

Roofing No. 3016

Subject: Impact of Temperature on the R-value for Polyisocyanurate Insulation

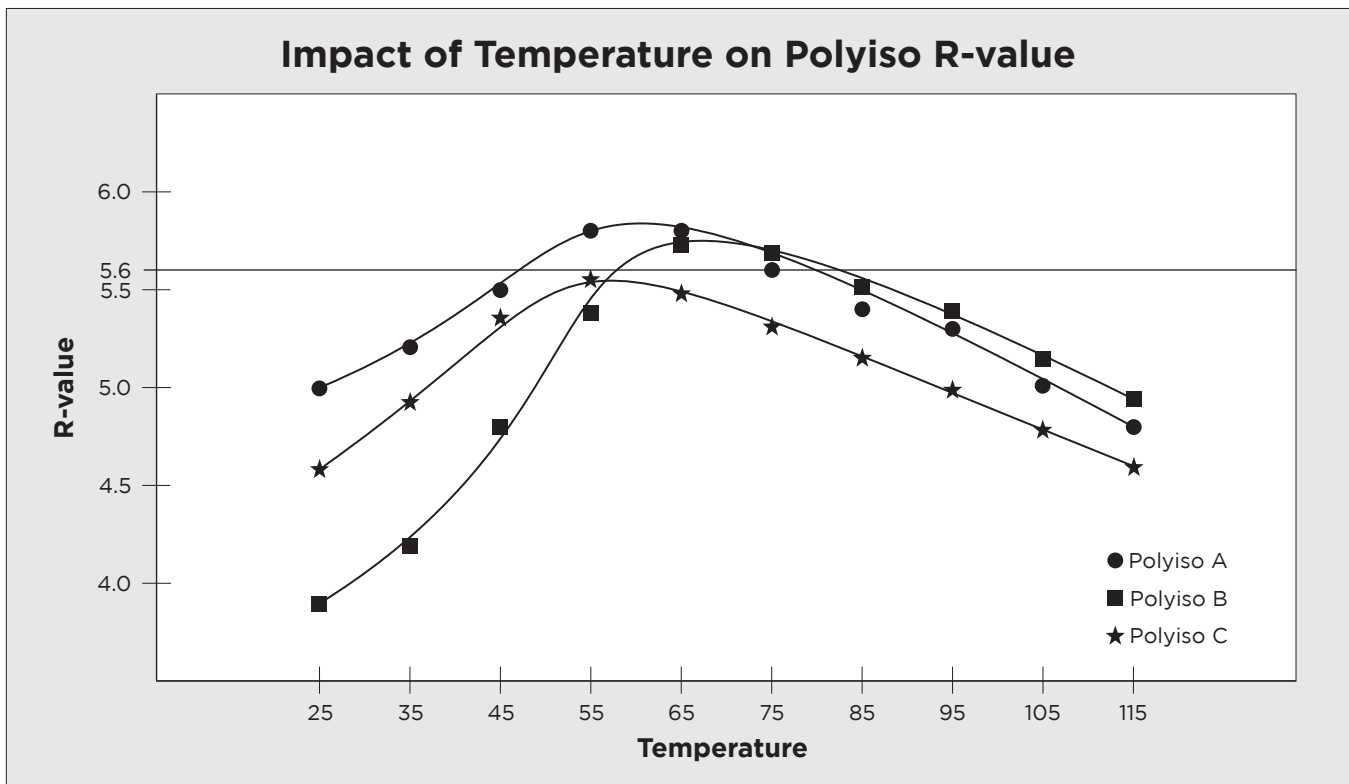
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The blowing agents used in polyisocyanurate (polyiso) foam insulations provide an initial high R-value. However, immediately after production and continuing throughout the life of the polyiso foam, air from the atmosphere diffuses into the cells of the foam and the internal blowing agents diffuse out of the foam. This change in the internal gas composition results in a loss of R-value for polyiso foams over time.

In addition to loss of R-value over time from blowing agent loss, the R-value performance of polyiso insulation is also very dependent on temperature. Understanding the temperature dependence of polyiso is an overlooked consideration.

R-value claims are commonly reported at a mean temperature of 75°F. The use of a 75°F mean temperature for simple comparisons between products is useful, but it is also obvious that buildings are subjected to temperature variations. R-values at other temperatures are important to building design.

R-value testing was conducted on 2 in. thick samples of polyiso roof insulation sourced from three of the largest U.S. suppliers to investigate the impact of temperature on the R-value of polyiso insulation. ASTM C518 testing was conducted on the polyiso samples at mean temperatures from 25°F to 115°F in increments of 10°F.




It is clear that polyiso insulation performs best at temperatures near 75°F but as the polyiso insulation is subjected to colder or warmer temperatures its performance is diminished. Similar results have also been published by the NRCA¹ and Building Science Corporation². Attached to this bulletin are their results for reference.

It is important to understand that a mean temperature of 40°F is representative of an insulation used in cold weather regions. Considering the results above and the results published by the NRCA and Building Science Corporation, lower R-value should be specified for polyiso insulations used in cold weather regions.

It is important to understand that a mean temperature of 90°F is representative of an insulation used in warm weather regions. Considering the results above and the results published by the NRCA and Building Science Corporation, lower R-value should be specified for polyiso insulations used in warm weather regions.

In contrast to polyisocyanurate insulations, the R-value for Tru-R 150 increases at lower mean temperatures. In fact, the R-value of Tru-R 150 at 40°F is very close to the R-value of polyiso insulations at 40°F and even greater than the R-value of polyiso at 25°F. In addition, the pricing of Tru-R insulation is significantly lower than polyiso insulation which can lead to significant costs savings when specifying a roof insulation system for use in cold weather regions.

R-value Comparison			
Insulation	Temperature		
	75°F	40°F	25°F
	4.2	4.6	4.8
Polyiso*	5.6	5.0	4.5

*Based on average results above

References:

1. Building Science Corporation Information Sheet 502, "Understanding the Temperature Dependence of R-values for Polyisocyanurate Roof Insulation", September 2013.
2. Professional Roofing, "Testing R-values, Polyisocyanurate's R-values are found to be less than their LTRR values", March 2015.

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