



Designation: D 4349 – 96

Classification System for Polyphenylene Ether (PPE) Materials¹

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1. Scope

1.1 This classification system covers the basic polymers and copolymers known as polyphenylene ethers and polyphenylene oxides, as well as filled, modified, and reinforced versions.

NOTE 1—Addition to the natural polymer or copolymer of pigments, colorants or additives may result in the final composition not meeting the requirements specified for the natural polymer or copolymer. Discussions with the supplier should take place before specifications of altered compositions are established.

NOTE 2—The preferred abbreviation for polyphenylene ether is PPE, as noted in Terminology D 1600.

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 is to 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 There may be other requirements necessary to identify particular characteristics important to specific applications. These may be specified by using the suffixes described in Section 5.

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

NOTE 3—No ISO standard exists that covers these materials.

2. Referenced Documents

2.1 ASTM Standards:

- D 256 Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials²
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²
- D 638 Test Method for Tensile Properties of Plastics²
- D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load²
- D 790 Test Methods for Flexural Properties of Unreinforced

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 Annual Book of ASTM Standards, Vol 08.01.

TABLE 1 Testing Parameters

ASTM Test Method	Test Specimen and Testing Parameters
D 638	Type I, 3.2-mm thickness, crosshead speed of 5 mm/min for reinforced materials and 50 mm/min for unreinforced materials.
D 790	3.2 by 12.7-mm specimen, tested by Method I, Procedure A (tangent) with a crosshead speed of 1.3 mm/min and a span to depth ratio of 16 to 1.
D 256	3.2 by 12.7-mm specimen, tested by Test Method A.
D 648	3.2 by 12.7-mm specimen, 102-mm support span, unannealed prior to testing.

- and Plastics and Electrical Insulating Materials²
- D 792 Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacements²
- D 883 Terminology Relating to Plastics²
- D 1600 Terminology for Abbreviated Terms Relating to Plastics²
- D 1898 Practice for Sampling of Plastics²
- D 3892 Practice for Packaging/Packing of Plastics³
- D 4000 Classification System for Specifying Plastic Material³
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴
- 2.2 Underwriters Laboratories:
 - UL 94 Standards for Tests for Flammability for Parts in Devices and Appliances⁵

3. Terminology

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

3.2 The polyphenylene ether materials will be designated PPE as specified in Terminology D 1600.

4. Classification

4.1 Polyphenylene ether-based materials are classified into groups according to their compositions. These groups are subdivided into classes and grades, as shown in Table PPE.

³ Annual Book of ASTM Standards, Vol 08.02.

⁴ Annual Book of ASTM Standards, Vol 14.02.

⁵ Available from Underwriters Laboratories Inc. Publications Stock, 333 Pfingsten Road, Northbrook, IL 60067.

TABLE PPE Requirements for Polyphenylene Ether (PPE) Materials

NOTE 1—Values given are for natural materials only. Other colors may be different.^A

Group Description	Class Description	Grade Description	Heat Deflection, min		Specific Gravity, ASTM D 792, min	Tensile Strength, D 638, ^{B,C} MPa, min	Flexural Modulus, D 790, ^{B,C} MPa, min	Izod Impact, D 256, ^{B,D} J/m, min	
			at 1.82 MPa, D 648, ^B °C	at 0.45 MPa, D 648, ^B °C					
1 Unmodified	1 general purpose	0 other	E						
	2 flame retardant ^F	0 other	E						
	0 other	0 other	E						
2 PS modified materials	1 general purpose	1	90	N/A ^G	1.03	32	1750	265	
		2	100	N/A ^G	1.03	38	1900	240	
		3	100	N/A ^G	1.03	44	2150	185	
		4	110	N/A ^G	1.04	55	2300	160	
		5	130	N/A ^G	1.05	57	2300	160	
	0 other	...	...	...	...	...	...	...
	2 flame retardant ^F	1	67	N/A ^G	1.06	36	2200	190	
		2	80	N/A ^G	1.07	40	2250	130	
		3	85	N/A ^G	1.07	48	2350	100	
		4	105	N/A ^G	1.07	55	2350	160	
		5	125	N/A ^G	1.08	60	2500	160	
	0 other	...	...	...	...	...	...	...
	3 PA modified materials	1 general purpose	1	N/A ^G	145	1.05	50	2000	170
			2	N/A ^G	155	1.05	50	2000	160
			3	N/A ^G	170	1.05	50	1800	530
4			N/A ^G	180	1.05	55	2000	185	
5			N/A ^G	195	1.05	58	2200	160	
0 other		...	...	...	...	...	...	...
2 flame retardant ^F		0 other	E	...	...	...	...	...
0 other		0 other	...	...	...	...	...	...
4 Other	1 general purpose	0 other	...	...	...	...	...	...
	2 flame retardant ^F	0 other	...	...	...	...	...	...
	0 other	0 other	...	...	...	...	...	...
5 Rework modified	1 general purpose	0 other	...	...	...	...	...	...
	2 flame retardant ^F	0 other	...	...	...	...	...	...
	0 other	0 other	...	...	...	...	...	...

^A Use Tables A and B where necessary for colored materials.

^B See Table 1 for test parameters and conditions.

^C MPa × 145 = psi.

^D J/m × 0.01873 = ft-lbf/in.

^E Unfilled materials currently not available. Use Table A.

^F Flammability ratings determined in accordance with UL 94.

^G N/A—Not applicable for grade description.

TABLE A Reinforced Polyphenylene Ether Materials, Details Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Heat deflection temperature, ^A D 648, ^B 1.82 MPa, °C, min	unspecified	100	110	120	130	140	150	160	170	specify value
2	Heat deflection temperature, ^A D 648, ^B 0.45 MPa, °C, min	unspecified	180	190	200	210	220	230	240	250	specify value
3	Tensile strength, D 638, ^B MPa, ^C min	unspecified	45	55	65	80	100	120	140	160	specify value
4	Flexural modulus, D 790, ^B MPa, ^C min	unspecified	2000	3000	4000	5000	6000	7500	9000	10 500	specify value
5	Izod impact, D 256, ^B J/m, ^D min	unspecified	25	50	75	100	125	150	200	250	specify value

^A For specifying HDT use the "order number" corresponding to the appropriate test conditions for the material being defined. It is intended that one or the other of these requirements be used unless specific agreement between the supplier and the user requires both.

^B See Table 1 for test specimen sizes.

^C MPa × 145 = psi.

^D J/m × 0.01873 = ft-lbf/in.