



MEASURING THE R-VALUE OF POLYISO ROOF INSULATION

Background: The 2016 edition of the Roofing Manual of the National Roofing Contractors Association (NRCA) includes a recommendation for the use of an arbitrary unit R-value of 5.0 for all thicknesses and configurations of polyiso roof insulation in lieu of current ASTM C-1289 Long-Term Thermal Resistance (LTTR) values as published by polyiso insulation manufacturers. After reviewing the NRCA manual and related documents and presentations, the Polyisocyanurate Insulation Manufacturers Association (PIMA) has developed this Performance Bulletin to provide additional information to support and validate the use of PIMA member published LTTR values as the most reliable measure of polyiso thermal value for building owners, designers, specifiers, and contractors.

THE NORTH AMERICAN STANDARD FOR R-VALUE MEASUREMENT OF POLYISO ROOF INSULATIONⁱ

The R-value recommendation and underlying data published by NRCA differ from the long-established Long-Term Thermal Resistance (LTTR) data published by PIMA members for over a decade. Based on years of research and development, LTTR:

- Remains **the most reliable and relevant measure of long-term polyiso roof insulation R-value** for the building designer, specifier and roofing contractor.
- Is **supported by years of scientific study** conducted by leading research organizations, including Oak Ridge National Laboratory (ORNL) and the National Research Council of Canada (NRC-CNRC).
- Has been established as a reliable national consensus standard both in the United States (ASTM C1289) and Canada (CAN/ULC- S704) and is **incorporated within all North American building codes as the designated measure of polyiso roof insulation performance**.

THIRD-PARTY CERTIFIED FOR OVER TEN TEARS

Polyiso roof insulation LTTR values are further supported by PIMA's QualityMark^{CM} program, a voluntary program that allows participating polyiso manufacturers to certify LTTR values through an independent third party.

- QualityMark covers over 30 participating plants across North America, and each facility must submit to an annual verification of LTTR product values.
- During verification, an independent third-party representative visits each manufacturing facility and randomly selects a minimum of five boards for testing.
- Each selected board is sent to an approved testing laboratory, and the overall verification process is administered by FM Global, a leading independent construction testing and standards organization.
- The QualityMark program is supported by over 2,000 polyiso insulation samples tested over the past ten years, and the ultimate evidence of the success of the program is that all participating manufacturing facilities have maintained continuous certification since the program's inception.

The results of the 2015 QualityMark verification testing are provided in the following tableⁱ. Note that the average thermal performance of these insulation boards not only consistently exceeds PIMA-member published thermal values but also surpasses NRCA's recommendation by no less than 15 percent.

THERMAL VALUE TEST RESULTS FROM 2015 QUALITYMARK PROGRAM

SAMPLE THICKNESS	1"	2"	3"	4"
No. of Samples Tested	33	33	33	33
Manufacturer Published LTTR / Inch	5.7	5.7	5.8	5.9
AVERAGE LTTR / INCH	5.78	5.74	5.85	5.95
Average LTTR versus:				
Manufacturer Published LTTR / Inch	101%	101%	101%	101%
NRCA Recommendation (5.0 / Inch)	116%	115%	117%	119%

It should be noted that the LTTR testing conducted under the QualityMark program uses a more severe conditioning procedure than the standard R-value test used by NRCA as a basis for its recommendation. In contrast to the NRCA's conditioning of samples for only a few days prior to R-value testing, LTTR test samples are cut into quarter inch-thin slices to accelerate aging and then re-assembled into the original product thickness prior to testing. As a result of this additional accelerated aging procedure, LTTR test results are almost always more conservative than standard R-value test results. Given the difference in NRCA's recommendation and PIMA's QualityMark program testing results, PIMA suggests that this difference may be attributed to a smaller testing sample size used by NRCA to support its recommendation and a possible lack of experimental controls regarding how NRCA insulation samples were procured and selected.

CONCLUSION: USE A RECOGNIZED R-VALUE MEASURE BACKED BY THIRD-PARTY CERTIFICATION

As a leader in the manufacture of energy-efficient roof insulation, PIMA encourages building owners, designers, specifiers, and contractors to rely on thermal performance information based on recognized national standards and validated by a recognized third party. In the case of polyiso roof insulation, the most widely recognized standard is ASTM C-1289 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board." According to this standard, the appropriate means of measuring the thermal value of polyiso roof insulation is LTTR as currently published by PIMA members.

More information on the third-party certified PIMA QualityMark program, LTTR and this topic can be found at polyiso.org.

ⁱ It should be noted that LTTR values shown in this bulletin apply only to polyiso roofing products using permeable facers. Other polyiso insulation products, such as polyiso wall insulation use impermeable or gas-tight facers such as aluminum foil and are tested under a different R-value test method which results in higher unit R values, typically R-6 per inch and greater. As a result, LTTR testing and thermal values shown in this bulletin should be applied only to standard polyiso roofing products with permeable facers addressed in this bulletin and should not be applied to polyiso insulation products with gas-tight facers such as aluminum foil.

ⁱⁱ Data provided by FM Global