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Standard Specification for Rigid Cellular Polystyrene Geofoam¹

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1. Scope

1.1 This specification covers the types, physical properties and dimensions of rigid cellular polystyrene intended for use as geofoam.

1.2 This specification does not cover the layout, placement and workmanship for proper installation and performance of rigid cellular polystyrene geofoam.

1.3 Rigid cellular polystyrene geofoam covered by this specification may need protection from certain chemicals, environmental exposure, and concentrated loads. Additional design considerations may include thermal conductivity and buoyancy. Guidelines regarding these end use considerations are included in [Appendix X1](#).

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- [C165 Test Method for Measuring Compressive Properties of Thermal Insulations](#)
- [C203 Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation](#)
- [C303 Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation](#)
- [C390 Practice for Sampling and Acceptance of Thermal Insulation Lots](#)
- [C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation](#)
- [D1621 Test Method for Compressive Properties of Rigid Cellular Plastics](#)

[D1622 Test Method for Apparent Density of Rigid Cellular Plastics](#)

[D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics \(Oxygen Index\)](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

3. Terminology

3.1 *Definitions:*

3.1.1 Terms used in this specification are defined in Terminology D4439.

3.1.2 *geofoam*—block or planar rigid cellular foam polymeric material used in geotechnical engineering applications.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *EPS, XX*—number designation for expanded polystyrene geofoam Type(s) having a minimum density of XX kg/m³ (lb/ft³).

3.2.2 *XPS, XX*—number designation for extruded polystyrene geofoam Type(s) having a minimum density of XX kg/m³ (lb/ft³).

3.2.3 *RCPS*—letter designation for EPS and XPS rigid cellular polystyrene geofoam covered by this specification.

4. Ordering Information

4.1 Acquisition documents shall specify the following:

4.1.1 Title, number and year of this specification.

4.1.2 Type, as per [Table 1](#), or minimum density required.

4.1.3 Total product volume required of each Type, or minimum density.

5. Materials and Manufacture

5.1 RCPS geofoam shall be formed by the expansion of polystyrene resin beads or granules in a molding process (EPS) or by the expansion of polystyrene base resin in an extrusion process (XPS). RCPS geofoam may be manufactured with reprocessed polystyrene foam (regrind).

5.2 RCPS geofoam shall be of uniform density and have essentially closed cells. RCPS geofoam is an organic material and is considered combustible. It should not be exposed to flames or other ignition sources.

¹ This specification is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.03 on Permeability and Filtration.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Physical Property Requirements of RCPS Geofoam^A

Type	EPS12	EPS15	EPS19	EPS22	EPS29	EPS39	EPS46	XPS20	XPS21	XPS26	XPS29	XPS36	XPS48
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)	45.7 (2.85)	19.2 (1.20)	20.8 (1.30)	25.6 (1.60)	28.8 (1.80)	35.2 (2.20)	48.0 (3.00)
Compressive Resistance, min., kPa (psi) at 1 % strain	15 (2.2)	25 (3.6)	40 (5.8)	50 (7.3)	75 (10.9)	103 (15.0)	128 (18.6)	20 (2.9)	35 (5.1)	75 (10.9)	105 (15.2)	160 (23.2)	280 (40.6)
Flexural Strength, min., kPa (psi)	69 (10.0)	172 (25.0)	207 (30.0)	240 (35)	345 (50.0)	414 (60.0)	517 (75.0)	276 (40.0)	276 (40.0)	345 (50.0)	414 (60.0)	517 (75.0)	689 (100.0)
Oxygen index, min., volume %	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0

^AFor products that have an external skin, testing shall be undertaken with skins intact.

TABLE 2 Additional Physical Property Requirements of RCPS Geofoam^{A,B}

Type	EPS12	EPS15	EPS19	EPS22	EPS29	EPS39	EPS46	XPS20	XPS21	XPS26	XPS29	XPS36	XPS48
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)	45.7 (2.85)	19.2 (1.20)	20.8 (1.30)	25.6 (1.60)	28.8 (1.80)	35.2 (2.20)	48.0 (3.00)
Compressive Resistance, min., kPa (psi) at 5 % strain	35 (5.1)	55 (8.0)	90 (13.1)	115 (16.7)	170 (24.7)	241 (35.0)	300 (43.5)	85 (12.3)	110 (16.0)	185 (26.8)	235 (34.1)	335 (48.6)	535 (77.6)
Compressive Resistance, min., kPa (psi) at 10 % strain ^A	40 (5.8)	70 (10.2)	110 (16.0)	135 (19.6)	200 (29.0)	276 (40.0)	345 (50)	104 (15.0)	104 (15.0)	173 (25.0)	276 (40.0)	414 (60.0)	690 (100.0)

^AIf yield occurs prior to 10% deformation, report compressive resistance and deformation at yield in addition to the compressive resistance at 1%, 5% and 10% deformation.

^BFor products that have an external skin, testing shall be undertaken with skins intact.

6. Qualification Requirements

6.1 The physical properties listed in **Table 1** constitute the minimum product qualification requirements for commonly manufactured types of RCPS geofoam. The compressive resistance at 1% strain is within the elastic limit of the geofoam product Types in **Table 1** and is accepted as design compressive resistance to limit long-term deformation under structural load.

6.2 *RCPS Geofoam Types*—It is the users responsibility to specify the required Type as in **Table 1** and to obtain supporting documentation regarding physical properties from the material supplier.

6.3 The compressive resistance properties in **Table 2** are provided for applications where compressive resistance requirements for intended end-use applications are beyond the elastic limit of geofoam.

NOTE 1—The application of sustained load to geofoam beyond the elastic limit will result in significant deflections beyond the values provided in **Table 2**.

6.4 *Combustibility Requirements*—All RCPS geofoam shall contain sufficient flame retardants to meet a minimum Oxygen Index as required in **Table 1**.

6.5 *Curing*—Unless otherwise specified in the contract, RCPS geofoam shall be cured for a minimum of 24 h before delivery and inspection.

7. Availability and Dimensional Tolerance

7.1 *Availability*—The RCPS geofoam materials covered by this specification are commonly available in the size range shown in **Table 3**. Specific RCPS geofoam block dimensions vary by manufacturer equipment characteristics.

7.2 *Dimensional Tolerance*—Unless otherwise specified, the acceptable length, width, thickness, flatness and squareness tolerance criteria on RCPS geofoam shall not exceed $\pm 0.5\%$.

8. Damage and Degradation

8.1 *Damage*—RCPS geofoam as delivered to the project site shall have no defects that will adversely affect its service and workability qualities. Material units that manifest unacceptable surface or volumetric damage shall be replaced.

8.1.1 *Surface Damage*—Damage to load bearing RCPS geofoam surfaces shall be limited to less than 20 % of the equivalent load bearing area of the unit.

TABLE 3 Common Manufactured Dimensions of RCPS Geofoam

Dimension, mm (in.)	All EPS Types	All XPS Types
Width	305 to 1219 (12 to 48)	406 to 1219 (16 to 48)
Length	1219 to 4877 (48 to 192)	1219 to 2743 (48 to 108)
Thickness	25 to 1219 (1 to 48)	25 to 102 (1 to 4)