



**Designation: D 4617 – 96**

## **Standard Specification for Phenolic Compounds (PF)<sup>1</sup>**

This standard is issued under the fixed designation D 4617; 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.

### **1. Scope**

1.1 This specification covers phenolic compounds suitable for molding.

1.2 This specification is intended to be 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 plastics 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 inherent properties of the material other than those covered by this specification, and the economics.

1.3 The properties included in this specification are those required to identify the compositions covered. There may be other requirements necessary to identify particular characteristics important to specialized applications. These will be agreed upon between the user and the supplier, by using the suffixes specified in Section 5.

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

1.5 *This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.*

1.6 The following precautionary caveat pertains only to the test method portion, Section 13 of this specification: *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—ISO 800-1977(E) is similar but not equivalent to this specification. Product classification and characterization are not the same.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.16 on Thermosetting Materials.

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This edition includes the addition of an ISO equivalency statement.

### **2. Referenced Documents**

#### **2.1 ASTM Standards:**

D 256 Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials<sup>2</sup>

D 570 Test Method for Water Absorption of Plastics<sup>2</sup>

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing<sup>2</sup>

D 638 Test Method for Tensile Properties of Plastics<sup>2</sup>

D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load<sup>2</sup>

D 695 Test Method for Compressive Properties of Rigid Plastics<sup>2</sup>

D 700 Specification for Phenolic Molding Compounds<sup>2</sup>

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials<sup>2</sup>

D 792 Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement<sup>2</sup>

D 796 Practice for Compression Molding Test Specimens of Phenolic Molding Compounds<sup>2</sup>

D 883 Terminology Relating to Plastics<sup>2</sup>

D 1600 Terminology for Abbreviated Terms Relating to Plastics<sup>2</sup>

D 1896 Practice for Transfer Molding Specimens of Thermosetting Compounds<sup>2</sup>

D 1898 Practice for Sampling of Plastics<sup>2</sup>

D 3419 Practice for In-Line Screw-Injection Molding of Test Specimens from Thermosetting Compounds<sup>3</sup>

D 3892 Practice for Packaging/Packing of Plastics<sup>3</sup>

D 4000 Classification System for Specifying Plastic Materials<sup>3</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specification<sup>4</sup>

#### **2.2 Military Standard:**

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes<sup>5</sup>

#### **2.3 ISO Standard:<sup>6</sup>**

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 08.02.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>5</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

<sup>6</sup> Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.



ISO 8000-1977(E)

### 3. Terminology

3.1 *Definitions*—For definitions of technical terms pertaining to plastics used in this specification see Terminology D 883.

### 4. Classification

4.1 Phenolic compounds are classified into groups according to their application. These groups are subdivided into classes and grades as shown in Table PF.

NOTE 2—An example of this classification system is as follows:  
The designation PF 111 indicates:

- PF = Phenol-Formaldehyde (Phenolic) as found in Terminology D 1600
- 1 = General Purpose (Group)
- 1 = Cellulose Filled, Type III (Class)
- 1 = Compression Molding Grade with Requirements given in Table PF.  
(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 PF. The basic properties can be obtained from Table A.

4.2 Specific requirements for special or new phenolic compounds shall be shown by a six-character designation. The designation will consist of the letter A and the five digits comprising the cell numbers for the property requirements in the order they appear in Table A.

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

4.3 When the grade of the basic material is not known, or is not important, the use of “0” grade classification shall be used.

NOTE 3—An example of this classification system for a special phenolic compound is as follows:

The designation PF110A34130 indicates:

- PF110 = General-purpose injection molding grade phenolic from Table PF,
- A = Table A property requirements,
- 3 = 50 MPa Tensile strength, min,
- 4 = 75 MPa Flexural modulus, min,
- 1 = 15 J/M Izod impact strength; min,
- 3 = 150°C Deflection temperature, min, and
- 0 = Unspecified.

NOTE 4—Specific gravity of pigmented or colored phenolic compounds can differ from black or natural phenolic compound, depending on the choice of colorants and the concentration.

### 5. Suffixes

5.1 When additional requirements are needed, values that are not covered by the basic requirements or cell table requirements shall be indicated through the use of suffixes. Use Classification D 4000 suffixes for additional requirements.

### 6. Basic Requirements

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

### 7. General Requirements

7.1 The material composition shall be uniform and shall

conform to the requirements specified herein. The color and form of the material shall be as agreed upon by the supplier and the user. Specification changes due to the effects of colorants should be noted by both parties and, where necessary, covered by suffixes.

