

NRCA responds to MRCA's position on aged R-values

The Midwest Roofing Contractors Association (MRCA) published a position paper on Nov. 1, 1985, that recommended the establishment of an interim in-service resistance R-value for urethane and isocyanurate roofing insulations. As could be expected, MRCA's action has sparked a fair amount of controversy between various segments of the industry.

Some manufacturers and their respective associations have cried "foul." Others have written to MRCA to challenge the Association's data, claiming the numbers are inaccurate and unreliable. Still others have simply said, "Who cares, we all know that insulation values have been subjected to more manipulation than the federal budget."

MRCA responds to these criticisms by saying that in the past it may have been accepted that R-values weren't always exactly as advertised, but the roofing industry is entering into a new era, and a change is due. First, we are dealing with new technology in insulations just as we are in other roofing systems. Today's products have R-values greater than we would have even dreamed of 15 or 20 years ago. The higher the thermal resistance, the more important accurate R-value measurements become; a 10 or 20 percent overstatement in, for example, isocyanurate insulation's R-value may result in a substantial change in annual heating and cooling costs. Over the life of the roof the total cost differential could be staggering.

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President
calls
for
more
study
and
prompt
resolution

The roofing industry also needs accurate R-value statements to protect itself in our increasingly litigious society. An unreliable R-value can be one more element that may find its way into a roofing lawsuit. There is some precedent for these concerns. A recent Wisconsin court case awarded damages to the plaintiff school district based upon the additional heating and cooling costs that the district experienced after the in-place insulation failed to meet advertised R-values.

MRCA seeks National support

In February of this year, MRCA approached NRCA's Executive Committee and Board of Directors to seek assistance in resolving this issue. NRCA, at its Board meeting on Feb. 9, addressed this matter in some detail. The Association concluded that it is concerned about the issues raised in the MRCA position paper and would like to assist in bringing the matter to a prompt and effective resolution for the benefit of all segments of the industry.

To that end, NRCA has communicated its concerns to the Roof Insulation Committee of the Thermal Insulation Manufacturers Association (RIC/TIMA) and requested that, if possible, prompt industry-wide action be taken to begin resolution of this issue.

NRCA does not have independent testing data on this issue, so it is simply unable to take a position regarding the need for an interim in-service R-value, let alone what that value might be if adopted.

In an attempt to advise our readers of this important undertaking by MRCA and its position, we print the position paper in total:

MRCA's tests have indicated that the R-value of applied PUR and PIR foamed insulation can, over time, continue to drift lower.

Definitions

The following definitions will be used for purposes of this position paper:

■ **Polyisocyanurate (PIR) and polyurethane (PUR) plastic foamed insulations** are roof insulations made from polyisocyanurate- or polyurethane-base materials that are foamed with fluorocarbon gas.¹

■ **K-value** is the heat energy that will be transmitted by conduction through 1 square foot of 1-inch-thick homogeneous material in one hour when there is a difference of 1 degree Fahrenheit perpendicularly across the two surfaces of the material. The formula for thermal conductivity is:

$$k = \text{BTU/square foot/inch/hour/degree Fahrenheit}^2$$

■ **C-value** is a unit of heat flow that is used for specific thicknesses of material or for materials of combination construction such as laminated insulation. The formula for thermal conductance is:

$$C = k/\text{thickness in inches}$$

■ **R-value** is an index of a material's resistance to heat flow. It is the reciprocal of the k-value or C-value. The formula for thermal resistance is:

$$R = 1/C \text{ or } R = 1/k \text{ or } R = \text{thickness in inches}/k$$

Background

Experience indicates that the insulation value of polyisocyanurate and polyurethane decreases with aging under in-service conditions. The primary reason cited is that the fluorocarbon gas, which has one-half the conductivity of air, is replaced by air in the cells of these materials, resulting in a reduction of insulation thermal value.

