



Designation: D6098 – 16

# Standard Classification System and Basis for Specification for Extruded and Compression Molded Shapes Made from Polycarbonate (PC)<sup>1</sup>

This standard is issued under the fixed designation D6098; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## INTRODUCTION

This classification system is intended to be a means of calling out mechanical grade plastic product used in the fabrication of end items or parts.

### 1. Scope\*

1.1 This classification system covers requirements and test methods for the material, dimensions, and workmanship, and the properties of extruded and compression molded plate, rod, and tubular bar manufactured from polycarbonate. This classification system allows for the use of recycled materials provided that all specifications are met.

1.2 This standard is not intended to cover materials used in glazing and signage as defined in 3.1.2 and 3.1.8. It is intended to be a means of calling out mechanical grade plastic products used for fabrication of end items or parts as defined in 3.1.3.

1.3 The properties included in this standard are those required for the compositions covered. Other requirements necessary to identify particular characteristics important to specialized applications are to be described by using the callout system given in Section 4.

1.4 The values stated in inch-pound units are to be regarded as the standard in all property and dimensional tables. For reference purposes, SI units are also included in Table S-PC and Table 1 only.

1.5 The following precautionary caveat pertains only to the test method portions, Section 12, of this standard. *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.*

NOTE 1—There is no known ISO equivalent to this standard.

<sup>1</sup> 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:<sup>2</sup>

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

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3892 Practice for Packaging/Packing of Plastics

D3935 Classification System and Basis for Specification for Polycarbonate (PC) Unfilled and Reinforced Material

D4000 Classification System for Specifying Plastic Materials

#### 2.2 ANSI Standard:

Z1.4-1993 Sampling Procedures and Tables for Inspection by Attributes<sup>3</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 Except for the terms defined below, the terminology used in this classification system is in accordance with Terminologies D883 and D1600.

3.1.2 *glazing product, n*—a finished product which is glazed or set in frame or sash and not held by mechanical fasteners which pass through the product.

<sup>2</sup> 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.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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

3.1.3 *mechanical grade plastic product, n*—extruded or compression molded shapes made from polycarbonate used for fabrication of end items or parts.

3.1.4 *plate, n*—flat stock greater than ¼ in.

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

3.1.6 *regrind plastic, n*—a product or scrap such as sprues and runners and edge trim that have been reclaimed by shredding and granulating for use in-house.

3.1.7 *rod, n*—an extruded solid cylindrical shape with a minimum diameter of ⅛ in.

3.1.8 *signage product, n*—a fabricated sign or outdoor/indoor structure, consisting of any letter, figure, character, mark, point, plane, marquee sign, design, poster, pictorial, picture, stripe, line, trademark, reading matter or illuminating device, which is constructed, attached, erected, fastened, or manufactured in any manner so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, and displayed in any manner for recognized advertising purposes.

3.1.9 *tubular bar, n*—an extruded annular shape with minimum inside diameter of ⅜ in. and minimum wall thickness of ⅙ in.

#### 4. Classification and Material

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

4.2 This classification system covers product extruded and compression molded as listed in Table 1 S-PC. Products included in the designations refer to specification callouts from D3935 where applicable.

4.2.1 The polycarbonate shape product is categorized by type, class, and grade depending on resin and filler compositions as defined in Table 1 S-PC.

4.2.2 Each polycarbonate shape is categorized into one of several grades:

4.2.2.1 *Grade 1—General Purpose*—Extruded or compression molded product made using only 100 % virgin polycarbonate resin.

4.2.2.2 *Grade 2—Recycled*—Extruded or compression molded product made using any amount up to 100 % recycled polycarbonate plastics.

4.3 The type, class and grade is further differentiated based on dimensional stability (elevated temperature excursion test), Table 1 S-PC, and dimensional requirements, Table 2 A-1, Table 3 B-1, and Table 4 B-2.

#### 4.4 Property Tables:

4.4.1 Table 1 S-PC is used to describe both extruded and compression molded products.

4.4.2 Table 5 is used to describe extruded or compression molded products not included in Table 1 S-PC via a cell callout that includes the applicable Table 1 S-PC polycarbonate type and specific properties (Designations 1-7).

4.4.3 To facilitate the incorporation of future or special materials not covered by Table 1 S-PC, the “as specified” category (00) for type, class and grade is shown in the table with the basic properties to be obtained from Table 5, as they apply.

4.4.4 *Reinforcements and Additive Materials*—A symbol (single-letter) is used for the major reinforcement or combination, or both, along with two numbers that indicate the percentage of reinforcement and/or additive by mass with the tolerances as tabulated below. This must be included in all Table 5 callouts (Specifications).

TABLE 1 S-PC Requirements for Polycarbonate (PC) Shapes

Type	Description	Class	Description	Grade	Resin Type <sup>A</sup>	Description	Ultimate Tensile Strength, min, psi (MPa)	Tensile Elongation, % at break, min	Tensile Modulus, min, psi (MPa)	Dimensional Stability, max, %
01	Polycarbonate	1	Unfilled	1	PC111, <sup>B</sup> PC112, <sup>B</sup> PC113, <sup>B</sup> PC114, <sup>B</sup> PC115, <sup>B</sup> PC116, <sup>B</sup> PC117, <sup>B</sup> or PC110B34720 <sup>B</sup>	General Purpose	8000 (55)	50	300 000 (2070)	0.4
				2	As Specified <sup>C</sup>	Recycled	...	...	...	...
				0	As Specified <sup>C</sup>	As Specified	...	...	...	...
		2	UV Stabilized	1	PC0135 <sup>B</sup> or PC0136	General Purpose	8000 (55)	50	300 000 (2070)	0.4
				2	As Specified <sup>C</sup>	Recycled	...	...	...	...
				0	As Specified <sup>C</sup>	As Specified	...	...	...	...
00	Other Polycarbonates	0	As Specified	1	As Specified	General Purpose	...	...	...	...
				2	As Specified	Recycled	...	...	...	...
				0	As Specified <sup>C</sup>	As Specified	...	...	...	...

