Designation: ~~D7293 – 06~~ D7293 – 12

Standard ~~Test Method~~ 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 ~~test method~~ specification is intended to be a means of calling out plastic shapes used in the fabrication of end items or parts.

1. ~~Scope~~ Scope*

1.1 This ~~test method~~ specification covers requirements and test methods for the ~~material,~~ dimensions, ~~and~~ 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 ~~test method~~ 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 ~~agreed upon between the user and the supplier,~~ specified by using the suffixes as given in Section 5.

1.3 This ~~test method~~ specification does not allow for the use of recycled plastics (as defined in Guide ~~D5033~~D7209).

1.4 The values stated in ~~inch-pound~~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 *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 limitations prior to use.*

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

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
~~D5033~~D7209 Guide for ~~Development of ASTM Standards Relating to Recycling~~ Waste Reduction, Resource Recovery, and Use of Recycled ~~Plastics~~Polymeric Materials and Products ~~(Withdrawn 2007)~~
D5205 Classification System and Basis for Specification for Polyetherimide (PEI) Materials
IEEE/ASTM SI-10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

2.2 *ANSI Standard:*[3]

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

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

Current edition approved ~~Dec. 1, 2006~~Aug. 1, 2012. Published ~~December 2006~~October 2012. Originally approved in 2006. Last previous edition approved in 2006 as D7293 – 06. DOI: 10.1520/D7293-06.

[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] 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. Terminology

3.1 *Definitions*—For definitions of other technical terms pertaining to plastics used in this ~~test method,~~ specification, see Terminology D883.

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) thickness.~~ (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 ~~test method~~ 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 ~~class depending on~~ composition.

4.1.2 ~~Every~~ There shall be only one class of PEI ~~shape shall be categorized into one grade for virgin unfilled~~ shape, for virgin products.

4.1.2.1 ~~*Grade*~~*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 ~~materials~~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 at time of order.~~ 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~~	~~Polyetherimide~~	~~1~~	~~Unfilled~~	~~1~~	~~D5205 PEI 0113~~	~~General purpose~~	~~14 000 (97)~~	~~50~~	~~425 000 (2930)~~	~~0.4~~
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
~~02~~	~~Glass filled~~	~~1~~	~~30 % glass reinforced~~	~~3~~	~~D5205 PEI0110[B]~~	~~General purpose~~	~~16 000 (110)~~	~~2~~	~~800 000 (5516)~~	~~0.4~~
	Glass filled	1	30 % glass reinforced	3	D5205 PEI0110[B]	General purpose	16 000 (110)	2	800 000 (5516)	0.4
	~~As specified~~ Glass filled	1	Glass reinforced	0		Other				
00	~~4000~~ Other ~~4001~~	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
1 1/8	+0.005–0.000	0.005	1¼ /8
1 1/4	+0.005–0.000	0.005	1¼ /8
1 3/8	+0.005–0.000	0.005	1¼ /8
1 1/2	+0.005–0.000	0.005	1¼ /8
1 5/8	+0.005–0.000	0.005	1¼ /8
1 3/4	+0.005–0.000	0.005	1¼ /8
1 7/8	+0.005–0.000	0.005	1¼ /8
2	+0.005–0.000	0.010	1¼ /8
2 1/8 –2 3/4	+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 millimetres, 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 millimetres, 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 ~~also~~ be used to describe extruded or ~~cast~~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 ~~as-specified~~other category ~~(00)~~ 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)~~	~~by agreement between the supplier and the user~~
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 ~~test method.~~ specification. The system uses predefined cells to refer to specific aspects of this ~~test method~~ 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