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Standard Classification System and Basis for Specification for Poly (Phenylene Sulfide) (PPS) Injection Molding and Extrusion Molding, Extrusion and Blow Molding Materials Using ISO Methods¹

This standard is issued under the fixed designation D6358; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This classification system covers unfilled, reinforced filled, and ~~filled~~ impact modified materials suitable for injection molding and ~~extrusion molding, extrusion and blow molding~~ using ISO methods. The system allows for the use of poly (phenylene sulfide) (PPS) plastic materials that are recycled, reconstituted recycled-regrind, recovered or reprocessed, or both, provided that the requirements as stated in this specification are met. It is the responsibility of the supplier and the buyer of recycled, reconstituted, recycled-regrind, recovered or reprocessed, or both, poly (phenylene sulfide) plastic materials to ensure compliance (see Guide [D7209](#)).

1.2 The properties included in this classification are those required to identify the compositions covered. It is possible that other requirements are necessary to identify particular characteristics important to specialized applications. The use of suffixes as shown in Section [5](#) is one way of specifying these requirements.

1.3 This classification system and subsequent line callout (specification) are intended to provide a means of calling out plastic materials used in the fabrication of end items or parts. It is not intended for the selection of materials. Material selection needs to be made by those having expertise in the plastic 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 costs involved, and the inherent properties of the material other than those covered by this classification.

1.4 The following precautionary caveat pertains only to the test method portion, Section [11](#), of this classification system: *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 ~~health~~ environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This standard and ISO 28078 address the same subject matter, but differ in technical content. [1487327809/astm-d6358-19](#)

NOTE 2—ASTM [D4067](#) for PPS uses ASTM test methods.

1.5 *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

[D618 Practice for Conditioning Plastics for Testing](#)

[D883 Terminology Relating to Plastics](#)

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials](#)

[D3892 Practice for Packaging/Packing of Plastics](#)

[D4000 Classification System for Specifying Plastic Materials](#)

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 (Section [D20.15.17](#)).

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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.

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

D4067 Classification System and Basis for Specification for Reinforced and Filled Poly(Phenylene Sulfide) (PPS) Injection Molding and Extrusion Materials Using ASTM Methods

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

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

2.2 IEC and ISO Standards:⁴

IEC 60112 Recommended Methods for Determining the Comparative Tracking Index of Solid Insulation Materials

IEC 60243 Recommended Methods for Electric Strength of Solid Insulating Materials at Power Frequencies

ISO 62 Plastics—Determination of Water Absorption

ISO 178 Plastics—Determination of Flexural Properties of Rigid Plastics

ISO 180/1A Plastics—Determination of Izod Impact Strength of Rigid Materials

ISO 294-1 Plastics—Injection Moulding Test Specimens of Thermoplastic Materials

ISO 527 Plastics—Determination of Tensile Properties

ISO 604 Plastics—Determination of Compressive Properties

ISO 1133 Plastics—Determination of Mass Flow Rate and Melt Volume Flow Rate

ISO 1183 Plastics—Methods for Determining the Density and Relative Density of Noncellular Plastics

ISO 3167 Plastics—Multipurpose Test Specimens

ISO 3451 Plastics—Determination of Ash

ISO 11443 Plastics—Determination of the Fluidity of Plastics Using Capillary and Split Die Rheometers

ISO 28078 Plastics—Poly(phenylene sulfide) (PPS) Moulding and Extrusion Materials—Part 1: Designation System and Basis for Specifications

2.3 UL Standards:⁵

UL 94 Test for Flammability of Plastic Materials for Parts in Devices and Appliances

2.4 NTIS Standards:⁶

AD297457 Procedures and Analytical Method for Determining Toxic Gases Produced by Synthetic Compounds

2.5 Military Standards:⁷

MIL-M-24519

MIL-P-46174

3. Terminology

3.1 *Definitions*—The terminology used in this classification system is in accordance with Terminology D883 and Terminology D1600.

4. Classification

4.1 Poly(phenylene sulfide) materials are classified according to their composition. These classes are subdivided into grades as shown in the Basic Property Table (Table PPS).