<sup>A</sup>In accordance with Classification System D3935.

<sup>B</sup>Applicable D3935 resin type to be specified on purchase order.

<sup>C</sup>Alphanumeric sequence indicating filler type and quantity must precede Table 5 callouts for modified products (see 4.4.4).

TABLE 2 A-1 Dimensional Requirements for Polycarbonate Rod<sup>A</sup>

Size, in.	Diameter Tolerance, in.	Roundness TIR, in.	Camber, in./ft
1/8 to 7/8	+0.002/-0.001	0.002	2 1/2 /8
1	+0.005/-0	0.002	1 1/4 /8
1 1/8 to 1 1/4	+0.005/-0	0.004	1 1/4 /8
1 3/8 to 1 7/8	+0.005/-0	0.005	1 1/4 /8
2	+0.005/-0	0.010	1 1/4 /8
2 1/8 to 2 1/2	+0.030/-0	0.025	1 1/4 /8
2 5/8 to 6	+0.250/-0	0.050	1/4 /4

<sup>A</sup>To convert inches to millimetres multiply by 25.40.

TABLE 3 B-1 Dimensional Requirements for Extruded Polycarbonate Plates (Grade 1)<sup>A</sup>

Size, in.	Thickness Tolerances, in.	Length Camber, in./ft	Width Bow, in./ft
1/4 to 2	+0.025/-0	3/4 /4	3/16 /2
2 1/8 to 3	+0.050/-0	1/4 /4	1/16 /2
3 1/8 and over	+0.050/-0	1/4 /4	1/16 /1

<sup>A</sup>To convert inches to millimetres multiply by 25.40.

TABLE 4 B-2 Dimensional Requirements for Compression Molded Polycarbonate Plates<sup>A,B</sup>

Size, in.	Thickness Tolerance, in.	Length Camber, in./ft	Width Bow, in./ft
3/8 to 7/8	+0.090/-0	3/8 /4	3/32 /2
1 and over	+0.090/-0	1/8 /4	3/64 /2

<sup>A</sup>To convert inches to millimetres multiply by 25.40.

<sup>B</sup>Compression molded plate is supplied sufficiently oversize to finish to nominal dimension listed.

TABLE 5 Additional Detail Requirements—Reinforced/Unreinforced Extruded and Compression Molded Polycarbonates

NOTE 1—The applicable table polycarbonate type (including fillers in accordance with 4.4.4 ) must precede this table designation.

Designation Order Number	Property	0	1	2	3	4	5	6	7	8	9
1	Tensile strength, Test Method D638, min, psi (MPa)	Unspecified	6000 (41)	8000 (55)	10 000 (69)	12 000 (83)	14 000 (97)	16 000 (110)	20 000 (138)	25 000 (172)	Specify Value
2	Elongation at Break Test Method D638, %, min	Unspecified	1	3	5	10	20	50	100	200	Specify Value
3	Tensile Modulus, min, Test Method D638 min, psi (MPa)	Unspecified	100 000 (690)	200 000 (1379)	300 000 (2073)	400 000 (2760)	500 000 (3448)	600 000 (4137)	800 000 (5516)	1 000 000 (6895)	Specify Value
4	Dimensional Stability, % max, per 12.2	Unspecified	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.5	Specify Value
5	Flexural Modulus, Test Method D790, min, psi (MPa)	Unspecified	250 000 (1649)	350 000 (2400)	450 000 (3100)	550 000 (3792)	650 000 (4482)	750 000 (5171)	1 000 000 (6895)	1 500 000 (10 343)	Specify Value
6	Izod impact, Test Method D256, min ft-lb/in. (J/m)	Unspecified	0.5 (27)	0.75 (40)	1.0 (53)	2.5 (133)	5.0 (266)	10.0 (533)	15.0 (800)	18.0 (960)	Specify Value
7	To be determined	Unspecified	...	...	...	...	...	...	...	...	...

Symbol	Material	Tolerance (Based on the Total Mass)
C	Carbon and graphite fiber reinforced	±2 %
G	Glass-reinforced	
	<15 % glass content	±2 %
	>15 % glass content	±3 %
L	Lubricants (for example, PTFE, graphite, and silicone)	Depends upon material and process—to be specified
M	Mineral	±2 %
R	Combinations of reinforcements or fillers, or both	±3 % for the total reinforcement

4.5 Callout Designation—A one-line system shall be used to specify polycarbonate materials covered by this classification

system. The system uses pre-defined cells to refer to specific aspects of this classification system as illustrated below:

4.5.1 Examples:

4.5.1.1 Example 1—Product made from general purpose polycarbonate:

CELL CALLOUT: S-PC0111

S-PC01 = Product made from PC in accordance with Table 1 S-PC

1 = Unfilled class

1 = General purpose grade product

4.5.1.2 Example 2—Product made from 20 % glass reinforced general purpose polycarbonate:

CELL CALLOUT: S-PC0100G2053454430