

Evaluating the Moisture Resistance of Polyiso Closed-Cell Foam

About Polyiso Insulation

Polyiso is a rigid foam insulation used in more than 70% of commercial roof construction and offers a continuous insulation solution for commercial and residential wall assemblies. As one of North America's most widely used and readily available building products, Polyiso is a cost-effective insulation option for reducing building energy use and improving the overall service-life of roofs and walls.

The benefits of using Polyiso include:

- High R-value per inch of thickness
- Excellent fire test performance
- Extensive building code approvals
- Cost-effective continuous insulation (ci) solution
- Compatible with most roof and wall systems
- Dimensional stability
- Compressive strength
- Moisture resistance
- Thinner walls and roofs with shorter fasteners
- Long service life
- Preferred insurance ratings
- Virtually no global warming potential
- Zero ozone depletion potential
- Recyclable through reuse
- Recycled content (amount varies by product)
- Regional materials (nationwide production network)

Polyiso is a closed-cell foam

Polyisocyanurate (polyiso) insulation is a closed-cell foam. The closed-cell foam structure is responsible for polyiso's high R-value and delivers increased resistance to moisture when compared to open-cell foam or fibrous insulation materials. An insulation product's resistance to moisture is critical – especially in below-grade environments – as moisture intrusion can reduce a product's R-value.

Why is polyiso manufactured with facers?

Polyiso insulation is manufactured with different facer types that make the product suitable for a wide range of applications. Facers are critical to the manufacturing process allowing the foam to rise and form a rigid board as it passes through the laminator. Additionally, polyiso can be specified by facer type to meet the performance demands of the application or project. For more information on polyiso facer types, visit: www.polyiso.org/page/Facers.

Important: When selecting polyiso insulation for below-grade projects, contact the manufacturer for information on suitable product options for this application.

ASTM C1512: Putting polyiso foam to the test

All polyiso products are manufactured with facers. However, the Polyisocyanurate Insulation Manufacturers Association engaged Intertek – a third-party accredited laboratory – to perform experimental testing to measure the performance of the polyiso foam (i.e., with the facing materials removed) under cyclic environmental – moisture and temperature – conditions in accordance with the ASTM C1512¹ test standard.

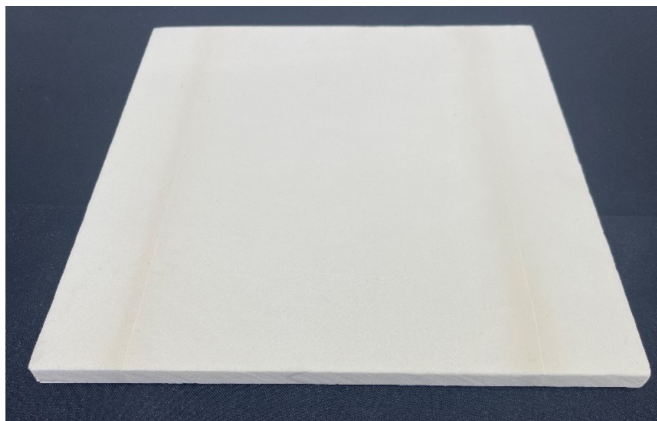


Image 1. Polyiso foam board with the facers removed.



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1. ASTM C1512-10(2020) *Standard Test Method for Characterizing the Effect of Exposure to Environmental Cycling on Thermal Performance of Insulation Products*, available at: [www.astm.org/c1512-10\(20\).html](http://www.astm.org/c1512-10(20).html).

About the test

ASTM C1512 is a standardized test method for insulation that characterizes the effects of exposure to environmental cycling conditions on the thermal performance of insulation products. The scope of the standard states that the “test method measures the ability of the product to maintain thermal performance and critical physical attributes after being subjected to standardized exposure conditions.” Understanding how an insulation product resists the effects of moisture under dynamic conditions is key when evaluating options for installing insulation below grade.

During the test, product samples are first pre-conditioned for 28-days to increase moisture content (via water vapor diffusion) under a constant thermal gradient. This stage is important because its objective is to load maximum moisture content into the samples. The second stage of testing features a 20-day environmental cycling exposure during which samples are exposed to cyclic temperature and moisture conditions. This stage redistributes the moisture within the sample that was first introduced during the pre-conditioning stage.

Polyiso closed-cell foam effectively resists moisture intrusion

The table below contains the results for the polyiso foam sample (with facing materials removed) tested in accordance with ASTM C1512 following the pre-conditioning and environmental cycling phases. The tested samples were obtained from a polyiso product classified as ASTM C1289 Type II, Class 2.

Table 1. ASTM C1512 test results for the polyiso foam sample (with facers removed).

Measured Attribute ¹	Results after 28-day pre-conditioning	Results after 20-day environmental cycling
Moisture Content (% by volume)	0.07%	0.05%
R-value versus control sample (ASTM C518)	-0.55%	-0.55%
Compressive Strength versus control sample (ASTM D1621)	N/A ²	0.78%

Notes for understanding Table 1

1. The polyiso foam was not subjected to drying conditions prior to the thermal resistance, moisture content, and compressive strength measurements required by the ASTM C1512 test standard. Testing was performed immediately after removing the samples from the pre-conditioning and cycling chambers to determine the impact of moisture on the measured properties. Only observed surface moisture was blotted from the samples prior to testing to protect laboratory equipment.
2. ASTM C1512 requires that compressive strength testing be performed on samples that have undergone both the pre-conditioning and environmental cycling phases. Compressive strength measurements were not performed on samples following the pre-conditioning phase. The change in compressive strength was measured after the environmental cycling phase, which captured the impacts of both exposure phases.

What you need to know about the polyiso foam research

- **Exposures Did Not Impact Polyiso Foam Performance:** ASTM C1512 measures the impact of environmental exposures on three key physical properties: moisture resistance, thermal performance, and compressive strength. These properties are key when selecting insulation products for below-grade applications and the polyiso foam's performance in these categories was not impacted by the environmental exposures of the test.
- **Polyiso Foam is Inherently Moisture Resistant:** The results demonstrate that the closed-cell structure of the polyiso foam itself provides inherent and suitable resistance to moisture intrusion. This counters a common misperception that polyiso products rely exclusively on facers for water and moisture protection.
- **Low Moisture Content:** The slight increase in measured moisture content is minimal and well below maximum moisture content limits for other common below-grade products like extruded polystyrene (XPS) insulation (0.3% by volume).
- **Consistent Thermal Performance:** The thermal performance of the polyiso foam measured prior to and after both exposure phases showed no significant decline. The slight decrease in measured R-value shown in the table above correlates to the slight increase in moisture content.
- **Compressive Strength That Holds Up:** The compressive strength of the polyiso foam was not impacted by the environmental exposures under ASTM C1512.

ABOUT PIMA

Since 1987, the Polyisocyanurate Insulation Manufacturers Association (PIMA) has served as the voice of the rigid polyiso industry, proactively advocating for safe, cost-effective, sustainable, and energy-efficient construction. PIMA is an association of polyiso manufacturers and industry suppliers and polyiso is one of North America's most widely-used and cost-effective insulation products.

PIMA produces technical bulletins to address frequently asked questions about polyiso insulation. These publications update and inform architects, specifiers, and contractors about and build consensus on the performance characteristics of polyiso insulation. Individual companies can provide specific information about their respective polyiso products.

For more information on polyisocyanurate insulation, visit www.polyiso.org