NOTE 3—An example of the use of this classification system for specifying fiberglass reinforced poly(phenylene sulfide) is given as follows: The line callout PPS011G40 (specification) indicates the following:

PPS	=	poly(phenylene sulfide) as found in Terminology D1600.
01	=	general purpose (group),
1	=	glass reinforced (class), and
G40	=	nominal 40 % glass with the requirements given in Table PPS (grade).

4.1.1 To facilitate incorporation of future or special materials the “other” category for group (00), class (0), and grade (0) is shown in Table PPS. The basic properties of these materials are obtained from Table A as they apply.

4.2 Reinforced, filled, and unfilled versions of poly(phenylene sulfide) materials that are not in Table PPS are specified in accordance with Tables PPS, A, and B. Table PPS is first used to identify the group and class of poly(phenylene sulfide). Table A is then used to specify the property requirements after the addition or reinforcements, pigments, fillers, or lubricants at the nominal level indicated (see 4.2.1) or Table B is used to specify the property requirements of unfilled/unreinforced versions of poly(phenylene sulfide).

4.2.1 Reinforced versions of the basic materials are identified by a single letter that indicates the reinforcement used and two digits that indicate the nominal quantity in percent by weight. Thus, a letter designation G for glass-reinforced and 30 for percent

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ *ISO and IEC Selected Standards for the Plastics Industry, 2nd Edition*, ASTM, Stock#: ISOPLAS2.

⁵ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

⁶ Available from National Technical Information Service (NTIS), 5301 Shawnee Rd., Alexandria, VA 22312, <http://www.ntis.gov>.

⁷ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

of reinforcement, G30, specifies a filled material with a nominal glass level of 30 %. The reinforcement letter designations and associated tolerance levels are shown as follows:

Symbol	Material	Tolerance (Based on Total Mass)
C	carbon and graphite fiber reinforced	±2 percentage points
G	glass-reinforced	±3 percentage points
L	lubricants (such as PTFE, graphite, silicone)	depends upon material and process. to be specified by supplier/user agreement.
M	mineral-reinforced	±3 percentage points
R	combinations of reinforcements or fillers, or both	±3 percentage points

NOTE 4—This part of the classification system uses the percent of reinforcements or additives, or both, in the callout (specification) of the modified basic material. The types and percentages of reinforcements and additives are usually shown on the supplier’s technical data sheet unless they are proprietary in nature. If necessary, additional callout of these reinforcements and additives are to be accompanied by use of the suffix part of the system (see Section 5).

4.2.2 Specific requirements for reinforced, filled, or lubricated poly(phenylene sulfide) materials shall be identified by using a six-character line callout. The specification shall consist of the letter “A” and the five digits comprising the cell number for the property requirements in the order as they appear in Table A.

4.2.2.1 Although the values listed are necessary to include the range of properties available in existing materials, this does not infer that every possible combination of the properties exists or can be obtained.

4.2.3 When the grade of the basic material is not known, or is not important, the use of the “0” grade classification shall be used for the reinforced materials in this system.

NOTE 5—An example of a specification for a reinforced PPS material is given as follows. The specification PPS0110G20A31042 indicates the following material requirements:

PPS0110	=	Glass reinforced poly(phenylene sulfide), from Table PPS,
G20	=	Glass reinforced at 20 % nominal,
A	=	Table A property requirements,
3	=	110 MPa tensile strength, min,
1	=	6000 MPa flexural modulus, min,
0	=	Unspecified Izod strength,
4	=	160 MPa flexural strength, min, and
2	=	1.5×10^3 kg/m ³ density, min.

If no properties are specified, the designation would be PPS010G20A00000.

NOTE 6—An example of a specification for an unfilled/unreinforced PPS material is given as follows. The designation PPS0000B32030 indicates the following material requirements:

PPS0000	=	unfilled/unreinforced poly(phenylene sulfide), from Table PPS,
B	=	Table B property requirements,
3	=	60 MPa tensile strength, min,
2	=	2000 MPa flexural modulus, min,
0	=	unspecified Izod strength,
3	=	80 MPa flexural strength min, and
0	=	unspecified.

If no properties are specified, the designation would be PPS0000B00000.

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.

5.2 A list of suffixes is found in Classification System D4000 (Table 3) and shall be used for additional requirements as appropriate. Additional suffixes will be added to that standard as test methods and requirements are developed and requested.

6. General Requirements

6.1 Basic requirements from the property tables or cell tables are always in effect unless superseded by specific suffix requirements, which always take precedence.

