



Designation: D 5336 – 00

Standard Specification for Polyphthalamide (PPA) Injection Molding Materials¹

This standard is issued under the fixed designation D 5336; 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 polyphthalamide materials suitable for injection molding.

1.2 The properties included in this specification are those required to identify the compositions covered. There may be other requirements necessary to identify particular characteristics important to specialized applications. These may be specified by using suffixes as given in Section 5.

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

1.4 This specification is intended to be a means of calling out plastics materials used in the fabrication of end items or parts. It is not intended for the selection of materials. Material selection should be made by those having expertise in the plastics field after careful consideration of the design and the performance required of the part, the environment to which it will be exposed, the fabrication process to be employed, the inherent properties of the material other than those covered by this specification, and the economics.

1.5 The values stated in SI units are to be regarded as the standard (see IEEE/ASTM SI-10).

1.6 The following precautionary caveat pertains only to the test methods 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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Note 6.

NOTE 1—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

D 256 Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics²

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²

D 638 Test Method for Tensile Properties of Plastics²

D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load²

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials²

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement²

D 883 Terminology Relating to Plastics²

D 1600 Terminology for Abbreviated Terms Relating to Plastics²

D 2857 Practice for Dilute Solution Viscosity of Polymers³

D 3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis³

D 3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials³

D 3835 Test Method for Determination of Properties of Polymeric Materials by Means of a Capillary Rheometer³

D 3892 Practice for Packaging/Packing of Plastics³

D 4000 Classification System for Specifying Plastic Materials³

D 4019 Test Method for Moisture in Plastics by Coulometric Regeneration of Phosphorus Pentoxide³

D 5225 Test Method for Measuring Solution Viscosity of Polymers with a Differential Viscometer⁴

D 5630 Test Method for Ash Content in Thermoplastics⁴

D 5740 Guide for Writing Material Standards in the D 4000 Format⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵

IEEE/ASTM SI-10 Standard for Use of the International System of Units (SI): The Modern Metric System⁶

2.2 *Underwriters Laboratories Standard:*

UL94 Standard for Tests for Flammability of Plastic Materials⁷

3. Terminology

3.1 *Definitions*—The terminology used in this specification is in accordance with Terminologies D 883 and D 1600.

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 (Section D20.15.09).

Current edition approved April 10, 2000. Published July 2000. Originally published as D 5336 – 92. Last previous edition D 5336 – 93.

² *Annual Book of ASTM Standards*, Vol 08.01.

³ *Annual Book of ASTM Standards*, Vol 08.02.

⁴ *Annual Book of ASTM Standards*, Vol 08.03.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 14.04.

⁷ Available from Underwriters Laboratories, 1285 Walt Whitman Road, Melville, Long Island, NY 11747.

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



3.2 Definitions of Terms Specific to This Standard:

3.2.1 *polyphthalamide, PPA, n*—a polyamide in which residues of terephthalic acid or isophthalic acid or a combination of the two comprise at least 55 molar percentage of the dicarboxylic acid portion of the repeating structural units in the polymer chain.

4. Classification

4.1 The polyphthalamide materials will be designated “PPA,” as specified in Terminology D 1600.

4.2 Unreinforced polyphthalamide materials are classified into groups according to crystallinity. These groups are subdivided into classes and grades as shown in Table PPA.

NOTE 2—An example of this classification system is as follows:
The designation PPA0121 would indicate from Table PPA:

- PPA = Polyphthalamide as found in Terminology D 1600
- 01 (Group) = Semicrystalline PPA
- 2 (Class) = Low-temperature molding material
- 1 (Grade) = With the corresponding requirements shown in Table PPA

4.2.1 To facilitate the incorporation of future or special materials, the “other/unspecified” category (00) for group, (0) for class, and (0) for grade is shown. The basic properties of the material can be obtained from Table A as they apply.

TABLE PPA Requirements for Unreinforced Polyphthalamide Resins

Group	Description	Class	Description	Grade	Description	Inherent Viscosity ^A dL/g	Melting Temperature, ^B °C	Glass Transition ^B , T _g , °C	
01	semicrystalline PPA	1	high-temperature molding	1		0.98-1.06	305-320	115-130	
				2		0.91-0.99	305-320	115-130	
				3		0.83-0.91	305-320	115-130	
		2	low-temperature molding	0	other				
				1		0.95-1.05	320-335	90-105	
				2		0.85-0.95	290-305	85-95	
0	other	0	other	3		0.95-1.05	300-315	85-95	
				0	other				
				0	other				
00	other	0	other	0	other				

^APractice D 2857 or Test Method D 5225 with conditions as specified in 12.6 of this specification.

^BTest Method D 3418 using a heating rate of 10°C/min.

TABLE A Detail Requirements of Special Reinforced PPAs

NOTE—All mechanical properties are determined on dry-as-molded injection molded specimens.

Property	0	1	2	3	4	5	6	7	8	9
Inherent viscosity, ^A Test Method D 2857, dL/g, min	^B 0.60	0.70	0.75	0.8	0.85	0.9	0.95	1.0	1.1	1.2
Tensile strength, Test Method D 638 ^D , MPa ^E (psi), min	^B 45 (6500)	75 (10900)	90 (13000)	100 (14500)	135 (19600)	200 (29000)	230 (33400)	255 (37000)	^C	^C
Flexural modulus, Test Method D 790 ^F , GPA (kpsi), min	^B 1.5 (218)	2.5 (363)	3.0 (435)	5.5 (798)	6.5 (943)	10.0 (1450)	13.5 (1958)	15.0 (2175)	^C	^C
Izod impact, Test Method D 256 ^G J/m ^H (ft-lbf/in), min	^B 20 (0.38)	40 (0.75)	60 (1.1)	90 (1.6)	100 (1.9)	350 (6.6)	500 (9.4)	650 (12.1)	^C	^C
Deflection Temperature Test Method D 648 ^I , °C, min	^B 100	125	160	185	210	235	260	285	^C	^C

^ASee 12.6 of this specification for specific conditions.

^BUnspecified requirement.

^CSpecific value must be given in call-out.

^DTest Method D 638, Type I tensile bar. The speed of testing shall be as described in 12.2 of this specification.

^EMPa × 145 = psi.

^FTest Method D 790 with a 1-mm (0.05-in.)/min testing speed.

^GTest Methods D 256, Test Method A.

^HJ/m × 0.01873 = ft-lb/in.

^ITest Method D 648, using 1820-kPa (264-psi) stress.

4.3 Reinforced and lubricated versions of the polyphthalamide materials are classified in accordance with Tables PPA and A, where Table PPA specifies the unreinforced material and Table A the properties after the addition of reinforcements or lubricants at the nominal level indicated (see 4.3.1).

4.3.1 A single letter shall be used to indicate the major reinforcement, or filler, or combinations of reinforcements or fillers, or both, along with two digits that indicate the percent-

age of additive(s) by total mass, with tolerances as tabulated as follows:

Symbol	Material	Tolerance (Based on the Total Mass)
C	Carbon or graphite fiber	±3 %
G	Glass reinforced	±3 %
L	Lubricants	by agreement between the supplier and the user
M	Mineral	±3 %
R	Combinations of reinforcements or fillers, or both	±3 % for the total reinforcement or filler, or both