



# Standard Specification for Rigid Cellular Polystyrene Geofoam<sup>1</sup>

This standard is issued under the fixed designation D 6817; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 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:

- C 165 Test Method for Measuring Compressive Properties of Thermal Insulation<sup>2</sup>
- C 203 Test Methods for Breaking Load and Flexural Properties of Block Type Thermal Insulation<sup>2</sup>
- C 303 Test Method for Density of Preformed Block-Type Thermal Insulation<sup>2</sup>
- C 390 Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots<sup>2</sup>
- C 578 Specification for Rigid Cellular Polystyrene Insulation<sup>2</sup>
- D 1621 Test Method for Compressive Properties of Rigid Cellular Plastics<sup>2</sup>
- D 1622 Test Method for Apparent Density of Rigid Cellular Plastics<sup>2</sup>
- D 2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)<sup>2</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 Terms used in this specification are defined in Terminology D 4439.

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/m<sup>3</sup>(lb/ft<sup>3</sup>).

3.2.2 *XPS, XX*—number designation for extruded polystyrene geofoam Type(s) having a minimum density of XX kg/m<sup>3</sup>(lb/ft<sup>3</sup>).

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.

## 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.

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 *Combustibility Requirements*—All RCPS geofoam shall

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol

**TABLE 1 Physical Property Requirements of RCPS Geofoam**

Type	EPS12	EPS15	EPS19	EPS22	EPS29	XPS20	XPS21	XPS26	XPS29	XPS36	XPS48
Density, min., kg/m <sup>3</sup> (lb/ft <sup>3</sup> )	11.2 (0.70)	14.4 (0.90)	18.4 (1.15)	21.6 (1.35)	28.8 (1.80)	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 %	15 (2.2)	25 (3.6)	40 (5.8)	50 (7.3)	75 (10.9)	20 (2.9)	35 (5.1)	75 (10.9)	105 (15.2)	160 (23.2)	280 (40.6)
Compressive Resistance, min., kPa (psi) at 5 %	35 (5.1)	55 (8.0)	90 (13.1)	115 (16.7)	170 (24.7)	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 %	40 (5.8)	70 (10.2)	110 (16.0)	135 (19.6)	200 (29.0)	104 (15.0)	104 (15.0)	173 (25.0)	276 (40.0)	414 (60.0)	690 (100.0)
Flexural Strength, min., kPa (psi)	69 (10.0)	172 (25.0)	207 (30.0)	276 (40.0)	345 (50.0)	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

For XPS at yield or 10% deformation whichever occurs first and tested with skins intact.

contain sufficient flame retardants to meet a minimum Oxygen Index as required in Table 1.

6.4 *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 2. 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.

8.1.2 *Volume Damage*—Volumetric damage of RCPS geofoam shall be limited to less than 1 % of the volume of a single unit.

8.1.3 *UV (Ultra-Violet) Degradation*—Discoloration and dusting of RCPS geofoam caused by the extensive exposure to sunlight is a defect that will adversely affect its service and is grounds for rejection. Refer to X1.6.

## 9. Inspection

9.1 *Sampling*—Unless otherwise specified in the purchase order or contract, the material shall be sampled for inspection in accordance with Criteria C 390.

9.2 *Weight*—Determine the weight of selected full size units in accordance with Test Method D 1622, or as specified.

9.3 *Dimensions*—Verify specified dimensions and tolerances, as prescribed in Test Method D 1622 and 7.2 of this specification.

**TABLE 2 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)

9.4 *Density*—Compute the density of test samples in accordance with Test Method D 1622.

## 10. Acceptance or Rejection

10.1 Material that fails to conform to this specification shall be rejected promptly in writing. The manufacturer or supplier shall have the right to re-inspect the rejected shipment and resubmit selected units for acceptance under tightened inspection.

## 11. Certification

11.1 Unless otherwise specified in the purchase order or contract, the manufacturer or supplier shall furnish third party certification that representative material has either been tested or inspected as directed in the specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

## 12. Product Marking

12.1 The following shall be marked on each whole unit of product:

- 12.1.1 Manufacturers Identification,
- 12.1.2 Date of Manufacture,
- 12.1.3 Type, (See Table 1), and
- 12.1.4 Weight, or Density.

## 13. Test Methods

13.1 *Dimensions and Density*—Test in accordance with Test Method C 303 or Test Method D 1622.

13.2 *Compressive Resistance*—Test in accordance with Test Method C 165 or Test Method D 1621 using 50 mm (2 in.) cubes. The rate of cross-head movement shall be  $5.0 \pm 0.5$  mm/min ( $0.2 \pm 0.02$  in/min) equivalent to 10 % strain per minute.

13.3 *Flexural Strength*—Test in accordance with Test Method C 203.

13.4 *Oxygen Index*—Test in accordance with Test Method D 2863.

## 14. Keywords

14.1 block; board; cellular polystyrene; EPS; expanded polystyrene; extruded polystyrene; foam plastic; geofoam; RCPS; reprocessed; rigid cellular polystyrene; XPS

## APPENDIX

### (Nonmandatory Information)

#### X1. END-USE CONSIDERATIONS

##### X1.1 Thermal Resistance

X1.1.1 RCPS geofoam also functions as a thermal insulation. The thermal insulation properties of RCPS geofoam are as specified in Specification C 578, and may impact the end use design of applications subject to different exposure conditions. Consult the RCPS geofoam manufacturer for specific recommendations.

##### X1.2 Solvent Exposure

X1.2.1 RCPS geofoam must be protected from petroleum based solvents and their vapors. Examples of these solvents are: gasoline, diesel fuel, concrete curing compound, coal tar pitch, and asphaltic mastic compounds.

##### X1.3 Equipment Traffic

X1.3.1 Equipment traffic that can impose contact pressures in excess of the allowable design stress for RCPS geofoam should be restricted. Protective materials such as sheathing or

planks may be placed on the material to allow light rubber-tired equipment use.

##### X1.4 Buoyancy

X1.4.1 RCPS geofoam becomes buoyant when submerged in water and adequate ballast must be provided to resist expected uplift forces.

##### X1.5 Design

X1.5.1 The design and installation of RCPS geofoam is the responsibility of the user.

X1.5.2 RCPS geofoam can be supplied precut to specified dimensions to fit specific project needs. Desired shapes and sizes can also be field cut with a hot wire, saw, or other cutting tool.

##### X1.6 Ultra-Violet Degradation

X1.6.1 Discoloration and dusting of load bearing surfaces of RCPS geofoam caused by extended exposure to sunlight shall be removed by pressure washing.

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