



Designation: D4067 – 03

Standard Classification System for Reinforced and Filled Poly(Phenylene Sulfide) (PPS) Injection Molding and Extrusion Materials Using ASTM Methods¹

This standard is issued under the fixed designation D4067; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This classification system covers reinforced and filled poly(phenylene sulfide) materials suitable for injection molding and extrusion.

1.2 This classification system is not intended for the selection of materials, but only as a means to call out plastic materials to be used for the manufacture of parts. The selection of these materials shall be made by personnel with expertise in the plastics field where the environment, inherent properties of the materials, performance of the parts, part design, manufacturing process, and economics are considered.

1.3 The properties included in this classification system are those required to identify the compositions covered. If necessary, other requirements identifying particular characteristics important to specific applications shall be designated by using the suffixes given in Section 5 or Classification System D4000.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 This precautionary statement pertains only to the test method portion of this classification system, Section 12. *This standard does not purport to address all of the safety concerns 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.

¹ This classification system 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. 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
- D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- 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
- D1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
- D3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials
- D3835 Test Method for Determination of Properties of Polymeric Materials by Means of a Capillary Rheometer
- D3892 Practice for Packaging/Packing of Plastics
- D4000 Classification System for Specifying Plastic Materials
- D5630 Test Method for Ash Content in Plastics

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.

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

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E595 Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment

E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials

2.2 Military Standards:³

MIL-P-46174 (MR) Plastic Molding Material, Polyphenylene Sulfide, Glass Fiber Reinforced

³ Available from Standardization Documents, Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

TABLE A Physical Property Requirements

Designation Order	Property/ASTM Test Method	Units	0	1	2	3	4	5	6	7	8	9
1	Tensile strength, min D638 ^A	MPa ^B	C	60	80	110	120	130	160	180	200	D
2	Flexural modulus, min D790 ^E	MPa ^B	C	7 000	10 000	12 000	14 000	17 000	20 000	23 000	26 000	D
3	Izod impact strength, min D256 ^F	J/m ^G	C	28	40	52	70	80	90	100	110	D
4	Flexural strength, min D790 ^E	MPa ^B	C	85	105	135	165	195	225	255	285	D
5	Density, min D792	g/cm ³	C	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	D

^A Type I specimens, 3.18 mm thickness, crosshead speed of 5 mm/min.

^B MPa × 145 = psi.

^C Unspecified.

^D Specific value (must be shown).

^E Tangent modulus of elasticity. Test specimens are 3.18 by 12.7 mm and tested with a crosshead speed of 1.3 mm/min ± 50 % with a span to depth ratio of 16:1.

^F Test specimens are 3.18 mm thick with a notch radius of 0.25 mm and tested by Method A.

^G J/m × 18.73 × 10⁻³ = ft.lbf/in.

MIL-M-24519 Molding Plastics, Electrical, Thermoplastic

2.3 ISO Standard:⁴

ISO 527-2 Plastics—Determination of Tensile Properties—Part 2: Test Conditions for Moulding and Extrusion Plastics

- L >15 % glass content ±3 percentage points
- L Lubricants (such as PTFE, graphite, silicone, and molybdenum disulfide) or lubricants with fillers/reinforcements By agreement between the supplier and the user.
- M Mineral-reinforced ±2 percentage points
- R Reinforced-combination/mixtures of reinforcements or other fillers/reinforcements. ±3 percentage points based on the total reinforcement.

3. Terminology

3.1 Definitions:

3.1.1 The definitions used in this classification system are in accordance with Terminology D883 and Terminology D1600.

4. Classification

4.1 There is currently no group, class, or grade distinction and no basic property table is given.

NOTE 2—Where no basic property table exists, the generic family designation will be followed by three zeros, for example: PPS 000.

4.1.1 Table A shall be used to specify the physical property requirements that shall be shown by a six-character designation. The designation shall consist of the letter A and the five digits comprising the cell numbers for the property requirements in the order as they appear in Table A.

4.1.1.1 The values listed are necessary to include the range of properties available in existing materials. However, this does not imply that every possible combination of properties exists or can be obtained with the current state of technology.

4.2 A single letter shall be used to indicate the major category of the reinforcement, along with two numbers that indicate the percentage of additive(s) by mass, with the tolerances as tabulated below:

Category	Material	Tolerance (Based on the total mass)
C	Carbon and graphite fiber-reinforced	±2 percentage points
G	Glass-reinforced ≤15 % glass content	±2 percentage points

NOTE 3—This part of the system uses the type and percentage of additive to designate the modification of the basic material. To facilitate this designation, the type and percentage of additive can be shown on the supplier's technical data sheet unless it is proprietary in nature. If necessary, additional requirements shall be indicated by the use of the suffix part of the system, as given in Section 5. Special agreements on tolerances may be needed below 5 % levels.

NOTE 4—An example of this classification system for a poly(phenylene sulfide) material is as follows: The designation PPS000G40A42043 would indicate the following material requirements from Table A:

- PPS000 = poly(phenylene sulfide) material,
- G40 = glass-reinforced at 40 % nominal level,
- A = Table A physical property requirements,
- 4 = tensile strength, min 120 MPa,
- 2 = flexural modulus, min 10 000 MPa,
- 0 = Izod impact strength, unspecified,
- 4 = flexural strength, min 165 MPa, and
- 3 = density, min 1.60 g/cm³.

If no properties are specified, the designation would be PPS000G40A00000.

5. Suffixes

5.1 When additional requirements are needed that are not covered by the basic requirements or cell table requirements, they shall be indicated through the use of suffixes. Electrical, flammability or other requirements shall be designated by the appropriate suffix from Table 3 of Classification System D4000.

