POLYSTYRENE INSULATION BOARD SPECIFICATIONS

GSA's Federal Specification Now Emphasizes Physical Properties Over Manufacturing Process

Styrofoam* SM brand insulation applied to the Interior masonry walls at the Mercer Island High school gymnasium in Washington reduced annual fuel costs by more than $2,000 The gym and adjacent utility rooms were constructed before energy costs became a critical factor in the school's operating budget.
'Trademark of the Dow Chemical Company

The Federal Supply Service of the General Services Administration (GSA) has issued a revised federal specification for polystyrene thermal insulation board. Unlike its predecessor, which dealt with the difference in polystyrene board manufacturing methods, the new specification—HH-I-524C—categorizes materials purely by their physical characteristics.

Since GSA specifications are employed in all federal construction and many privately funded building projects, this modification offers the architectural and contractor community increased control over insulation specifications. Previously, many architects designing federal projects specified Type II polystyrene-board insulation, assuming the contractor would use an extruded polystyrene product. However, if class B wasn't specified as well, the contractor sometimes substituted a molded polystyrene bead product, with a lower R-value and less water-resistant properties.

Under the old specification, three types were categorized. Type I covered commercial and residential insulation, as well as cold storage. Type II emphasized subflooring and overdeck insulation, along with drywall construction bases. Type III offered the high compressive strength necessary for heavily loaded areas.

Also, the specification was further subdivided into two classes described as follows: "Class A insulation board shall be formed by an expansion of polystyrene resin beads or granules in a mold. Class B insulation board shall be formed by the expansion of polystyrene base resin in an extrusion process. The insulation shall be uniformly fused, homogenous and essentially unicellular." The old specification, then, was actually defining the manufacturing process.

While understanding of actual manufacturing processes could prove helpful, architects and engineers tend to be concerned with performance rather than with how a product is made. HH-I-524C clears the confusion by concentrating on the thermal resistance, compressive strength, density and water absorption properties of a thermal board as the primary classification of polystyrene board insulation. Designed primarily for building insulation, the specification does not cover cryogenic applications. (To compare the old GSA specs with the new, please refer to Tables 1 and 2).

Classifications for the five types of polystyrene insulation are as follows:

***Type I** Thermal resistance . . . R = 3.6 per inch at 75 °F; Compressive strength . . . 10.0 pounds per square inch (psi); Density . . 0.9 pounds per cubic foot (pcf) minimum; Water absorption . . . 4.0% vol. maximum.

***Type II** Thermal resistance . . . R = 4.0 per inch at 75 °F; Compressive strength . . . 15.0 psi minimum; Density . . . 1.3 pcf minimum; Water absorption . . . 3.0% vol. maximum.

***Type III** Thermal resistance . . . R = 4.4 per inch at 75 °F; Compressive strength . . . 20.0 psi minimum; Density . . . 1.6 pcf minimum; Water absorption . . . 2.0% maximum.

***Type IV** Thermal resistance . . . R = 5.0 per inch at 75 °F; Compressive strength . . . 20.0 psi minimum; Density . . . 1.6 pcf minimum; Water absorption . . . 0.3% vol. maximum.

Type V Thermal resistance . . . R = 5.0 per inch at 75 °F; Compressive strength . . . 100.0 psi; Density . . . 3.0 pcf minimum; Water absorption . . . 0.3% vol. maximum.

Table I

CROSS REFERENCE OF PREVIOUS GSA POLYSTYRENE INSULATION TYPE CLASSIFICATIONS WITH NEW REQUIREMENTS

OLD "B" VERSION CLASSIFICATION	OLD "C" VERSION CLASSIFICATION
Type I, Class A	Type I
Type II. Class A	Type II
Type (none)	Type III
Type II, Class B	Type IV
Type II, Class B	Type V

Table 2

GSA's NEW POLYSTYRENE BOARD INSULATION PROPERTIES REQUIREMENTS

Property	Type I	Type II	Type III	Type IV	Type V
Minimum Compression Strength (pounds/square inch)	10.0	15.0	20.0	20.0	100.0
Minimum Density (pounds/cubic foot)	0.9	1.3	1.6	1.6	3.0
Dimensional Stability (percent change in any dimension)	2.0	2.0	2.0	2.0	2.0
Minimum Oxygen Index (percent oxygen)	24.0	24.0	24.0	24.0	24.0
Maximum Water Vapor Transmission (per-inch)	5.0	3.5	1.5	1.1	1.1
Maximum Water Absorption (percent volume)	4.0	3.0	2.0	0.3	0.3
Minimum Flexural Strength (pounds/square inch)	25.0	40.0	55.0	60.0	100.0
Minimum Thermal Resistance at 75 degrees R, and 2 degrees Mean Temp. (1-inch board thickness)	3.6	4.0	4.4	5.0	5.1

Testing methods documenting compliance rely on American Society for Testing and Materials (ASTM) standards.

While compressive strength and density are important, the key to successful long-term performance of an insulation relies on the material's ability to resist moisture intrusion. As moisture enters most insulating materials, insulating effectiveness drops dramatically. For instance, a split in a conventional roofs waterproofing system, or a simple thunder shower during installation can seriously impair insulation performance. Hence, an insulation's ability to per-vent absorption determines its long-term benefit.

The insulation in roofs, walls and foundations also can be subject to numerous alternating freeze/thaw fluctuations throughout the year. Constant expansion and contraction during these cycles can rupture the closed-cell structure of certain cellular installations, permitting moisture penetration.

Warm, humid air contains a higher water vapor pressure than colder, drier air. A warm area's water vapor naturally tends to supply moisture to a colder region. Some insulations can absorb large amounts of moisture caused by this water vapor drive, leading to decrease in thermal efficiency.

"The federal government's emphasis on performance, reflected by the more definitive breakdown in insulation properties, allows the arch tect to specify the material required more precisely," noted William Strezpec, research engineer for Styrofoam brand insulation products, Dow Chemical, U.S.A., the leading manufacturer of extruded polystyrene products worldwide.