Designation: D7292 – 18

Standard Specification for Extruded, Compression-Molded, and Injection-Molded Basic Shapes of Polyamide-Imide (PAI)[1]

This standard is issued under the fixed designation D7292; 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.

1. Scope*

1.1 This specification covers requirements and methods of test for the material, dimensions, and workmanship of extruded, compression molded, and injection molded parts manufactured from PAI.

1.2 The properties included in this specification are those required for the compositions covered. Requirements necessary to identify particular characteristics important to specialized applications are described by the classification system given in Section 5.

1.3 This specification allows for the use of recycled materials provided that specification requirements based upon this specification are met.

1.4 The values stated in English units are to be regarded as standard in all property and dimensional tables. For reference purposes, SI units and conversion factors are also included.

1.5 The following precautionary caveat pertains only to the test method portion Section 12, of 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

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D883 Terminology Relating to Plastics

D1708 Test Method for Tensile Properties of Plastics by Use of Microtensile Specimens

D3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry

D3892 Practice for Packaging/Packing of Plastics

D4000 Classification System for Specifying Plastic Materials

D5204 Classification System and Basis for Specification for Polyamide-Imide (PAI) Molding and Extrusion Materials

D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *finished product (F), n*—a product that meets the dimensional criteria of Tables A and B in this specification.

3.1.2 *plate, n*—flat stock with thickness greater than 3⁄16 in. (4.76 mm).

[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.

Current edition approved Aug. 1, 2018. Published August 2018. Originally approved in 2006. Last previous edition approved in 2012 as D7292 - 12. DOI: 10.1520/D7292-18.

[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.

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

3.1.3 *recycled plastic shape, n*—a product made from up to 100 % recycled plastic.

3.1.4 *rod, n*—solid extruded cylindrical shape with a minimum diameter of 3⁄32 in. (2.38 mm).

3.1.5 *virgin plastic shape, n*—a shape produced entirely of plastic resin that has not been melt processed more than once.

3.2 *Additional Definitions:*

3.2.1 For definitions of other technical terms pertaining to plastics used in this specification, see Terminology D883 or Guide D7209.

4. Applications

4.1 Typical applications for these parts are for products that require low coefficient of friction, good thermal resistance, and toughness up to 250°C. However, usage is not limited to these applications. Specific grades are designed for high strength, wear resistance, low coefficient of friction and reinforced for improved load bearing capacity and non-abrasive wear.

5. Classification and Material

5.1 Product shape and size as defined in the applicable purchase order.

5.2 This specification covers product manufactured as listed in Table S-PAI. Materials included in the designations reference Classification System D5204 callouts where applicable.

5.2.1 The PAI material used in the product is normally categorized by type, grade, and class depending on resin and filler compositions as defined in Table S-PAI.

5.3 The type, class, and grade are further differentiated based on Table S-PAI, Table A, and dimensional requirements, Table I.

5.4 *Property Tables:*

5.4.1 Table S-PAI is used to describe manufactured parts.

5.4.2 Table I is used to describe products not included in Table S-PAI via a cell callout that includes the applicable Table S-PAI type and specific properties.

5.4.3 To facilitate the incorporation of future or special materials not covered by the Table S-PAI, the "other" category (00) for type, class and grade is shown in the table with the basic properties to be obtained from Table I, as they apply.

5.4.4 *Reinforcements and Additive Materials*—A symbol (single letter) is to be used for the major reinforcement or combination, or both, along with two numbers which indicate the percentage of addition by mass with the tolerances as tabulated below. This must be included in all Table I callouts.

Symbol	Material	Tolerance (Based on the Total Mass)
C	Carbon and graphite fiber	±2 %
G	Glass fiber	±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 %

5.5 *Callout Designation*—A one-line system shall be used to specify PAI parts covered by this specification. The system uses predefined cells to refer to specific aspects of this specification, as illustrated below:

5.5.1 *Description:*

5.5.1.1 *Example 1*—Extruded PAI rod:

CELL CALLOUT: S-PAI0111
S-PAI01 = Extruded Product made from PAI resin in accordance with Table S-PAI
1 = Class: Electrical grade
1 = Grade: PAI011M03 as specified in Table S-PAI

5.5.1.2 *Example 2*—Product made from injection molded glass filled PAI material:

CELL CALLOUT: S-PAI0231
S-PAI02 = Injection molded product made from PAI resin as specified in Table S-PAI
3 = Class: glass reinforced
1 = Grade: PAI013G30 as specified in table S-PAI

5.5.1.3 *Example 3*—Product not included in Table S-PAI:

CELL CALLOUT: S-PAI 0000 1022500
S-PA0000 = Molded product made from PAI resin

00 = Type Other
0 = Class Other
0 = Grade Other

1 = Minimum Tensile Strength of 10,000 psi
0 = Elongation – no requirement
2 = Minimum tansile Modulus of 400,000 psi
2 = Minimum Flexural Modulus of 550,000 psi
5 = Izod Impact specified value of 4.5 ft-lb/in min
0 = Minimum glass transition temperature – not required
0 = other – not required

5.5.2 The three examples illustrate how a one-line, alphanumeric sequence identify the product composition, commercial parameters, and physical characteristics of extruded, compression-molded or injection-molded product. A space must 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 must be noted at time of order and are inserted after the grade in parenthesis and preceded by a comma.

TABLE S-PAI Additional Detailed Requirements—for Extruded, Compression- and Injection-Molded PAI Shapes

Type	Description	Class	Description	Grade	Applicable D5204 Callout	Ultimate Tensile Strength, min. psi (MPa)	Elongation at Break, % min.	Specific Gravity
01	Extruded Shapes	1	Electrical Grade	1	PAI021M03	17 000 (117)	10	1.38–1.44
			Other	0	As Specified			
		2	Bearing Grade	1	PAI022L15	12 000 (83)	3	1.43–1.48
			Other	0	As Specified			
		3	Glass Fiber	1	PAI023G30	18 000 (124)	2	1.57–1.62
			Other	0	As Specified			
		4	Carbon Fiber	1	PAI023C30	8000 (55)	2	1.44–1.49
			Other	0	As Specified			
		0	Other	0	As Specified			
02	Injection Molded Shapes	1	Electrical Grade	1	PAI011M03			
			Other	0	As Specified			
		2	Bearing Grade	1	PAI012L15			
			Other	0	As Specified			
		3	Glass Fiber	1	PAI013G30			
			Other	0	As Specified			
		4	Carbon Fiber	1	PA013C30			
		0	Other	0	As Specified			
03	Compression Molded	1	Electrical Grade	1	PAI000M30	10 000 (69)	2	1.38–1.44
			Other	0	As Specified			
		2	Bearing Grade	1	PAI000L15	10 000 (69)	2	1.43–1.48
			Other	0	As Specified			
		3	Glass Fiber					
			Other	0	As Specified			
		4	Carbon Fiber					
		0	Other	0	As Specified			
00	Other	0	Other	0	As Specified			

TABLE A Dimensional Requirements for Extruded PAI Rod

Size (in.)	Roundness Tolerances (in.)	Camber, max. (in.)	
		4 ft	8 ft
0.093	+0.003/-0	0.625	2.50
0.125	+0.003/-0	0.625	2.50
0.250[A]		0.625	2.50
0.375[A]		0.375	1.50
0.500[A]		0.250	1.00
0.625[A]		0.250	1.00
0.750[A]		0.250	1.00
1.000[A]		0.187	0.75
1.250[A]		0.187	0.75
1.375[A]		0.125	0.50
1.750[A]		0.125	0.50
2.000[A]		0.125	0.50

[A]Supply oversized and machine to size.