Designation: D7293 – 19

Standard Specification for Extruded and Compression-Molded Shapes Made from Polyetherimide (PEI)[1]

This standard is issued under the fixed designation D7293; 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 (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This specification is intended to be a means of calling out plastic shapes used in the fabrication of end items or parts.

1. Scope*

1.1 This specification covers requirements and test methods for the dimensions, workmanship, and the properties of extruded and compression-molded sheet, plate, rod and tubular bar manufactured from polyetherimide (PEI) resins.

1.2 The properties included in this specification are those required for the compositions covered. It is possible that other requirements will be necessary to identify particular characteristics important to specialized applications. These shall be specified by using the suffixes as given in Section 5.

1.3 This specification does not allow for the use of recycled plastics (as defined in Guide D7209).

1.4 The values stated in English units are regarded as standard in all property and dimensional tables. For reference purposes, SI units are also included in Table 1 and Table S-PEI.

1.5 The following safety hazards caveat pertains only to the test method or test methods described in this specification. *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D883 Terminology Relating to Plastics

D3892 Practice for Packaging/Packing of Plastics

D4000 Classification System for Specifying Plastic Materials

D5205 Classification System and Basis for Specification for Polyetherimide (PEI) Materials

D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)[3]

IEEE/ASTM SI-10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

2.2 *ANSI Standard:*[4]

Z1.4-1993 Sampling Procedures and Tables for Inspection by Attributes

3. Terminology

3.1 *Definitions*—For definitions of the terms used in this specification and associated with plastics issues, refer to the terminology contained in D883.

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

***A Summary of Changes section appears at the end of this standard**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *rod, n*—extruded solid cylindrical shape with a minimum diameter of 1/16 in. (1.6 mm).

3.2.2 *sheet, n*—flat stock with thickness greater than 1/4-in. (6.4-mm).

3.2.3 *tubular bar, n*—extruded annular shapes with minimum inside diameter of 3/8 in. (0.5 mm) and minimum wall thickness of 1/16 in. (1.6 mm).

4. Classification

4.1 This specification covers shapes extruded and compression molded from polyetherimide (PEI) resins as listed in Table S-PEI. The PEI resin is included in the designation using Specification D5205 callout.

4.1.1 The type of PEI extruded shape shall be categorized by composition.

4.1.2 There shall be only one class of PEI shape, for virgin products.

4.1.2.1 *Class 1*—General purpose product made using 100 % virgin resin.

4.2 The type and class shall be further differentiated based on dimensional tolerances and dimensional stability (based on elevated temperature excursion testing). Grades 1 and 2 shapes are produced with the closest commercial tolerances and lowest stress levels for machined parts as delineated in Table A and Table B. Any additional or custom tolerance requirements are to be specified. Custom tolerances shall be noted following the grade designation.

TABLE S-PEI Requirements for PEI Shapes, Dry-as-Manufactured (<0.2 % Moisture)

Type	Description	Class	Description	Grade	Applicable D5205 Callout[A]	Description	Ultimate Tensile Strength, min, psi (MPa)	Tensile Elongation, % at Break, min	Tensile Modulus, min, psi (MPa)	Dimensional Stability, %, max
01		1	Unfilled	1	D5205 PEI 0113	General purpose	14 000 (97)	50	425 000 (2930)	0.4
		1	Unfilled	0		Other				
02	Glass filled	1	10 % glass reinforced	1	...	General purpose	14 500 (100)	2	500 000 (3447)	0.4
	Glass filled	1	20 % glass reinforced	2	...	General purpose	15 000 (103)	2	600 000 (4137)	0.4
	Glass filled	1	30 % glass reinforced	3	D5205 PEI0110[B]	General purpose	16 000 (110)	2	800 000 (5516)	0.4
	Glass filled	1	Glass reinforced	0		Other				
00	Other	1	Other	0		Other				

[A] Applicable Classification System D5205 resin type to be specified on purchase order.
[B] G30A99169

TABLE A Dimensional Requirements for Natural and Glass-Filled Extruded PEI Rod[A]

Size, in.[B]	Diameter Tolerance, in.	Roundness TIR, in.	Camber, in./ft
1/16	+0.002–0.001	0.002	2½ /8
1/8	+0.002–0.001	0.002	2½ /8
3/16	+0.002–0.001	0.002	2½ /8
1/4	+0.003–0.001	0.002	2½ /8
3/8	+0.003–0.001	0.002	2½ /8
1/2	+0.003–0.001	0.002	2½ /8
5/8	+0.003–0.001	0.002	2½ /8
3/4	+0.003–0.001	0.002	2½ /8
7/8	+0.003–0.001	0.002	2½ /8
1	+0.003–0.001	0.002	1¼ /8
1⅛	+0.005–0.000	0.005	1¼ /8
1¼	+0.005–0.000	0.005	1¼ /8
1⅜	+0.005–0.000	0.005	1¼ /8
1½	+0.005–0.000	0.005	1¼ /8
1⅝	+0.005–0.000	0.005	1¼ /8
1¾	+0.005–0.000	0.005	1¼ /8
1⅞	+0.005–0.000	0.005	1¼ /8
2	+0.005–0.000	0.010	1¼ /8
2⅛ –2¾	+0.005–0.000	0.030	1¼ /8
3	+0.250–0.000	0.060	1/4/4

[A] Based on dry-as-manufactured condition and proper product storage and handling.
[B] To convert inches to millimeters, multiply by 25.40.

