

TECH SOLUTIONS 516.0 STYROFOAM™ BRAND EXTRUDED POLYSTYRENE FOAM FOR WALK-IN COOLERS AND FREEZERS



SUMMARY

The Energy Independence and Security Act (EISA) of 2007 and federal regulations have raised R-value requirements for insulations used in the manufacture of walk-in coolers and freezers.

While a variety of insulation materials are used for temperature-controlled applications, most manufacturers agree that polystyrene offers one of the best long-term performance compared to other materials such as spray foam, urethane or polyisocyanurate. Both extruded polystyrene (XPS) and expanded polystyrene (EPS) are used in the manufacture of walk-in coolers and freezers. EPS has been an especially popular core insulation for these applications. However, with its lower R-value per inch, EPS alone cannot meet today's more stringent thermal requirements.

This document presents the reasons XPS is preferred to EPS for walk-in coolers and freezers that must meet EISA 2007 requirements.

The Two Polystyrenes

STYROFOAM™ brand extruded polystyrene foam insulation products (XPS) manufactured exclusively by The Dow Chemical Company are high performing closed cell rigid insulations with excellent insulating characteristics, high resistance to water and water vapor, and long term durability. STYROFOAM™ extruded polystyrene foam insulation products are durable, versatile, and reusable making them the preferred choice of rigid insulations with much higher R-value compared to EPS. For example, the fresh R-value of STYROFOAM Brand XPS Foam Insulation (Type X) is 8.1 when tested at 20°F according to ASTM C518 while that of Type I EPS is 4.3.

Expanded Polystyrene Products (EPS) are open cell and have lower R-value and higher water absorption compared to extruded polystyrene

insulation. The resin or bead used to manufacture EPS products is closed cell, however when these beads are heated and fused together in the manufacturing process voids or spaces between the beads are created allowing for both moisture gain and R-value loss in the product itself. Expanded Polystyrene Products (EPS) are made from polystyrene beads which are heated with steam and injected into a mold under pressure. During the process, the beads are fused together as a function of the steam and pressure. The quality of the bead fusion can vary throughout the block or cut board. Fusion typically occurs best on the outside edge of the finished block and lowest in the center. To varying degrees the spaces between the beads create pathways which allow moisture and air to readily enter and leave the product.

STYROFOAM™ brand extruded polystyrene foam insulation products (XPS) are manufactured using a proprietary process in which plastic resin or beads are melted into a liquid, extruded through a die, and expanded some 30 times its original volume into a flat continuous rigid board insulation. The finished board contains millions of tiny sealed cells without voids, breaks, or weak spots.

XPS and Thermal Performance

According to the EISA of 2007, Section 312:

"Each walk-in cooler or walk-in freezer manufactured on or after January 1, 2009, shall contain wall, ceiling and door insulation of at least R-25 for coolers and R-32 for freezers ..."

STYROFOAM™ Brand XPS Foam meets EISA 2007 standards and federal requirements for higher R-values.

In April 2011, The Department of Energy (DOE) issued a new test procedure for walk-in coolers and freezers. This new test procedure was issued in preparation for the new performance-

based energy standards the DOE is working on. The DOE plans to issue the performance-based standards final ruling in 2012, after which manufacturers will have to comply with those standards within three years of publication of the final ruling. Upon completion of the performance-based energy conservation standards ruling, manufacturers will be required to certify compliance to those standards using the new test procedure by 2015, unless the DOE adopts an alternative compliance date (DOE may also provide for a delayed effective date if the Secretary determines this three-year period is inadequate). STYROFOAM™ XPS foam insulation complies with EISA 2007 requirements with R-values tested based on ASTM C518 (Table 1).

For the most updated status of the new energy standard from the DOE and its implementation schedule, please visit www.energy.gov or contact the DOE directly.

The Original XPS

STYROFOAM™ Brand XPS Foam Insulation – the original extruded polystyrene foam invented by Dow more than 60 years ago – is offered in a variety of densities, thicknesses, lengths and surface/edge treatments. All STYROFOAM™ Brand XPS Foam Insulation products are closed-cell, high-performance foam insulation materials manufactured to comply with ASTM C578. Dow's proprietary manufacturing process enables precise control of parameters such as density, cell size and cell orientation, and also helps the insulation maintain a consistent R-value over time, for excellent long-term performance.

- Closed-cell structure prevents the foam from absorbing water, key to helping maintain insulating properties in high-humidity and high-moisture conditions
- Hydrophobic, void-free structure of the foam minimizes potential for water absorption

STYROFOAM™ BRAND EXTRUDED POLYSTYRENE FOAM FOR WALK-IN COOLERS AND FREEZERS

- Planned surfaces enhance adhesion performance, and with tight dimensional tolerances, the highly uniform boards help ensure long-term panel integrity

See Table 1 for typical physical properties of STYROFOAM™ Brand Panel Core 20 XPS Foam Insulation.

XPS and the Environment

In advance of U.S. and Canadian regulations under the Montreal Protocol, Dow developed a new foaming agent technology for STYROFOAM™ Brand XPS Foam Insulation products that is non-ozone depleting. This technology allows Dow to manufacture STYROFOAM™ Brand XPS Foam Insulation with a zero ozone-depletion factor and cut foaming agent greenhouse gas emissions in half from Dow's production of STYROFOAM™ Brand XPS Foam Insulation in North America. The new formulation of STYROFOAM™ Brand Foam Insulation meets EISA 2007 insulation requirements.

STYROFOAM™ Brand XPS Foam Insulation is reusable in many applications.

In the United States, a 50-year thermal limited warranty is available on STYROFOAM™ Insulation products 1.5 inches and greater. For thickness less than 1.5 inches, other warranties may apply. Warranties are available as described at www.dbswarranties.com

References

- H.R. 6-110th Congress (2007): Energy Independence and Security Act of 2007, Section 312 (b)

TABLE 1: TYPICAL PROPERTIES OF STYROFOAM™ BRAND PANEL CORE 20 XPS FOAM INSULATION

| Property and Test Method | Value |
|--|-------------|
| "Fresh" R-Value ⁽¹⁾ , ASTM C518 | |
| At 20°F, °F•ft ² •h/Btu | 8.1 |
| At 55°F, °F•ft ² •h/Btu | 7.2 |
| Compressive Strength ^{(1), (2)} , ASTM D1621, psi, min. | 20.0 |
| Water Absorption ⁽¹⁾ , ASTM C272, % by volume, max. | 0.3 |
| Water Vapor Permeance ⁽¹⁾ , ASTM E96, perm, max. | 1.5 |
| Water Affinity | Hydrophobic |
| Water Capillarity | None |
| Surface Burning Characteristics, ASTM E84 ⁽³⁾ | |
| Flame Spread | 15 |
| Smoke Developed | 165 |

(1) Properties reported are for 1" STYROFOAM™ Brand XPS Foam products engineered to have the values shown here.

(2) Value at yield or 10 percent, whichever occurs first.

(3) These numerical flame spread and smoke developed ratings are not intended to reflect hazards presented by this or any other material under actual fire conditions.

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STYROFOAM™ Brand Extruded Polystyrene Foam Insulation

CAUTION: This product is combustible. Protect from high heat sources. A protective barrier or thermal barrier may be required as specified in the appropriate building code. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400.

WARNING: Rigid foam insulation does not constitute a working walkable surface or qualify as a fall protection product.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No material supplier including Dow can give assurance that mold will not develop in any specific system.