### 8. Detail Requirements

8.1 Test specimens for the various materials shall conform to the requirements prescribed in Table PF and Table A, and suffix requirements as they apply.

8.2 Observed or calculated values obtained from analysis, measurement, or test shall be rounded off to the nearest unit in the last right-hand place of figures used in expressing the specified limiting value in accordance with the rounding method of Practice E 29. The value obtained is compared directly with the specified limiting value. Conformance or nonconformance with the specification is based on this comparison.

### 9. Sampling

9.1 Unless otherwise agreed upon between the user and the supplier, sample the materials in accordance with the sampling procedure prescribed in Practice D 1898. Adequate statistical sampling shall be considered an acceptable alternative. A lot of compound shall be considered as a unit of manufacture as prepared for shipment, and may consist of a blend of two or more production runs or batches of material.

### 10. Number of Tests

10.1 Conduct the number of tests as agreed upon between the user and the supplier.

### 11. Specimen Preparation

11.1 Mold the test specimens by compression in accordance with Practice D 796, by transfer in accordance with Practice D 1896, by injection in accordance with Practice D 3419, or as specified by the compound supplier.

### 12. Conditioning

12.1 Condition test specimens in the standard laboratory atmosphere in accordance with Procedure A of Practice D 618 before performing the required tests.

12.2 Conduct tests in the standard laboratory atmosphere of  $23 \pm 2^\circ\text{C}$  and  $50 \pm 5\%$  relative humidity in accordance with Practice D 618.

### 13. Test Methods

13.1 Determine the properties enumerated in this specification by means of the ASTM test methods as they apply, unless otherwise stated herein.

### 14. Rejection and Rehearing

14.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the supplier promptly, and in writing. In case of dissatisfaction with the results of the test, the supplier may make claim for a rehearing.

### 15. Certification

15.1 *Certification and Lot Acceptance Inspection*—



Certification and lot acceptance of the material shall be made as agreed upon between the user and the supplier, or as part of the purchase order or contract, and must meet the requirements in Table PF.

15.2 *Periodic Check Inspection*—The periodic check inspection shall consist of the test specified for all requirements of the material under this specification, or as agreed upon between the user and the supplier.

15.3 *Reports*—When specified in the purchase order or contract, a report of the test results shall be furnished at a frequency agreed upon between the user and the supplier.

