Designation: D 6778 – 02

Standard Classification for Polyoxymethylene (POM, Acetal) Molding and Extrusion Materials[1]

This standard is issued under the fixed designation D 6778; 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 classification covers polyoxymethylene materials suitable for molding and extrusion. This specification allows for the use of polyoxymethylene plastic materials that are recycled, reconstituted, recycled-regrind, recovered, or reprocessed, or combination thereof, 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 polyoxymethylene plastic materials, or combination thereof, to ensure compliance. (See Guide D 5033).

1.2 The properties included in this classification 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 the suffixes as given in Section 5.

1.3 This classification and subsequent line callout 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 should be made by those having expertise in the field of plastics design 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 values stated in SI units are to be regarded as the standard.

1.5 The following precautionary caveat pertains only to the test method portion, Section 11, of this classification. *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 requirements prior to use.*

NOTE 1—This classification is similar to ISO 9988-1 and 9988-2, although the technical content is significantly different.

2. Referenced Documents

2.1 *ASTM Standards:*

D 618 Practice for Conditioning Plastics for Testing[2]

D 883 Terminology Relating to Plastics[2]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

D 3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials[3]

D 3892 Practice for Packaging/Packing of Plastics[3]

D 4000 Classification System for Specifying Plastic Materials[3]

D 5033 Guide for the Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics[4]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[5]

2.2 *ISO Standards:*[6]

ISO 75-1 Plastics and Ebonite—Determination of Temperature of Deflection under Load—Part 1: General Test Methods

ISO 75-2 Plastics—Determination of Temperature of Deflection under Load—Part 2: Plastics and Ebonite

ISO 179-1 Plastics—Determination of Charpy Impact Properties—Part 1: Non-instrumented Impact Test

ISO 294-1 Plastics—Injection Moulding Of Test Specimens Of Thermoplastic Materials—Part 1: General Principles, and Moulding of Multipurpose and Bar Test Specimens

ISO 527-1 Plastics—Determination of Tensile Properties—Part 1: General Principals

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

ISO 1133 Plastics—Determination of the Melt Mass Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of Thermoplastics

ISO 11357-3 Plastics—Differential Scanning Calorimetry (DSC)—Part 3: Determination of Temperature and Enthalpy of Melting and Crystallization

[1] This classification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (Section D20.15.18).

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

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

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

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

[6] Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

ISO 1183 Plastics—Methods for Determining the Density and Relative Density of Non-Cellular Plastics
ISO 3167 Plastics—Multipurpose Test Specimens
ISO 9988-1 Plastics—Polyoxymethylene (POM) Moulding and Extrusion Materials—Part 1: Designation System and Basis for Specifications
ISO 9988-2 Plastics—Polyoxymethylene (POM) Moulding and Extrusion Materials—Part 2: Preparation of Test Specimens and Determination of Properties

TABLE POM Polyoxymethylene Materials, Detail Requirements (Natural and Black Color Only)[A,B,C]

