



Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material¹

This standard is issued under the fixed designation D 3935; 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 unfilled and reinforced polycarbonate and polycarbonate copolymer materials suitable for injection molding, blow molding, and extrusion. Some of these compositions may also find use for compression molding or application from solution.

1.2 This specification 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 is to be made by personnel with expertise in the plastics field in which the environment, inherent properties of the materials, performance of the parts, part design, manufacturing process, and economics are considered.

1.3 The properties in this specification are those required for identifying the compositions covered. There may be other requirements necessary for identifying particular characteristics important to specific applications. Those may be specified by using the suffixes in accordance with Section 5.

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

NOTE 1—This specification is similar to ISO 7391 – 1987 in title only. The technical content is significantly different.

2. Referenced Documents

2.1 ASTM Standards:

- D 256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics²
- D 638 Test Method for Tensile Properties of Plastics²
- D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position²
- D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials²

- D 792 Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement²
 - D 883 Terminology Relating to Plastics²
 - D 1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer²
 - D 1600 Terminology for Abbreviated Terms Relating to Plastics²
 - D 1897 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials³
 - D 2584 Test Method for Ignition Loss of Cured Reinforced Resins⁴
 - D 3892 Practice for Packaging/Packing of Plastics⁵
 - D 4000 Classification System for Specifying Plastic Materials⁵
 - E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁶
 - E 169 Practices for General Techniques of Ultraviolet-Visible Quantitative Analysis⁷
- #### 2.2 ISO Standard:⁸
- ISO 7391—1987 Plastics—Polycarbonate Molding and Extrusion Materials (Part 1: Designation—1987) (Part 2: Preparation of Test Specimens and Determination of Properties)

3. Terminology

3.1 *Definitions*—The terminology used in this specification is in accordance with Terminologies D 883 and D 1600. The polycarbonate materials will be designated PC as specified in Terminology D 1600.

4. Classification

4.1 Unfilled polycarbonate materials are classified into groups according to their composition. These groups are subdivided into classes and grades as shown in Table PC

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.

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Significant changes to the content of this specification have been made. New grades and recycle grades, recommended molding conditions, an ISO equivalency statement, revised inspection and certification criteria, and a keywords section have all been added. Modifications to the tables have been made to allow the callout of the new materials. Almost every section of the specification has been affected either technically or in an editorial manner.

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

³ Discontinued; see *1990 Annual Book of ASTM Standards*, Vol 08.01.

⁴ *Annual Book of ASTM Standards*, Vol 08.02.

⁵ *Annual Book of ASTM Standards*, Vol 08.03.

⁶ *Annual Book of ASTM Standards*, Vol 14.02.

⁷ *Annual Book of ASTM Standards*, Vol 14.01.

⁸ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

TABLE PC Polycarbonate Materials and Detail Requirements

Note— The values are for naturals; colors may be different.

