



Designation: D7293 – 06

Standard Test Method 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 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 test method 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 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, by using the suffixes as given in Section 5.

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

1.4 The values stated in inch-pound 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

¹ This test method 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.

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 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics (Withdrawn 2007)³

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:⁴

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

3. Terminology

3.1 *Definitions*—For definitions of other technical terms pertaining to plastics used in this test method, 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 $\frac{1}{16}$ in. (1.6 mm).

3.2.2 *sheet, n*—flat stock greater than $\frac{1}{4}$ -in. (6.4-mm) thickness.

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.

TABLE 1 Additional Detail Requirements—Reinforced/Unreinforced^A

Designation Order Number	Property	0	1	2	3	4	5	6	7	8	9
1	Tensile strength, Test Method D638 , min, psi (MPa)	Unspecified	6000 (41)	8000 (55)	10 000 (69)	12 000 (83)	14 000 (97)	16 000 (110)	20 000 (138)	25 000 (172)	Specify Value
2	Elongation at break, Test Method D638 , %, min	Unspecified	1	3	5	10	20	50	100	200	Specify Value
3	Tensile modulus min, Test Method D638 , min, psi (MPa)	Unspecified	100 000 (690)	200 000 (1379)	300 000 (2073)	400 000 (2760)	500 000 (3448)	600 000 (4137)	800 000 (5516)	1 000 000 (6895)	Specify Value
4	Dimensional stability, % max, per 11.2	Unspecified	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.5	Specify Value
5	Flexural modulus, Test Methods for D790 , min, psi (MPa)	Unspecified	250 000 (1649)	350 000 (2400)	450 000 (3100)	550 000 (3792)	650 000 (4482)	750 000 (5171)	1 000 000 (6895)	1 500 000 (10 343)	Specify Value
6	Izod impact, Test Method for D256 , min, ft lbs/in. J/m) of notch	Unspecified	0.4 (21)	0.6 (32)	0.8 (43)	1.0 (53)	2.0 (107)	3.0 (160)	4.5 (240)	6.0 (320)	Specify Value
7	Table 1 grade, dimensional requirements	Unspecified	A-1	B-1	...	...	...	...	...	...	Specify Value
8	To be determined	Unspecified	...	...	...	...	...	...	...	...	Specify Value

^AThe applicable Practice **D5205** resin callout (including resin type, fillers) must precede this table designation.

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

4. Classification

4.1 This test method 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 class of PEI shape shall be categorized into one grade for virgin unfilled products.

4.1.2.1 *Grade 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 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. 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	General purpose	14 000 (97)	50	425 000 (2930)	0.4
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	General purpose	16 000 (110)	2	800 000 (5516)	0.4
	As specified				PEI0110 ^B					
	4000									
	4001									

^AApplicable Classification System D5205 resin type to be specified on purchase order.

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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	2 1/2 /8
1/8	+0.002-0.001	0.002	2 1/2 /8
3/16	+0.002-0.001	0.002	2 1/2 /8
1/4	+0.003-0.001	0.002	2 1/2 /8
3/8	+0.003-0.001	0.002	2 1/2 /8
1/2	+0.003-0.001	0.002	2 1/2 /8
5/8	+0.003-0.001	0.002	2 1/2 /8
3/4	+0.003-0.001	0.002	2 1/2 /8
7/8	+0.003-0.001	0.002	2 1/2 /8
1	+0.003-0.001	0.002	1 1/4 /8
1 1/8	+0.005-0.000	0.005	1 1/4 /8
1 1/4	+0.005-0.000	0.005	1 1/4 /8
1 3/8	+0.005-0.000	0.005	1 1/4 /8
1 1/2	+0.005-0.000	0.005	1 1/4 /8
1 5/8	+0.005-0.000	0.005	1 1/4 /8
1 3/4	+0.005-0.000	0.005	1 1/4 /8
1 7/8	+0.005-0.000	0.005	1 1/4 /8
2	+0.005-0.000	0.010	1 1/4 /8
2 1/8 -2 3/4	+0.005-0.000	0.030	1 1/4 /8
3	+0.250-0.000	0.060	1/4/4

^ABased on dry-as-manufactured condition and proper product storage and handling.

^BTo convert inches to millimetres, multiply by 25.40.

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TABLE B Dimensional Requirements for Natural and Glass-Filled Extruded 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

^ABased on dry-as-manufactured condition and proper product storage and handling.

^BTo convert inches to millimetres, multiply by 25.40.

^CWidth 24-in. sheet (+0.5 in.-0). Length 48-in. sheet (+1.0 in.-0).