RIC/TIMA recommended back in 1981 that its manufacturer members publish insulation thermal values for PIR and PUR foamed insulation on an "aged" basis. RIC/TIMA issued a procedure² pursuant to which an insulation's C-value is tested after the insulation has been allowed to age 6 months in a controlled environment and at a constant temperature. RIC/TIMA used C-value so the value would be representative of composite as well as plain foamed board stock. MRCA believes this information is a representative guide to resistance value at the time of application of the insulation. However, tests³ sponsored by MRCA in 1982 indicated that the insulation resistance R-value of PIR and PUR fluorocarbon gas foamed insulation tended to decrease for a period of years.

Current information

Testing reported on during the 1985 MRCA convention now substantiates further in-service aging of PUR and PIR foamed insulations. When manufactured, many of these insulations have R-values as high as 9.09 (a k-value of 0.11). When tested pursuant to RIC/TIMA's procedure, many of these insulations have 6-month aged R-values varying from 7.69 to 6.25. Our tests have indicated that the R-value of applied PUR and PIR foamed insulation can, over time, continue to drift lower (continue to deteriorate) to the point where thermal resistance is less than the American Society of Heating, Refrigerating and Air Conditioning Engineers' generic typical R-value of 6.26 (k-value of 0.16). Depending upon the stability of a particular insulation, the R-value can approach the range of 5 (k-value of 0.20).

The 1985 MRCA tests¹ and other industry-published information² presented have shown that the further reduction in insulation value (R-value) over time for these field samples of PIR and PUR foamed insulations was significant.

Recommendations

- MRCA recommends that the roofing industry and the design profession utilize those PIR and PUR insulations that publish insulation values based on, and in conformity with, the RIC/TIMA 6-month-aged procedure. The published aged R-values should be considered an "at installation" value, understanding that it will change as the product continues to age in the roof.
- MRCA recommends that a national independent laboratory³ help establish realistic guidelines for in-service R-values for PIR and PUR plastic foamed insulations based on testing of field samples with known in-service life.

■ MRCA recommends that, as an interim procedure, specifiers should utilize and calculate PIR and PUR roof insulation requirements based on an R-value of 5.56 per inch. This R-value, which would be known as the interim in-service R-value (I/IS), more realistically reflects what can be expected while the insulation is in service.

Action

When a specifier is designing roof insulation to meet a certain required heating and/or cooling criteria, he should use a foamed insulation thickness that will provide the desired R-value for the insulation only. Next, he should base the thickness of the foamed insulation on a k-value of 0.18 by dividing the R-value by 5.56 per inch to determine the thickness of insulation required. He should round off the thickness to the next higher tenth of an inch, or up to the next available manufactured size.

Example no.	Desired system resistance R-value determined for insulation	Thickness in inches of PIR or PUR insul. based on an R = 5.56 inches = R/5.56	Call for thickness rounded up to nearest 1/10th of an inch
(1)	18.52	3.33"	3.4"
(2)	14.08	2.53"	2.6"
(3)	10.00	1.79"	1.8"

For interim "in-service" values, specify the thickness and brand(s) acceptable on the basis of and meeting the interim criteria of R = 5.56/in. as outlined.

Notes

¹Some of the new phenolic roof insulation is fluorocarbon-gas foamed and may exhibit similar insulation characteristics. Since these products have not been in field service long enough, they were not included in this current work.

²The RIC/TIMA roof insulation specimen conditioning procedure subjects products to conditioning for 175 to 185 days at 73.4F and 50 percent relative humidity.

³Reported on at the 1982 MRCA convention during a program titled "The Isothman Cometh."

⁴Data presented at the Nov. 10, 1985, MRCA convention program "The Three R's."

⁵"In-Place Thermal Aging of Polyurethane Foam Roof Insulations" by Sam P. Muhlenkamp and Steven E. Johnson, a technical paper presented at the 1983 NBS/NRCA 7th Technical Conference; and a RIC/TIMA Report presented in "Tech Talk" in the September 1985 *Roofing Spec.*

⁶Such as the National Bureau of Standards, the Oak Ridge National Laboratories or the Center for Insulation Studies at the Drexel Institute of Technology.

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