Group	Description	Class	Description	Grade	Description	Flow Rate ISO 1133,[D] G/10 min	Melting Point, ISO 11357-3[E] °C, min	Density, ISO 1183, g/cm^3	Tensile Strength, ISO 527,[F] MPa, min	Tensile Modulus, ISO 527[G] MPa, min	Charpy Impact Resistance, ISO 179[H]/ 1eA, kJ/m^2, min	Deflection Temperature, ISO 75/ Method A$_f$[I] 1.82 MPa, °C, min
01	Homopolymer	1	general purpose and high flow	1		<4	170	1.39 to 1.44	65	2400	7.0	80
				2		4 to 10	170	1.39 to 1.44	65	2500	6.0	80
				3		8 to 19	170	1.39 to 1.44	65	2700	4.5	80
				4		19 to 30	170	1.39 to 1.44	65	2700	4.5	85
				5		30 to 55	170	1.39 to 1.44	65	2700	4.0	85
				G10	10 % glass		170	1.45 to 1.53	80	3500	3.0	150
				G25	25 % glass		170	1.55 to 1.63	125	7000	6.0	160
				0	other							
		3	UV stabilized	1		<8	170	1.39 to 1.44	65	2400	7.0	75
				2		8 to 19	170	1.39 to 1.44	65	2700	4.5	75
				3		19 to 30	170	1.39 to 1.44	65	2700	4.5	75
				4		30 to 55	170	1.39 to 1.44	65	2700	4.5	75
				0	other							
		4	impact modified	1		<4	170	1.31 to 1.37	35	800	50.0	50
				2		8 to 17	170	1.36 to 1.42	45	1800	8.0	65
				3			170	1.32 to 1.38	35	1100	12.0	55
		0	other	0	other							
02	Copolymer	1	general purpose and high flow	1		<4	160	1.38 to 1.43	58	2000	4.0	80
				2		4 to 7	160	1.38 to 1.43	58	2200	3.5	80
				3		7 to 11	160	1.38 to 1.43	58	2200	3.5	80
				4		11 to 16	160	1.38 to 1.43	58	2000	3.0	80
				5		16 to 35	160	1.38 to 1.43	60	2300	3.0	80
				6		35 to 60	160	1.38 to 1.43	60	2500	2.5	80
				7		60+	160	1.38 to 1.43	60	2500	2.0	80
				G10	10 % glass		160	1.40 to 1.52	70	4000	3.0	150
				G15	15 % glass		160	1.45 to 1.55	80	5500	3.0	150
				G20	20 % glass		160	1.50 to 1.60	80	6500	3.0	150
				G25	25 % glass		160	1.54 to 1.65	80	7300	3.0	150
				0	other							
		2	UV stabilized	1		<4	160	1.38 to 1.43	56	2000	4.0	80
				2		4 to 7	160	1.38 to 1.43	56	2000	3.5	80
				3		7 to 11	160	1.38 to 1.43	57	2000	3.5	80
				4		11 to 16	160	1.38 to 1.43	57	2000	3.0	80
				5		16 to 35	160	1.38 to 1.43	58	2100	3.0	80
				6		35 to 60	160	1.38 to 1.43	58	2100	2.5	80
				7		60+	160	1.38 to 1.43	58	2100	2.0	80
				0	other							
		3	impact modified	1		11 to 28	155	1.34 to 1.40	46	1800	4.5	70
				2		11 to 28	155	1.30 to 1.38	40	1400	4.5	60
				3		4 to 12	155	1.34 to 1.40	44	1500	5.0	70
				4		4 to 12	155	1.30 to 1.40	35	1300	5.0	60
				0	other							
		4	high modulus	4		11 to 16	155	1.38 to 1.43	64	2700	4.0	80
				0	other							
03	Terpolymer	1	high melt strength	1		<2	160	1.38 to 1.43	56	2250	3.5	80
				0	other							
00	Other	0	other	0	other							

[A] No descriptions are listed unless needed to describe a special grade under the class. All other grades are listed by requirements.

[B] Refer to 9.1 under Specimen Preparation for source of test pieces.

[C] Data on 4 mm test specimens may be limited and the minimum values may be changed in a later revision after a statistical database of sufficient size is generated.

[D] Flow rate: 190/2.16 (T/M).

[E] Melting point rate 10°C/min. T_M second melting curve.

[F] Crosshead speed shall be 50 mm/min ± 10 % unless the specimen exhibits brittle failure (no yield point) and strain at break of <10 % in which case crosshead speed shall be 5 mm/min ± 25 %.

[G] Crosshead speed shall be 1 mm/min.

[H] Notched specimen tested edgewise (method 1eA).

[I] Deflection temperature shall be determined with the specimen in the flatwise position (Method A$_f$).

