

EPS Block Geofoam - Meeting Project Specifications

Foam density is a key consideration when bidding on a geofoam project. Achieving the minimum density in a geofoam specification is *not* a guarantee that other physical property requirements will be met, particularly the compressive resistance at 1% strain.

The American Standards and Testing Materials (ASTM) has two standards pertaining to EPS geofoam. ASTM D6817-06a *Standard Specification for Rigid Cellular Polystyrene Geofoam* provides information on the physical properties and dimensions of expanded polystyrene intended for use as geofoam. ASTM D7180-05 *Standard Guide for Use of Expanded Polystyrene (EPS) Geofoam in Geotechnical Projects* covers design considerations for the use of EPS in geotechnical applications.

The Federal Highway Administration (FHWA) has identified EPS geofoam as a market-ready technology and innovation that warrants special attention. For more information on FHWA's initiatives for geofoam, go to <http://www.fhwa.dot.gov/crt/lifecycle/geofoam.cfm>. Other specifications may exist and the above referenced documents may change over time.

Specifications & Density

Thorough knowledge and understanding of the specification being used on a geofoam project is essential. Of critical importance is the relationship between foam density and compressive resistance at 1% strain. In lay person's terms, this is related to the amount of load needed to compress (or strain) the foam thickness by 1%.

In general, performance requirements in thermal insulation standards such as ASTM C-578, *Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation* and CAN/ULC-S701, *Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering* should not be considered an indication that the product will meet the requirements established in a

geofoam specification. Specifically, the compressive resistance requirements in ASTM C-578 and CAN/ULC-S701 measured at 10% strain significantly differ from the compressive resistance typically included in a geofoam specification at 1% strain.

It is essential to determine the relationship between the specific molding equipment being used, the achieved product density and its compressive resistance at 1% strain. In most geofoam specifications, the *compressive resistance at 1% strain will be the overriding consideration*. Depending on the equipment used and other manufacturing variables, a block density higher than the specified minimum density may be required. Therefore, performance requirements for geofoam applications must be evaluated individually as they relate to each project specification.

Sample Size & Location

Samples for geofoam compression testing are typically cube-shaped. The specified sample size should be well understood and testing conducted accordingly. Two-inch cubes are the standard sample size although individual project specifications may stipulate a different sample size. Performance property test results may differ when atypical sample sizes are used. In addition, the sample location(s) within the EPS block may be further specified.

Some geofoam specification require third-party testing. These tests are conducted to ensure the material shipped to the site meet the compressive resistance at 1% specification. A lab experienced with testing in accordance with ASTM D 1621, "Test Method for Compressive Properties Of Rigid Cellular Plastics," is required .

Regrind & Other Additives

Equally important is the effect additives (regrind, mineral oil, etc.) may have on the foam's physical properties with both the



Photograph Courtesy of Paul Arch, NOVA Chemicals

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resin and equipment in use. Some studies have shown that regrind lowers the compressive resistance at 1% strain even though the data value at 10% strain is unaffected by regrind. Again, it is critical to determine the relationship between the actual block density and the specified compressive resistance at 1% strain relative to any additives being used AND the type of resin AND the manufacturing equipment.

Block Weight & Dimension

Typical changes in block weight over time must be known and accounted for. Blocks will often be test-weighed at the job site as a quality control measure. Blocks that are lighter than the specification requires will be rejected. Some specifications will accept a lower density for individual test samples to allow for normal density

gradients within a large block. However, the total block density must still meet the overall specification and elastic limit stress requirements will still govern over any minimum density specification.

Some specifications give a minimum aging time for EPS blocks to allow for some out-gassing of residual pentane.

The required block dimensional tolerances should be explained in the geofoam specification. Clarify whether extra trimming and cutting is required. Some geofoam projects may require shop drawings to demonstrate how to install the individual blocks. Each block may need to be labeled in sequence and in correspondence to the shop drawings.

Physical Property Requirements of RCPS Geofoam

Type	EPS12	EPS15	EPS19	EPS22	EPS29	EPS39
Density, min. Kg/m ³ (lb/ft ³)	11.2 (0.70)	14.4 (0.90)	18.4 (1.15)	21.6 (1.35)	28.8 (1.80)	38.4 (2.40)
Compressive Resistance, min. kPa (psi) at 1%	15 (2.2)	25 (3.6)	40 (5.8)	50 (7.3)	75 (10.9)	103 (15.0)
Compressive Resistance, min. kPa (psi) at 5%	35 (5.1)	55 (8.0)	90 (13.1)	115 (16.7)	170 (24.7)	241 (35.0)
Compressive Resistance, min. kPa (psi) at 10 %	40 (5.8)	70 (10.2)	110 (16.0)	135 (19.6)	200 (29.0)	276 (40.0)
Flexural Strength, min. kPa (psi)	69 (10.0)	172 (25.0)	207 (30.0)	276 (40.0)	345 (50.0)	414 (60.0)
Oxygen index, min. Volume %	24.0	24.0	24.0	24.0	24.0	24.0

Imperial/Metric Conversion

Length	1 foot	0.308 meter
Force	1 pound force	4.448 Newton
Stress (modulus of elasticity)	1 pound force per square foot (psf)	47.88 Pascal
	1 pound force per square inch (psi)	6.898 kilopascal (kPa)

