

XPS TECH TALK



Sustainable R-Value: Are You Really Getting What You Paid For?

When selecting a roofing insulation material, building professionals typically look for a product that offers high R-value at a competitive price. Equally important is the insulation's ability to withstand exposure to real-world conditions while maintaining long-term R-value and other important performance characteristics.

Polystyrene and polyisocyanurate insulation materials are affected differently by real-world conditions. So, the question becomes: Are building owners and roofing/architectural professionals getting long-term performance value from roofing insulation products?

In general, foam plastic insulation products, such as expanded polystyrene (EPS), extruded polystyrene (XPS) and polyisocyanurate (polyiso) offer higher insulation values than other materials. But even something as fundamental to insulation as its R-value can vary depending on:¹

- Density of the foam,
- Type of blowing agent used,
- How the product is handled,
- How the product is affected by moisture absorption
- Facer performance, if a facer is required on the insulation by the manufacturer, and
- Conditions under which the insulation is installed.

Following is an overview of product claims, performance characteristics and warranties for polystyrene and polyiso products. Compare these few points to see if you are really getting what you paid for!

Not All R-Value Claims Are on a Level Playing Field

Foam plastic manufacturers generally describe their product's R-value either by using the term "conditioned" or aged R-value." The latter method is much more indicative of the product's insulation value over time – especially in a roofing assembly.

Most polyiso manufacturers market their roofing insulation products based on a "conditioned" R-value of 6.0 per inch. While this figure is impressive on paper, it doesn't tell the entire story. Due to thermal drift, the R-value of polyiso may drop dramatically to 5.6 within 180 days of manufacture.² So, the questions for polyiso buyers are: "What R-value did you buy?" and, "What R-value will you still have in 15 years?"

Extruded Polystyrene Foam (XPS) manufacturers market their products based on *aged* R-values—so you get what you pay for!

¹ Taken from the U.S. Department of Energy's Energy Efficiency and Renewable Energy Network's "Reference Brief" on Foam and Foam Board Insulation.

² ASTM C 1289 Standard for Faced, Performed Rigid Cellular Polyisocyanurate.

The Truth About Facers

While some facers can help slow the R-value aging process, studies of polyiso facers show their effectiveness is minimal.

- The Research Council of Canada found that permeable-faced polyiso insulation R-value degrades approximately 20% over five years.
- Research from the Oak Ridge National Laboratory set R-value deterioration for permeable-faced polyiso at 15%.
- A Dynatech Research and Development Corporation study shows the aging rate of most impermeably faced foams was only 10-20% slower than unfaced foams.

For building owners, an unstable and diminishing R-value can significantly increase the energy cost of the building over the life of the structure.

Polystyrene insulation maintains a high, sustainable R-value for a longer period of time – even under real-world conditions.

Rooftop Durability Must be Considered

In 1997, NRCA's Board of Directors and committee members were surveyed to determine their experience with polyiso insulation since 1990. Their findings included a variety of ongoing problems including board compression, edge cavitation, bowing/cupping and facer separation/delamination. NRCA stated, "Some of the deficiencies clearly have been related to manufacturing problems and others have been related to design inadequacies, such as lack of system resistance to foot traffic."³

Polyiso roofing insulation is vulnerable to rooftop deterioration. Among the potential problems are:

- **Facer delamination** due to inadequate bonding during the manufacturing process,
- **Moisture intrusion** before or after installation, and
- **Rooftop foot traffic** that crushes surface cell layers, destroying the bond between foam and facer.

Facer delamination can lead to failure of fully adhered membrane systems. Using a coverboard layer over polyiso helps avoid the need to rely on unreliable facers to hold fully-adhered systems in place. Also, coverboards help polyiso products avoid delamination and lost R-value due to crushed cell layers caused by rooftop foot traffic.

Tom Smith, as Technical Director of the NRCA, wrote an article published in the July 1996 issue of Professional Roofing Magazine. This article supports the position that a coverboard should be used over polyisocyanurate insulation. He cited potential concerns for insulation board damage, facer adhesion, blistering in BUR membranes and a loss of R-value.

**Polystyrene foam roof insulation is durable on the rooftop.
Polyiso systems would benefit from the use of a coverboard.**

³ Taken from the Fall 1997 NRCA article "Research Review" by Thomas L. Smith, AIA, RRC, NRCA Director of Technical Services.



Dimensional Instability

“Polyisocyanurate foam roof insulation instability continues to be a problem on individual projects,” writes on roofing professional summarizing the technical problems the roofing industry faced in 1997.⁴ This professional also cited “the (polyiso) insulation product’s inherent dimensional instability.”

An unstable insulation substrate can cause major problems for the membrane and its seams as well as other watertight details.

**Extruded Polystyrene foam insulation is dimensionally stable
– a benefit that can help maintain membrane integrity.**

Questions About Warranties

Warranties for minimum R-values are standard offerings in the marketplace. But are all warranties equal? Some manufacturers have warranties that allow for excessive R-value deterioration.

While the following example is not representative for the entire polyiso industry, at least one major polyiso manufacturer provides for excessive R-value deterioration and includes unusually restrictive warranty conditions. Following are some excerpts:⁵

- The insulation value of the polyiso foam **will not diminish to less than 80%**.
- If the polyiso foam has been **punctured**, the warranty is void.
- Manufacturer must be notified at least 60 days prior to taking the polyiso sample and a **company representative determines from where the sample is taken**.
- Moisture content tests must be performed and the warranty is **void if the sample contains an excess of 3% moisture by weight**.

Most foam plastic insulation companies are confident that their insulation will maintain its R-value and generally offer warranties. Depending on the manufacturer, these warranties guarantee 90-100% of the minimum insulation value of their product. Think about it – what is the value of a warrantee that indicates that at 3% moisture absorption, the warranty is void?! Is this an admission that polyiso is susceptible to moisture? And, since the presence of moisture may diminish R-value, what is the likelihood of a moisture intrusion of 3%?

Why?

- Risk water absorption?
- Risk the fastener deterioration that goes with it?
And
- Risk as much as a 20% decrease in R-value?

**Is this an acceptable risk for you
– the building owner, architect, specifier or roofing professional?**

⁴ “Observations from the field during 1997: Well-known roofing professional provides his insight about various technical issues,” by Dick Baxter, Professional Roofing, February 1998.

⁵ Taken from the Atlas Energy Products AC Foam Limited Warranty.



Get the Facts

It's important for building and roofing professionals to be informed customers. The Extruded Polystyrene Foam Association (XPSA) encourages roofing professionals to question all insulation manufacturers about R-value claims and real-world exposures that can adversely impact R-values. Ask for an explanation of the fine print in the warrantee.

Extruded polystyrene foam (XPS) insulation manufacturers welcome the opportunity to discuss the real-world benefits and performance attributes of XPS roof insulation and direct-to-deck options for polystyrene foam insulation products in general.

XPS roof insulation products offer a reliable aged R-value that lasts on the roof. That means the insulation starts strong and, unlike other materials, does not easily degrade from exposure to real-world conditions like moisture and foot traffic. These are important performance characteristics – especially important for professionals who want to be known for quality work and building owners who want an energy-efficient roof.

