

Polyiso and XPS in Wall Applications

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

		XPS
R-value	★ R-value is 5.6 to 6.9 per inch based on actual thickness	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 forms a protective char layer and does not melt.	XPS softens at 165°F and melts between 200°F to 201°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 make it ideal for controlling condensation in stud walls	Higher permeability and lower thermal performance increases the likelihood of condensation in walls.
Global Warming Potential – GWP	★ Made with hydrocarbon-based blowing agent that has zero Ozone Depletion Potential (ODP) and virtually no Global Warming Potential (GWP)	XPS is made 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.
Construction 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

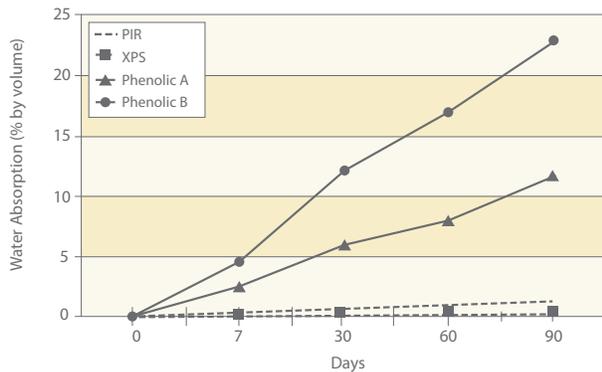
R-Value

Polyiso is unique in that the R-value increases with the thickness of the foam, so three inches of 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. The R-value of glass faced polyiso is 5.6 to 5.9 per inch.

Fire Performance¹

Foam plastic insulations do not perform equally well in fire tests. Polyiso insulation products are thermoset, which means that once manufactured, they are rigid, will not soften or melt and remain strong, 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:** Because XPS softens and melts potentially adding fuel to the fire, it requires fire stopping around the window and door header to pass NFPA 285. Polyiso passes without additional fire stopping materials. Currently, Polyiso is approved with more veneer 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)

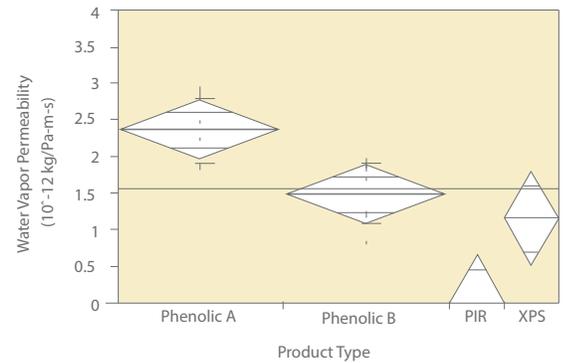
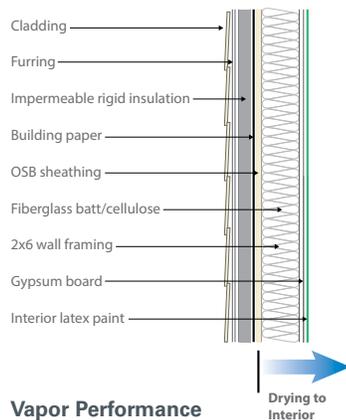
Water Performance:

Water can get into all types of buildings so it is critical to select a building insulation that is resistant to water absorption, and 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 is solved by using polyiso insulation. It 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, Polyiso is the product of choice and outperforms XPS.

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 more than 30 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's membership includes manufacturers of polyiso insulation and suppliers to the industry. The products of PIMA's members comprise the majority of the polyiso produced in North America.

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.



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