FAQ: POLYURETHANE-CORE PANELS

Raising the Performance of Walk-In / Reach-In Coolers and Freezers

What are the benefits of using polyurethane foam for refrigeration panel cores?

Refrigeration or walk-in coolers using panels made with a polyurethane rigid foam core offer many advantages in today's commercial world. Modern refrigeration units all feature an insulation core with metal or fiberglass protective skins. The skin helps protect the insulation, which forms a thermal and air migration barrier to resist heat flow and to hold cold temperatures inside. Panels made with polyurethane foam offer an initial R-value of 6.0 to 8.0 per inch[1], providing 30 to 40 percent more insulation per given thickness over expanded polystyrene (EPS), while extruded polystyrene (XPS) offers an R-value of 5.0 per inch. Polyurethane also offers moisture resistance to help ensure the long-term performance of the insulation in a refrigeration panel. Another advantage of polyurethane is that the foam is injected instead of glued. It adheres and bonds to every surface before becoming rigid without any chance of cracks, gaps or channels so you get continuous insulation performance.

What kinds of skins work well with polyurethane cores?

Polyurethane foam works well with all traditional refrigeration skins. Polyurethane foam is made from closed cells. Proper use of skins eliminates out-gassing or reduction of R-value[2]. There have been several studies that show the effectiveness of these skins. For example, the Alchem study[3] measured the R-value of a door panel for eight years and found no R-value loss. Lars-Erik Larsson[4] studied the effects of various skins on panels over a seven-year period with similar results.

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What is the insulation performance of polyurethane cores?

Polyurethane has an initial R-value of 6.0 to 8.0 per inch[1], making it the world's highest-rated insulation per inch. When it comes to refrigeration panels, the R-value is typically provided as the K-factor, which is the thermal conductivity for a unit thickness of material. The lower the K-factor, the better the insulation performance. Polyurethane foam has a K-factor of 0.15 – 0.16 @ 75 degrees F and a K-factor of 0.12 – 0.13 @ 20 degrees F.

Does polyurethane lose its insulation value over time?

Polyurethane foams protected by non-permeable facings, such as metal, do not lose insulating power over time[3/5]. A 1996 Levy showed that the K-factor of a polyurethane foam protected by moisture and air barriers increased only 0.004 units, from 0.122 to 0.126, in 16 months. Similarly, an SPI study from the early 1980s showed that the K-factor of a polyurethane foam faced with steel skins on both sides increased only 0.10 from 0.105 to 0.115 after two years at 75 degrees F. Polyurethane foam is also very dense.. Studies have shown that foams with densities of 1.8 – 2.3 lb/ft^3 have the best initial K-factors.

How does polyurethane perform in a fire?

The type of polyurethane foam used in refrigerator or freezer panels is a Class 1 rated polyurethane. It is a cross-linked thermoset plastic that is highly resistant to heat, capable of withstanding temperatures of 750 degrees F (399ºC). When exposed to high temperatures, the polyurethane chars. Polyurethane has a surface ignition rating of 599 to 698 degrees F (315 to 370ºC)[6].

Is polyurethane environmentally responsible?

Polyurethane foams, as used in refrigerator or freezer panels, are not harmful to the environment. BASF Polyurethane Foam Enterprises foams use ZONE3® zero-ozone-depleting blowing agents and do not emit volatile organic compounds (VOCs). And, the use of refrigeration panels made with polyurethane foam reduces the amount of energy needed to maintain the cold temperatures inside of the cooler. Less energy use also translates into fewer carbon dioxide and greenhouse gas emissions.

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[1] www.polyurethane.org, Center for the Polyurethanes Industry (formerly Alliance for the Polyurethanes Industry)
[2] R.J. Booth, Thermal Drift in Foam Insulations
[3/5] Alchem, Anchorage, Alaska. A door was cut into an 8-year old very humid pump house. The removed material was found to have an R-value of 6.94. The panels were wood-faced.
[4] Lars-Erik Larsson, Professor, Division of Building, Goteborg, Sweden. Studies concluded that polyurethane foam panels with a skin measured no decrease in R-value over a 7-year test period.
[5] Rigid Polyurethane and Polyisocyanurate Foams: An Assessment of Their Insulating Properties.
[6] Southwest Research Institute, SwRI Project No. 01-04918.01.020