6.2 The plastics composition shall be uniform and shall conform to the requirements specified herein.

7. Detail Requirements

7.1 The materials shall conform to the requirements in Table PPS, A, and B, and suffix requirements as they apply.

7.2 For purposes of determining conformance, all specified limits for a specification (line callout) based on this classification system are absolute limits, as defined in Practice E29. With the absolute method, an observed value or a calculated value is not rounded, but is to be compared directly with the limiting value. Conformance or nonconformance is based on this comparison.

8. Sampling

8.1 Sampling shall be adequate statistically to satisfy the requirements of 12.4.

8.2 A batch or lot shall be constituted as a unit of manufacture as prepared for shipment and may consist of a blend of two or more “production runs.”

9. Specimen Preparation

9.1 Test specimens for relevant test methods shall be based on the injection molded ISO 3167 Type 1A multipurpose test specimen. The following specimens are to be used for the listed relevant test methods (tolerances are found in ISO 3167). All test specimens are to be tested as molded and conditioned. Annealing is not allowed.

Test Piece ISO 3167 Type 1A bar 80 by 10 by 4-mm bar cut from the center portion of ISO 3167 Type 1A Specimen approximately 10 by 10 by 4-mm cut from the center portion of ISO 3167 Type 1A	Relevant Test Method Tensile strength Flexural modulus, Izod impact, Flexural strength Density
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9.2 The test specimens shall be prepared by an injection molding process as specified in ISO 294-1 and Practice D3641. Accurate, reproducible settings of the processing parameters are essential to obtain specimens with comparable properties. Processing conditions are:

Drying Plastic melt temperature Mold temperature Average injection velocity	2 h at 135°C 320°C 140°C 275 ± 75 mm/s
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10. Conditioning

10.1 Test specimens shall be conditioned for a minimum of 4 h at $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ relative humidity before performing the required tests.

10.2 Conduct those tests influenced by ambient conditions in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ relative humidity in accordance with Practice D618 (4/23/50).

11. Test Methods

11.1 Determine the properties enumerated in this classification system in accordance with the test methods in 2.1.

11.1.1 The number of tests shall be consistent with the requirements of Sections 8 and 12.4.

12. Inspection and Certification

12.1 Inspection and certification of the material supplied with reference to a specification based on this classification system shall be for conformance to the requirements specified herein.

12.2 Lot-acceptance inspection shall be the basis on which acceptance or rejection of the lot is made. The lot-acceptance inspection shall consist of apparent shear viscosity (Test Method ISO 11443) or flow rate (Test Method ISO 1133); reinforcement or filler content (reinforced and filled products only) (Test Method ISO 3451); and, tensile strength (reinforced and filled products only) (Test Method ISO 527).

12.3 Periodic check inspection with reference to a specification based upon this classification system shall consist of the tests for all requirements of the material under the specification. Inspection frequency shall be adequate to ensure the material is certifiable in accordance with 12.4.

12.4 Certification shall be that the material was manufactured by a process in statistical control; sampled, tested, and inspected in accordance with this classification system; and that the average values for the lot meet the requirements of the specification (line callout).

12.5 A report of test results shall be furnished when requested. The report shall consist of results of the lot-acceptance inspection for the shipment and, if requested, shall include the results of the most recent periodic-check inspection. If requested, the report shall also include that recycled, reconstituted, recycled-regrind, recovered or reprocessed, or both, poly(phenylene sulfide) plastic was used and the nominal weight percent.

13. Packaging, Packing, and Marking

13.1 The provisions of Practice D3892 apply to packaging, packing, and marking of containers for plastic materials.

14. Keywords

14.1 line callout; plastic materials; poly(phenylene sulfide); recycled

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**D6358 – 19****TABLE PPS Requirements for Poly(Phenylene Sulfide) Materials^A**