5.1.1 If applicable, heat deflection temperature shall be designated using the following suffix:

Y = Heat deflection temperature as designated by the following digits:

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

First Digit

1 = Test Method D648, 1820 kPa

Second Digit

1 = minimum of 260°C

2 = other minimum temperature (°C) - specify

NOTE 5—Heat treating the test specimens at 260°C for 4 h is permitted to achieve high heat deflection temperatures.

6. Basic Requirements

6.1 Basic requirements from Table A, as they apply, are always in effect unless superseded by specific suffix requirements, which always take precedence.

7. General Requirements

7.1 The plastics composition shall be uniform and shall conform to the requirements specified herein. The color and form of the material shall be as agreed upon between the supplier and the user.

8. Detail Requirements

8.1 Test specimens for the various materials shall conform to the requirements prescribed in Table A and suffix requirements as they apply.

8.2 For the purpose of determining conformance with this classification system, all specified limits in this classification system are absolute limits, as defined in Practice E29.

8.2.1 In the absolute method, an observed value or a calculated value is not rounded off, but is to be compared

directly to the specified limiting value. Conformance or non-conformance with the specification is based on this comparison.

9. Sampling

9.1 Unless otherwise agreed upon between the user and the supplier, the materials shall be sampled in accordance with the sampling procedure prescribed in Practice D1898 - 68(1989). Adequate statistical sampling shall be considered an acceptable alternative. A batch or lot of resin shall be considered as a unit of manufacture as prepared for shipment. It is acceptable to blend two or more production runs to create a batch or lot.

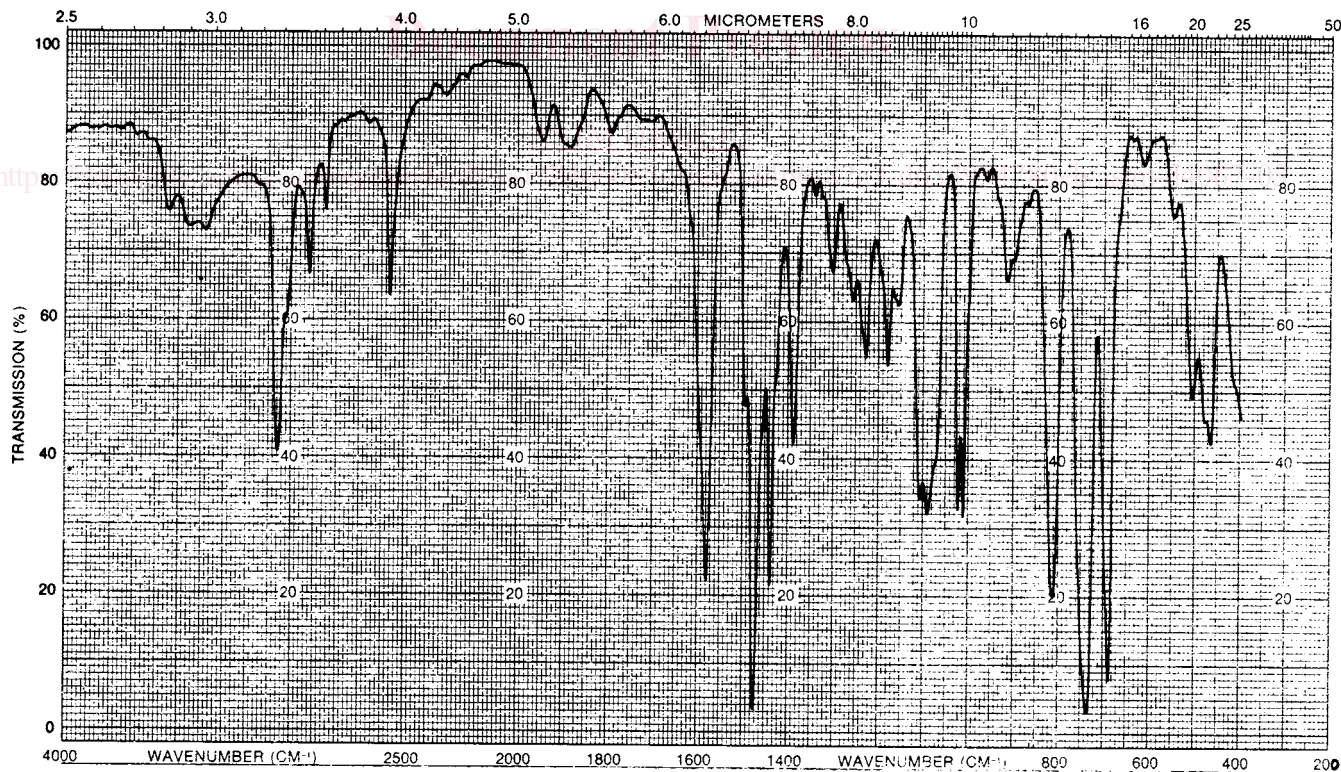
10. Specimen Preparation

10.1 The test specimens shall be prepared by injection molding in accordance with Practice D3641. Processing conditions are:

Drying	2 h at 135°C
Plastic melt temperature	305 - 335°C
Mold temperature	140°C minimum
Average injection velocity	200 ± 100 mm/s
Plastic Hold Pressure	600 bar minimum

11. Conditioning

11.1 *Conditioning*—Condition test specimens at 23 ± 2°C and 50 ± 5 % relative humidity for not less than 40 h prior to testing in accordance with Procedure A of Practice D618, where conditioning is specified.



Phase—Liquid
 Cell thickness—0.025 mm
 Sample—Pyrolyzate
 Prism—NaCl

FIG. 1 Infrared Spectrum of Poly(phenylene sulfide) Pyrolyzate