their main purpose is to reduce radiant heat loads, lower cooling costs and increase comfort. Most IRCCS are permeable and will not entrap moisture. Thus, they will not cause rot on the underside of roof sheathing where they are commonly applied. They are electrically non-conductive, and should not be a hazard if they come into contact with electrical wiring. Also, should a roof leak develop in a building with an IRCCS installed on the underside of the roof, it is still easy to find the source of the leak. They have relatively high reflectivity so they will enhance interior lighting levels, possibly lessening the number of electrical fixtures needed and lowering electrical usage. They are non-flammable when cured so they will not require thermal barriers in front of them. They have no known degrading effect on roof shingles.

Buildings with large south, east or west facing loading dock doors should also consider applying an IRCCS to the interior surface of these doors because they are a major source of radiation heat loads during the warm months. The application of an IRCCS on the interior surface of uninsulated side walls (especially those with dark exterior colors) is an effective, inexpensive way to drop interior temperatures during the summer months. Interior walls that face boilers or other heat generating sources may also be painted with an IRCCS to lessen heat transfer to other parts of the building. In agricultural applications an IRCCS on the underside of the roof deck can inexpensively replace complicated and expensive foil or fiberglass systems, while keeping an animal cooler, increasing output and life expectancy. It is also unaffected by rodents and insects and will provide some corrosion resistance to the harsh chemicals found in cow and chicken barns.

If high temperature radiant heaters are the primary heating source, an IRCCS applied to the interior side walls, in addition to the underside of the roof deck, will make an excellent radiant reflector, and it is possible that no other insulation will be necessary. An IRCCS installed as a radiant reflector will also do an excellent job of retarding summer heat influx. This is a good example of how an IRCCS can be used to thermally enhance uninsulated metal or frame buildings at very low cost.

Where an IRCCS may be effective in lowering summer heat loads, but not adequate for retaining heat during the winter months, additional fiberglass or foam insulation may be added to the system as long as a 2" air space is maintained between the IRCCS and the solid insulation system. Extensive testing of an IRCCS product at the Florida Solar Energy Center in a simulated attic showed that this product, when installed in conjunction with R-19 fiberglass batt insulation, raised the total R-value of the system to R-34 for heat influx. No testing was done for heat outflow, but the known principles of heat transfer dictate that an IRCCS will not increase winter heat loss and will probably slightly retard it. Thus using an IRCCS in conjunction with standard batt insulation is a very cost effective method of retarding summer heat influx without increasing winter heat loss. IRCCS systems cannot be assigned an R-value since they are dealing only with radiation heat transfer, but used in conjunction with standard insulation systems, they offer a very cost effective method of raising the performance of the total system in retarding heat flows.

The possible uses of IRCC products in metal buildings are endless, but they are not an instant panacea for reducing heat influx. If they are judiciously and realistically utilized, the building owner will be very pleasantly surprised by the outcome. The RIMA website previously cited is a good starting point for technical guidance as are the manufacturers of the products. Remember, it's a special paint when its emittance is low, and an IRCCS just might be your best solution to enhancing the thermal performance of the buildings you construct.