Group	Description	Class	Description	Grade	Description	Tensile Strength, ISO 527, ^B MPa, min	Flexural Modulus, ISO 178, ^C MPa, min	Notched Izod, ISO 180/1A, ^D kJ/m ² , min	Flexural Strength, ISO 178, ^C MPa, min	Density, ISO 1183, g/cm ³						
01	General purpose	1	glass reinforced	G15	15 %	120	6500	4.0	190	1.3						
				G30	30 %	135	9000	5.0	210	1.5 to 1.6						
				G40	40 %	105	11 500	5.0	180	1.6 to 1.7						
		2	combinations of fillers and reinforcements	2	combinations of fillers and reinforcements	R50	50 %	125	10 000	5.0	150	1.7 to 1.8				
						R53	53 %	120	13 500	3.0	210	1.5 to 1.8				
						R57	57 %	130	15 000	3.5	170	1.5 to 2.2				
				3	carbon fiber	3	carbon fiber	C10	10 %	135	10 000	3.5	170	1.5 to 2.2		
								C30	30 %	210	24 000	2.7	135	1.5 to 2.2		
								0	other	0	other	3.0	165	1.5 to 2.2		
						0	other	0	other	0	other	135	10 000	3.0	165	1.5 to 2.2
										0	other	210	24 000	3.0	165	1.5 to 2.2
										0	other	0	other	0	other	0
				02	Impact Modified	1	glass reinforced	G15	15 %	75	4500	6.0	120	1.3 to 1.5		
								G30	30 %	110	7000	6.0	170	1.4 to 1.6		
								G40	40 %	130	9000	5.0	210	1.5 to 1.7		
2	combination of fillers	2	combination of fillers			R50	50 %	115	9000	7.0	170	1.6 to 1.8				
						0	other	0	other	0	other	0	other			
						0	other	0	other	0	other	0	other			
03	Toughened	1	unfilled			1	low mod	30	2000	30.0	75	1.2 to 1.3				
						2	mid mod	30	2000	30.0	75	1.2 to 1.3				
						3	high mod	50	2800	5.0	90	1.5 to 1.6				
		1	glass filled			1	glass filled	G15	15 %	85	5500	13.0	145	1.3 to 1.5		
								G30	30 %	135	9000	9.0	190	1.5 to 1.6		
								G40	40 %	140	12 000	11.0	230	1.6 to 1.7		
		2	combination of fillers			2	combination of fillers	R50	50 %	140	11 000	8.0	215	1.6 to 1.8		
								0	other	0	other	0	other	0	other	
								0	other	0	other	0	other	0	other	
		04	Blow Molding & Extrusion	1	unfilled	1	low mod	30	1300	43	45	1.1 to 1.3				
						2	mid mod	35	1500	23	55	1.1 to 1.3				
						0	other	0	other	0	other	0	other			
2	glass filled			2	glass filled	G15	15 %	80	4000	7.5	150	1.3 to 1.5				
						0	other	0	other	0	other	0	other			
						0	other	0	other	0	other	0	other			
05	Wear & Friction	2	glass + fluoropolymer	G30	30 %	125	11 000	6.0	250	1.6 to 1.7						
				G40	40 %	160	12 000	6.0	250	1.7 to 1.9						
		3	carbon fiber + fluoropolymer	3	carbon fiber + fluoropolymer	0	other	0	other	0	other					
						G10	10 %	100	9000	0	other	0	other			
						0	other	0	other	0	other	0	other			
06	Blend (PPS + PESU)	1	glass filled	G30	30 %	130	9000	7.0	220	1.5 to 1.7						
				0	other	0	other	0	other	0	other					
				0	other	0	other	0	other	0	other					
				0	other	0	other	0	other	0	other					
0	Other	0	other	0	other	0	other	0	other							
00	Other	0	other	0	other	0	other	0	other							

^AIt is recognized that detailed test values, particularly Izod impact, do not predict nor even correlate with performance of parts molded under different conditions.
^BTensile strength shall be determined using an ISO 3167 Type IA tensile specimen, as described in ISO 527. Crosshead speed shall be 50 mm/min ± 10 % for unreinforced and 5 mm/min ± 25 % for filled and reinforced.
^CIzod impact-Flexural modulus and strength shall be determined on Test Method ISO 180 test specimens specimen 80 ± 2 mm by 10 ± 0.2 mm by 4 ± 0.2 mm cut from the center of an ISO 3167 Type 1A bar.
^DFlexural modulus and strength-Izod impact shall be determined on Test Method ISO 180 test specimens specimen 80 ± 2 mm by 10 ± 0.2 mm by 4 ± 0.2 mm cut from the center of an ISO 3167 Type 1A bar.