TABLE B Dimensional Requirements for Natural and Glass-Filled Extruded and Compression-Molded PEI Sheets and Plates (Squareness Requirement Listed in 11.4)[A]

Size, in.[B,C]	Thickness Tolerances, in.	Length Camber, in./ft	Width Bow, in./ft
1/16	±0.005	3/4 /4	3/16 /2
3/32	±0.005	3/4 /4	3/16 /2
1/8	+0.025–0.000	3/4 /4	3/16 /2
3/16	+0.025–0.000	3/4 /4	3/16 /2
1/4	+0.025–0.000	3/4 /4	3/16 /2
5/16	+0.025–0.000	3/4 /4	3/16 /2
3/8	+0.025–0.000	3/4 /4	3/16 /2
7/16	+0.025–0.000	3/4 /4	3/16 /2
1/2	+0.025–0.000	3/4 /4	3/16 /2
5/8	+0.025–0.000	3/4 /4	3/16 /2
3/4	+0.025–0.000	3/4 /4	3/16 /2
7/8	+0.025–0.000	3/4 /4	3/16 /2
1	+0.025–0.000	1/4 /4	1/16 /2
1 1/8	+0.025–0.000	1/4 /4	1/16 /2
1 1/4	+0.025–0.000	1/4 /4	1/16 /2
1 3/8	+0.025–0.000	1/4 /4	1/16 /2
1 1/2	+0.025–0.000	1/4 /4	1/16 /2
1 5/8	+0.025–0.000	1/4 /4	1/16 /2
1 3/4	+0.025–0.000	1/4 /4	1/16 /2
1 7/8	+0.250–0.000	1/4 /4	1/16 /2
2	+0.025–0.000	1/4 /4	1/16 /2
Over 2	+0.125–0.000	1/4 /4	1/16 /2

[A]Based on dry-as-manufactured condition and proper product storage and handling.
[B]To convert inches to millimeters, multiply by 25.40.
[C]Width 24–in. sheet (+0.5 in.-0). Length 48-in. sheet (+1.0 in.-0).

4.3 The type, class, and grade is further differentiated based on dimensional stability (elevated temperature excursion test), Table S-PEI and dimensional requirements, Tables A and B.

4.4 *Property Tables*

4.4.1 Table S-PEI shall be used to describe both extruded or compression-molded products.

4.4.2 Table 1 shall be used to describe extruded or compression-molded products not included in Table S-PEI by way of a cell callout that includes the applicable Table S-PEI type and specific properties (Designations 1-7).

4.4.3 To facilitate the incorporation of future or special materials not covered by Table S-PEI, the other category for type, class, and grade (0010) is shown on the table with the basic properties to be obtained from Table 1, as they apply (see 4.5).

4.4.4 *Reinforcements and Additive Materials*—A symbol (single letter) shall be used for the major reinforcement or combination or both along with two numbers that indicate the percentage of addition by mass with the tolerances as tabulated below. This shall be included in all Table 1 callouts (see 4.5, Example 5).

Symbol	Material	Tolerance (Based on the Total Mass)
C	Carbon and graphite fiber	±2 %
G	Glass	±2 %
L	Lubricants (for example, PTFE, graphite, silicone, and molybdenum disulfide)	Depends upon material and process— to be specified
M	Mineral	±2 %
R	Combinations of reinforcements or fillers or both	±3 % for the total reinforcement

4.5 *Callout Designation*—A one-line system shall be used to specify materials covered by this specification. The system uses predefined cells to refer to specific aspects of this specification as illustrated in the following examples:

4.5.1 *Description:*

4.5.1.1 *Example 1*—Product made from general purpose PEI 0111:

CELL CALLOUT: D7293 S-PEI0111

4.5.1.2 *Example 2*—Product made from extruded PEI, 30 % glass-reinforced:

CELL CALLOUT: D7293 S-PEI0213

4.5.1.3 *Example 3*—Product made from extruded PEI, 15 % graphite-filled with tensile strength greater than 8000 psi and elongation greater than 5 %:

CELL CALLOUT: D7293 S-PEI0100 C15 23000000

4.5.2 The examples illustrate how a one-line, alphanumeric sequence can identify the product composition, commercial parameters, and physical characteristics of extruded product. A space shall be used as a separator between the specification number and the type designation. No separators are needed between type, class, and grade. When special notes are to be included, such information shall be preceded by a comma. Special tolerances shall be noted in parentheses following a comma after the specification.

5. Physical Properties

5.1 The physical property values listed within this specification's tables are to be considered minimum specification values. Any requirement for specific test data for a given production lot shall be specified at the time of order. Physical properties for products not yet included in Table S-PEI shall be specified using Table 1 for extruded products.