Group	Description	Class	Description	Grade	Description ^A	Flow Rate, ^B Test Method D 1238, g/10 min	Specific Gravity, Test Method D 792	Izod Impact, ^C Test Methods D 256, J/m, min	Tensile Yield Strength ^D	Elongation at Break ^D	Flexural Modulus, ^E Test Methods D 790, MPa, min	Deflection Temperature, Test Method D 648, ^F °C, min					
									Test Method D 638, MPa, min	Test Method D 638, MPa, min	Test Method D 638, MPa, min	Test Method D 638, MPa, min					
01	PC	1	general purpose	1		>24	1.19–1.22			use Table B							
				2		15 to 30	1.19–1.22			use Table B							
				3		12 to 20	1.19–1.22	640	55	100	2000	126					
				4		9 to 18	1.19–1.22	750	60	105	2100	126					
				5		6 to 13	1.19–1.22	750	60	110	2200	128					
				6		4 to 8	1.19–1.22	750	60	110	2200	128					
				7		<5	1.19–1.22	780	60	110	2200	130					
				0	other	...	...	...	...	...	...	...	...
				2	flame-retarded ^G	1		>24	1.19–1.22				use Table B				
						2		15 to 30	1.19–1.22				use Table B				
						3		12 to 20	1.19–1.22	640	55	100	2000	126			
						4		9 to 18	1.19–1.22	640	60	100	2100	126			
						5		6 to 13	1.19–1.22	640	60	105	2200	128			
						6		4 to 8	1.19–1.22	640	60	110	2200	128			
		7				<5	1.19–1.22	640	60	110	2200	130					
		0	other			...	...	...	...	...	...	...	...
		3	UV ^H stabilized			1		>24	1.19–1.22				use Table B				
						2		15 to 30	1.19–1.22				use Table B				
						3		12 to 20	1.19–1.22	640	55	100	2000	124			
						4		9 to 18	1.19–1.22	750	60	105	2100	124			
						5		6 to 13	1.19–1.22	750	60	110	2100	126			
						6		4 to 8	1.19–1.22	750	60	110	2200	126			
				7		<5	1.19–1.22	750	60	110	2200	128					
				0	other	...	...	...	...	...	...	...	...
				4	impact-modified	1		6 to 15	1.18–1.22	375 ^I	50	90	1900	121			
						0	other	...	...	...	...	...	...	...
						5	FDA ^J compliant formulations	1		>24	1.19–1.22				use Table B		
								2		15 to 30	1.19–1.22				use Table B		
								3		12 to 20	1.19–1.22	640	55	100	2000	126	
								4		9 to 18	1.19–1.22	750	60	105	2100	126	
		5						6 to 13	1.19–1.22	750	60	110	2200	128			
		6						4 to 8	1.19–1.22	750	60	110	2200	128			
		7						<5	1.19–1.22	780	60	110	2200	130			
		0	other						
		0	other						
		0	other						
02	PC copolymer-flame retarded	1	general purpose			1		>24	1.22–1.26			use Table B					
						2		15 to 30	1.22–1.26				use Table B				
				3		12 to 20	1.22–1.26	80	60	100	2100	128					
				4		9 to 18	1.22–1.26	80	60	110	2200	128					
				5		6 to 13	1.22–1.26	90	60	110	2200	130					
				6		4 to 8	1.22–1.26	90	60	110	2200	130					
				7		<5	1.22–1.26	90	60	110	2200	132					
				0	other	...	...	...	...	...	...	...	...
				2	UV ^H stabilized	1		>24	1.22–1.26				use Table B				
						2		15 to 30	1.22–1.26				use Table B				
						3		12 to 20	1.22–1.26	80	60	100	2100	126			
						4		9 to 18	1.22–1.26	80	60	110	2200	126			
						5		6 to 13	1.22–1.26	90	60	110	2200	128			
						6		4 to 8	1.22–1.26	90	60	110	2200	130			
		7				<5	1.22–1.26	90	60	110	2200	130					
		0	other			...	...	...	...	...	...	...	...
		0	other			...	...	...	...	...	...	...	...
		0	other			...	...	...	...	...	...	...	...
		03	PC copolymer high-heat resin			1	general purpose	1		TBD	1.18–1.22	80	63	40	1700	150	
								0	other	
						2	UV ^H stabilized	1		TBD	1.18–1.22	80	63	40	1700	148	
								0	other	
				3	impact-modified	1		TBD	...	...	...	use Table B	...	...	
						0	other	...	...	...	...	...	...	...
				4	FDA ^J compliant formulation	1		TBD	1.18–1.22	80	63	40	1700	150			
						0	other	...	...	...	...	...	...	...
				0	other	...	...	...	...	...	...	...	...
				04	PC copolymer homopolymer intermediate heat blends	1	general purpose	1		TBD	1.18–1.22	480	65	60	1900	138	
		0	other					...	...	...	...	...	...	...

TABLE Continued

Note— The values are for naturals; colors may be different.

Group	Description	Class	Description	Grade	Description ^A	Flow Rate, ^B Test Method D 1238, g/10 min	Specific Gravity, Test Method D 792	Izod Impact, ^C Test Methods D 256, J/m, min	Tensile Yield Strength ^D	Elongation at Break ^D	Flexural Modulus, ^E Test Methods D 790, MPa, min	Deflection Tempera- ture, Test Method D 648, ^F °C, min	
									Test Method D 638, MPa, min	MPa, min	MPa, min	°C, min	
	2	UV ^H stabilized	1	1	other	TBD	1.18–1.22	480	65	60	1900	136	
						
	3	impact-modified	1	0	other	TBD	...	...	...	use Table B	...	...
						
	4	FDA ^J compliant formulation	1	0	other	TBD	1.18–1.22	480	65	60	1900	138	
					
	0	other	0	0	other	...	...	...	...	...	...	...
						
