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Comparing EPS and XPS Insulation

There is much competition among polystyrene insulation manufacturers for the below-grade, under slab, and cavity wall insulation market. Claims made by the XPS (extruded polystyrene) industry are conflicting with that of EPS (expanded polystyrene) manufacturers. The validity of some claims is debatable. Specifiers, architects, and contractors must make well-informed decisions.

To thoroughly understand the difference between EPS and XPS insulations, it's useful to begin with a look at their similarities:

Both are comprised of polystyrene resin;
Both use trapped air as their long-term insulating medium;
Both have a closed-cell structure;

And, both fall under the same manufacturing standard: ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation. The ASTM C578 standard includes 14 different types of polystyrene. The different classifications relate directly to physical characteristics of each type—most notably, the density, compressive resistance, and R-value.

What makes EPS and XPS different is their manufacturing processes. EPS uses steam and the blowing agent pentane to expand polystyrene resin beads and subsequently mold them into blocks, which can later be cut to size. XPS, on the other hand, processes melted polystyrene resin through an extruder and expands it, using blowing agents.

There are key differences between EPS and XPS—most importantly, moisture resistance, environmental impact, long-term R-value, compressive strength, panel sizes, and cost per R-value.

Moisture Resistance

Moisture resistance is an important issue for architects, contractors, and specifiers to consider when selecting below-grade, cavity wall, and under-slab insulation. Claims by the XPS industry on moisture resistance conflict with those made by the EPS industry because one source is using controlled laboratory testing and the other is using real-life field testing.

The XPS industry prefers a controlled underwater test, submerging the XPS for a relatively short period of time, depending upon the type of XPS tested and the test parameters. Usually the submersion time is somewhere between 2 and 24 hours. In this scenario, XPS appears to win over EPS because it resists water absorption in the near-term quite well. However, as the XPS takes in moisture more slowly than EPS, it also releases it very slowly. "We believe nothing is more real than an actual installation dug up and tested after 15 years in the ground," says "A 15-year field study demonstrates actual performance in the ground after 15 years. The results show dramatic differences in the performance of the two insulation types."

Environmental impact

EPS has never contained HCFCs. Environmental advocates also like that EPS uses no dyes, and can contain up to 15% recycled content. The XPS industry, with highly competitive subgroups, has used pink, blue, and green dyes as branding elements. In addition, the limited amount of recycled content in XPS varies widely by product and by company.

Long Term R-Value is affected by off-gassing. Off-gassing occurs when blowing agents present in XPS are released over the lifespan of the product and are slowly replaced with air, which then becomes the insulating medium. As the off-gassing occurs there is a loss of R-Value. This differential is evident in the disparate EPS/XPS industry warranties: The XPS industry offers a 90% R-value warranty due to the product's off-gassing. The EPS industry, on the other hand, offers a 100% R-value warranty.

Compressive strength and panel sizes

Although both XPS and EPS are available in compressive strengths of 15, 25, 40, and 60 psi, XPS also comes in 100 psi. If the job requires 100 psi compressive strength, it needs XPS. Because of market dominance, XPS is more widely available from distributors and in the insulation marketplace as a whole. Foam-Control Plus+ is first in the EPS market to provide face labeling. This is beneficial for specifiers, contractors, and distributors. "Although XPS has offered face stamping since nearly the inception of the insulation, EPS hasn't until now," "The face label on Geofoam America's grade insulation makes it easier for distributors to identify the product and easier for contractors to know what they're paying for. This in turn provides peace of mind to specifiers that the correct product was delivered to the jobsite."

Cost per R-value

EPS costs 10% to 30% less than XPS per equivalent R-value and compressive strength. Geofoam America has made it easier for contractors and specifiers to see this with comparable features unavailable until now.