TABLE A Detail Requirements: Filled or Reinforced Polyoxymethylene[A,B]

Designation Order Number	Property	0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ISO 527, min, MPa[C]	unspecified	20	35	50	65	90	110	130	150	specify value[D]
2	Tensile modulus, ISO 527, min, MPa[E]	unspecified	1500	2500	3500	4500	5500	6500	7500	8500	specify value[D]
3	Charpy impact, ISO 179/1eA, min, kJ/m^2	unspecified	1.0	2.0	3.0	4.0	6.0	10.0	20.0	40.0	specify value[D]
4	Deflection temperature, ISO 75, Method A_f, 1.82 MPa, min, °C[F]	unspecified	50	70	90	110	120	130	140	150	specify value[D]
5	To be determined	unspecified	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] It is recognized that detailed test values, particularly Charpy impact, may not predict nor even correlate with the performance of parts molded of these materials.
[B] Refer to 9.1 under Specimen Preparation for source of test specimens.
[C] Crosshead speed shall be 50 mm/min ± 10 % unless the specimen exhibits brittle failure (no yield point) and a strain at break of <10 % in which case crosshead speed shall be 5 mm/min ± 25 %.
[D] If specific value is required, it must appear on the drawing or contract, or both.
[E] Crosshead speed shall be 1 mm/min-(method 1eA).
[F] Deflection temperature shall be determined with the specimen in the flatwise position (Method A_f).

TABLE B Detail Requirements: Special Polyoxymethylene[A,B]

Designation Order Number	Property	0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ISO 527, min, MPa[C]	unspecified	10	20	30	40	50	60	70	80	specify value[D]
2	Tensile modulus, ISO 527 min, MPa[E]	unspecified	200	600	1000	1400	1800	2200	2600	3000	specify value[D]
3	Charpy impact, ISO 179/1eA, min, kJ/m^2	unspecified	1.0	2.0	3.0	4.0	6.0	10.0	20.0	50.0	specify value[D]
4	Deflection temperature, ISO 75, Method A_f, 1.82 MPa, min, °C[F]	unspecified	40	55	70	80	90	100	110	120	specify value[D]
5	To be determined	unspecified	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] It is recognized that detailed test values, particularly Charpy impact, may not predict nor even correlate with the performance of parts molded of these materials.
[B] Refer to 9.1 under Specimen Preparation for source of test specimens.
[C] Crosshead speed shall be 50 mm/min ± 10 % unless the specimen exhibits brittle failure (no yield point) and a strain at break of <10 % in which case crosshead speed shall be 5 mm/min ± 25 %.
[D] If specific value is required, it must appear on the drawing or contract, or both.
[E] Crosshead speed shall be 1 mm/min (method 1eA).
[F] Deflection temperature shall be determined with the specimen in the flatwise position (Method A_f).

3. Terminology

3.1 The terminology used in this classification is in accordance with Terminologies D 883 and D 1600.

4. Classification

4.1 Unreinforced polyoxymethylene materials are classified into groups in accordance with their composition. These groups are subdivided into classes and grades, as shown in Table POM.

NOTE 2—An example of this classification system is as follows. The designation POM0112 indicates the following: POM = polyoxymethylene (acetal) as found in Terminology D 1600, 01 = homopolymer (group), 1 = general purpose and high flow (class), and 2 = requirements given in Table POM (grade).

4.1.1 To facilitate the incorporation of future or special materials, the "other/unspecified" category (0) for group, class, and grade is shown in Table POM. The basic properties can be obtained from Tables A or B, as they apply (see 4.3).

4.2 Reinforced, filled, lubricated and special versions of the polyoxymethylene materials that are not in Table POM are classified in accordance with Table POM and Tables A or B. Table POM is used to specify the group of polyoxymethylene and Table A or B is used to specify the property requirements after the addition of reinforcement, pigments, fillers, or lubricants at the nominal level indicated (see 4.2.1).

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 33 for percent of reinforcement, G33, specifies a filled material with a nominal glass level of 33 %. The reinforcement letter designations and associated tolerance levels are shown as follows:

Symbol	Material	Tolerance
C	carbon and graphite fiber-reinforced	±2 %
G	glass-reinforced	±2 %
L	lubricants (such as, PTFE, graphite, silicone, and molybdenum disulfide)	depends upon material and process to be specified
M	mineral-reinforced	±2 %
R	combinations of reinforcements or fillers, or both	±3 %

NOTE 3—This part of the classification system uses the percent of reinforcements or additives, or both, in the callout of the modified basic material. The types and percentages of reinforcements and additives