	05	PC copolymer low-heat standard flow	1	general purpose	1	other	>50	1.18–1.22	use Table B
							nominal 45	1.18–1.22	570	50	100	2070	104
nominal 29							1.18–1.22	620	50	100	2070	106	
nominal 18							1.18–1.22	770	50	100	2160	107	
nominal 10							1.18–1.22	810	50	100	2200	108	
...							
...							
...							
...							
...							
2		UV ^H stabilized	1	1	1	other	>50	1.18–1.22	use Table B
							nominal 45	1.18–1.22	570	50	100	2070	102
							nominal 29	1.18–1.22	620	50	100	2070	104
							nominal 18	1.18–1.22	770	50	100	2160	105
							nominal 10	1.18–1.22	810	50	100	2200	106
						
						
						
						
						
3	impact-modified	0	0	other	...	...	...	...	...	...	...
						
4	FDA ^J compliant formulations	1	2	0	other	>50	1.18–1.22	...	...	use Table B	...	
						nominal 45	1.18–1.22	570	50	100	2070	104	
3	nominal 29	1.18–1.22	620	50	100	2070	106	...	...	...	...
												nominal 18	1.18–1.22	770	50	100	2160	107
5	nominal 10	1.18–1.22	810	50	100	2200	108	...	...	...	...
											
0	other	0	0	other	...	...	...	...	...	...	...
						
5	flame-retarded ^G	1	1	0	other	TBD	1.18–1.22	...	...	use Table B	...	
						
0	other	0	0	other	...	...	...	...	...	...	...
						
06	PC copolymer low-heat easy flow	1	general purpose	1	0	other	TBD	1.18–1.22	...	...	use Table B	...
						
	2	UV stabilized ^H	1	0	other	TBD	1.18–1.22	...	...	use Table B	...	...
						
	3	impact-modified	1	0	other	TBD	1.17–1.22	...	...	use Table B	...	...
						
	4	FDA ^J compliant formulations	1	0	other	TBD	1.18–1.22	...	...	use Table B	...	...
						
	5	flame-retarded ^G	1	1	0	other	TBD	1.18–1.22	...	...	use Table B	...
						
0	other	0	0	other	...	...	...	...	...	...	...
						
99	PC other ^I	0	other	0	other	...	...	...	...	...	...

^A All grades are listed by performance requirements.

^B Use condition 300/1.2 for Groups 01, 02, and 05. Define the conditions for other groups in the suffixes as needed.

^C Test specimens are 3.2 mm thick, with a notch radius of 0.25 mm, tested by Method A.

^D Test specimens are Type I tensile bars, 3.2 mm thick, tested at a crosshead speed of 50 mm/min.

^E Test specimens are 3.2 by 12.7 mm, tested by Method I, Procedure A (Tangent), at a crosshead speed of 1.3 mm/min and a span-to-depth ratio of 16 to 1.

^F Test specimens are 3.2 mm thick, tested at 1820 kPa, and are not annealed before testing.

^G Use suffix letter F, with the appropriate digits allowed in Classification D 4000, to define specific requirements.

^H Refer to Practices E 169 for testing procedure. Specific requirements shall be stated in the purchase order or contract.

^I Test specimens for Group 1, Class 4, Grade 1 are 6.4 mm thick with a notch radius of 0.25 mm and are tested by Method A.

^J Manufactured in compliance with Food Additive Regulation 21CFR177.1580 governing polycarbonate resins for food-contact applications..

NOTE 2—An example of this classification system is as follows: the designation PC0214 indicates:

- PC = polycarbonate as found in Terminology D 1600,
- 02 = polycarbonate copolymer-flame retarded (group),
- 1 = general purpose (class), and
- 4 = requirements given in Table PC.

4.1.1 To facilitate the specification of new, special, or recycled materials, the “other” category (0) for class or grade, or both, may be used as indicated in Table PC. The properties of these materials may be specified using Tables A, B, or R as they apply.

4.2 Reinforced, pigmented, filled, and lubricated versions of polycarbonate materials may be classified in accordance with Tables PC and A, B, or R. Table PC is used to specify basic materials, and Tables A or B are used to specify the property requirements after the addition of reinforcement, pigments, fillers, or lubricants at the nominal level indicated (see 4.2.1). Table R is used for recycled materials.

4.2.1 A single letter shall be used to indicate the major category of the reinforcement, along with two numbers indicating the nominal percentage of additive(s) by mass, with the