

Foil-Faced Polyiso and XPS in Wall Applications

When it comes to selecting the best overall rigid foam insulation for walls, foil-faced Polyiso is the product of choice and outperforms extruded polystyrene (XPS) in a variety of categories:

		XPS
Aged R-value	★ 1 inch of foil-faced Polyiso has a minimum R-value of 6.0. 4.5 inches of foil-faced Polyiso has an R-value of up to 6.9 per inch.	Standard XPS has an R-value of 5.0 per inch, regardless of thickness
Fire Test Performance: • ASTM E84 • NFPA 285 • NFPA 286/UL 1715	★ In all 3 fire tests, polyiso performs exceptionally well and does not melt.	XPS softens at 165°F and melts between 200°F to 210°F which can potentially spread flammable material.
Water Resistance	★ Classified as water resistant	★ Classified as water resistant
Vapor Resistance	★ The low permeability of foil-faced Polyiso coupled with its high thermal performance <u>decreases</u> the likelihood of condensation in walls.	Higher permeability and lower thermal performance <u>increases</u> the likelihood of condensation in walls.
Global Warming Potential – GWP	★ Foil-faced Polyiso is manufactured with a hydrocarbon-based blowing agent that has zero Ozone Depletion Potential (ODP) and virtually no Global Warming Potential (GWP)	XPS is manufactured with hydrofluorocarbon blowing agents, which have a Global Warming Potential (GWP) of 1300. This is 100 times greater than the blowing agent used in Polyiso.
Compatibility	★ Not affected when exposed to petroleum-based solvents in adhesives, paints, stains, water repellent and preservative coatings, and in bituminous waterproofing	Can dissolve when exposed to petroleum-based solvents in adhesives, paints, stains, water repellent and preservative coatings, and in bituminous waterproofing

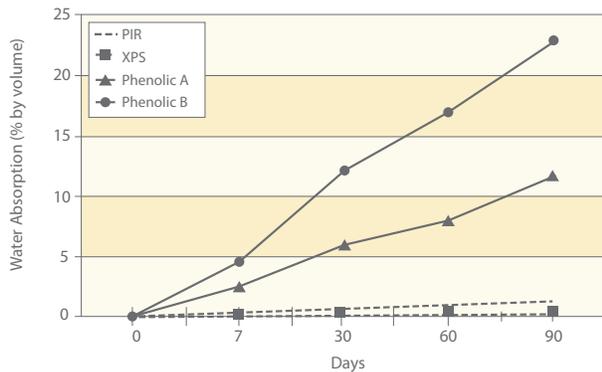
R-Value

Polyiso is unique in that the R-value increases with the thickness of the foam, so three inches of foil-faced Polyiso has a higher R-value per inch than two inches. The R-value of foiled-faced Polyiso insulation is between 20 to 38 percent higher per inch of thickness than the R-value of XPS.

Fire Performance¹

Polyiso insulation products are thermoset, which means that once manufactured, they are rigid, will not soften or melt and will remain stable, even at elevated temperatures. During fire tests polyiso forms a protective char layer and does not melt. XPS is a thermoplastic material which softens at 165°F and melts in the 200°F to 210°F range.

- **ASTM E84:** Polyiso can achieve a Class A or Class B rating. XPS can achieve a Class A rating although it melts and drips to the floor of the tunnel where it can continue to burn and spread the fire, a fact that is not currently accounted for in the results of the test.
- **NFPA 285:** Foil-faced Polyiso is approved in more NFPA 285 assemblies than XPS. XPS softens and melts potentially adding fuel to the fire and requires fire stopping around the window and door header to pass NFPA 285. Foil-faced Polyiso passes NFPA 285 without additional fire stopping materials and is approved for more cladding options than XPS.
- **NFPA 286/UL 1715:** Polyiso stays in place during this testing while XPS drips down to the floor potentially spreading flammable material. Many polyiso manufacturers have foil-faced products which have passed NFPA 286/UL 1715.



Water Absorption Results, 90 day soak, ASTM C209-07 (extended)

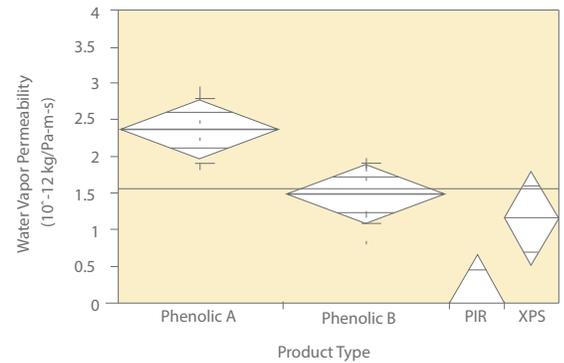
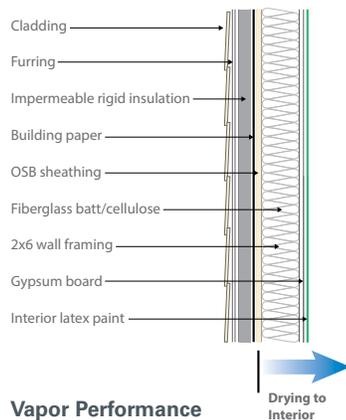
Water Performance:

Water can get into all types of buildings so it is critical to select a building insulation that is resistant to water absorption. In wall applications, foil-faced Polyiso (PIR in the illustration on the left) and XPS perform equally well. The graph, taken from a paper titled "Rigid Polymeric Foam Boardstock Technical Assessment," published by the Dow Chemical Company, shows that both Polyiso and XPS perform well in a 90 day soak test.²

Vapor Performance and Moisture Condensation

It is critical to prevent condensation. Water vapor enters walls through permeable materials and penetrations. Water vapor condenses when the temperature is lowered below the dew point. Controlling water vapor transmission and temperature within the wall assembly is the best practice to reduce the potential for condensation. The low permeability of foil-faced Polyiso coupled with the high thermal performance make it ideal for controlling condensation. The Vapor Performance graphic below, taken from a paper titled "Insight Macbeth Does Vapor Barriers" by Joseph W. Lstiburek, illustrates rigid insulation functioning as a vapor barrier on the exterior. Dr. Lstiburek includes the wall on his short list of "best performing walls" and states that "it is hard to beat the performance."³ The Water Vapor Permeability ASTM E96 graphic, taken from a paper titled "Rigid Polymeric Foam Boardstock Technical Assessment," published by the Dow Chemical Company,

shows that Polyiso (PIR in the illustration) outperforms XPS and has virtually no water vapor transmission.⁴ Better vapor performance and higher R-value make foil-faced Polyiso the clear material of choice for preventing condensation in walls.



Water Vapor Permeability ASTM E96

Low Global Warming Potential

XPS is made with hydrofluorocarbon blowing agents (HFCs), which have a Global Warming Potential (GWP) of 1300. This is 100 times greater than the blowing agent used in Polyiso. All Polyiso insulation manufactured by PIMA members utilizes an EPA compliant hydrocarbon-based blowing agent which has zero Ozone Depletion Potential (ODP) and virtually no GWP; it also meets HFC-, CFC- and HCFC-free specification requirements.

Compatibility with Construction Materials

It has been shown that the application of common construction materials — such as petroleum-based solvents in adhesives, paints, stains, water repellent and preservative coatings, and in bituminous waterproofing — can cause extruded polystyrene to dissolve. This problem can be solved by using foil-faced Polyiso which is not affected by these materials and therefore offers a level of comfort that the insulation value will remain in place year after year.

Remember, when it comes to selecting the best overall rigid foam insulation for walls, foil-faced Polyiso is the product of choice and outperforms XPS.

Foil-faced Polyiso:

- Has the highest R-value per inch
- Offers superior performance in fire tests (NFPA 285, NFPA 286/UL1715, ASTM E84)
- Provides water resistance
- Provides superior vapor performance
- Has low global warming potential
- Is compatible with construction materials

Notes:

¹ For more detailed information about how well polyiso performs during fire tests please refer to these technical bulletins found at polyiso.org, "PIMA Technical Bulletin #103: Fire Performance in Walls and Ceilings" and "PIMA Technical Bulletin #405: Fire Resistance Properties of Polyiso Foam Plastic Insulation Used in Wall Assemblies – Facts and Comparisons"

² Schroer, D., Hudack, M., Soderquist, M., and Beulich, I. Rigid Polymeric Foam Boardstock Technical Assessment, p.4

³ Lstiburek, J.W., "Macbeth Does Vapor Barriers (Double, Double Toil and Trouble)"; Building Science Insights, November 15, 2013

⁴ Schroer, D. Rigid Polymeric Foam Boardstock Technical Assessment, p.4

PIMA

For over 25 years, PIMA (Polyisocyanurate Insulation Manufacturers Association) has served as the unified voice of the rigid polyiso industry proactively advocating for safe, cost-effective, sustainable and energy efficient construction.

PIMA produces technical bulletins in an effort to address frequently asked questions about polyiso insulation. PIMA's technical bulletins are published to help expand the knowledge of specifiers and contractors and to build consensus on the performance characteristics of polyiso. Individual companies should be consulted for specifics about their respective products.

PIMA's membership consists of manufacturers and marketers of polyiso insulation and suppliers to the industry. Our members account for a majority of all of the polyiso produced in North America.

SAFETY

Polyiso insulation, like wood and other organic building materials, is combustible. Therefore, it should not be exposed to an ignition source of sufficient heat and intensity (e.g., flames, fire, sparks, etc.) during transit, storage or product application. Consult the product label and/or the PIMA members' Material Safety Data Sheets (MSDS) for specific safety instructions. In the United States, follow all regulations from OSHA, NFPA and local fire authorities; in Canada, follow all regulations from Health Canada Occupational Health and Safety Act (WMMHS) and local fire authorities.



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