## 16. Packaging and Package Marking

16.1 For packing, packaging, and marking, the provisions stated in Practice D 3892 apply.

## 17. Keywords

17.1 classification; description; PF; phenolic; plastics; properties

**TABLE PF Phenolic Materials Detail Requirement**

Group <sup>A</sup>	Description	Class	Filler <sup>B</sup>	Grade	Description (Flow/Form)	Specific Gravity max (D 792)	Water Absorption 24 h, max % (D 570)	Izod Impact <sup>C</sup> Strength min, J/m (D 256)	Flexural <sup>D</sup> Strength min, MPa (D 790)	Deflection Temp. °C, min, @ 1.82 MPa (D 648)	Tensile Strength min, MPa (D 638)	Compressive Strength min, MPa (D 695)		
1	General Purpose	1	Woodflour (Type II)	1	Comp-Granular	1.45	0.80	...	62	150	48	207		
				2	Inject-Granular	1.45	0.50	...	85	150	51	207		
				0	Other	...	...	...	...	...	...			
		2	Cellulose (Type III)	1	Comp-Granular	1.45	0.80	18	62	150	41	207		
				2	Inject-Granular	1.42	0.60	16	70	160	48	207		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
		2	Improved Impact	1	Chopped Fiber (Type IV)	1	Comp-Granular	1.45	1.75	56	55	...	41	138
						2	Comp-Pellets	1.45	1.50	56	55	150	41	138
						3	Comp-Macerated	1.45	1.50	56	55	150	41	177
0	Other					...	...	...	...	...	...	...		
2	Chopped Fiber (Type V)			1	Comp-Pellets	1.45	1.75	213	62	150	41	158		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
3	Chopped Cotton/Cord (Type VI)			1	Macerated	1.45	1.75	213	62	150	55	138		
				2	Chop Strand	1.45	1.75	200	62	150	55	138		
				0	Other	...	...	...	...	...	...	...		
4	Paper, Flock, Pulp (Type XII)			1	Comp-Granular	1.45	0.80	25	62	150	48	193		
				2	Comp-Pellets	1.45	0.80	25	62	150	48	193		
				3	Inject-Granular	1.45	0.40	18	76	150	48	193		
		4	Comp-Pellets	1.45	0.40	18	76	150	48	193				
3	Heat Resistant	0	Other	0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
		1	Mineral (Type IX)	1	Comp-	2.00	0.20	34	55	154	41	203		
				0	Other	...	...	...	...	...	...	...		
				1	Comp-Granular	2.00	0.25	17	48	154	41	151		
				2	Comp-Pellets	2.00	0.25	17	48	154	41	138		
				3	Comp-Pellets	1.80	0.20	15	80	162	41	186		
		2	Mineral (Type X)	4	Inject-Granular	1.80	0.20	15	90	176	41	207		
				5	Inject-Pellets	1.80	0.20	15	90	176	41	186		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
		3	Mineral, Flock (Type XIII)	1	Comp-Granular	1.68	0.5	16	55	150	41	151		
2	Comp-Pellets			1.68	0.5	16	55	150	41	138				
3	Inject-Granular			1.68	0.3	15	96	170	51	186				
4	Inject-Pellets			1.68	0.3	15	96	170	51	186				
4	Electrical	0	Other	0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
		1	Mineral (Type XIII)	1	Comp-Granular	2.00	0.07	15	55	175	34	138		
				2	Comp-Pellets	2.00	0.07	15	55	175	34	138		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
		2	Mineral (Type XXII)	1	Comp-Granular	1.80	0.4	19	55	149	45	177		
				2	Comp-Pellets	1.80	0.4	19	55	149	45	177		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
				0	Other	...	...	...	...	...	...	...		
7	Cellulose, Nylon (Type XXIV)	1	Comp-Granular	1.35	0.4	24	62	121	41	166				
		2	Nodular	1.35	0.4	24	62	121	41	138				
		0	Other	...	...	...	...	...	...	...				
		0	Other	...	...	...	...	...	...	...				



TABLE Continued

Group <sup>A</sup>	Description	Class	Filler <sup>B</sup>	Grade	Description (Flow/Form)	Specific Gravity max (D 792)	Water Absorption 24 h, max % (D 570)	Izod Impact <sup>C</sup> Strength min, J/m (D 256)	Flexural <sup>D</sup> Strength min, MPa (D 790)	Deflection Temp. °C, min, @ 1.82 MPa (D 648)	Tensile Strength min, MPa (D 638)	Compressive Strength min, MPa (D 695)	
				3	Trans-Pellets	1.80	0.4	18	90	149	48	177	
				4	Inject-Granular	1.68	0.2	16	100	177	48	177	
				5	Inject-Pellets	1.68	0.2	16	100	177	48	177	
				0	Other	...	...	...	...	...	...	...	
		3	Cellulose, Nylon (Type XXIV)	1	Comp-Granular	1.35	0.4	24	62	120	41	138	
				2	Comp-Pellets	1.35	0.4	24	62	120	41	138	
				3	Trans-Pellets	1.35	0.3	20	80	122	45	138	
				0	Other	...	...	...	...	...	...	...	
				4	Glass, Mineral (Type XXV)	1	Comp-Granular	1.80	0.15	24	83	250	55
				2	Inject-Granular	1.80	0.10	20	85	250	55	241	
				3	Inject-Pellets	1.80	0.10	20	85	250	62	241	
				0	Other	...	...	...	...	...	...	...	
		0	Other	0	Other	...	...	...	...	...	...	...	
0	Other	0	Other	0	Other	...	...	...	...	...	...	...	

<sup>A</sup> Molding compounds may be either single-stage or two-stage. Two-stage compounds generally have better storage stability and permit a broader range of molding conditions than single-stage compounds. Parts molded from single-stage compounds have greater freedom from undesirable tastes and odors and are less likely to cause corrosion of certain metals.

<sup>B</sup> Refer to the 1988 edition of Specification D 700 for detailed descriptions of these types.

<sup>C</sup> J/m × 18.73 × 10<sup>-3</sup> = ft.(ft-lbf/in. of notch).

<sup>D</sup> MPa × 145 = psi.

TABLE A Phenolic Compounds Detail Requirements

Designation Order No.	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile Strength, (D 638) Type I, min, MPa <sup>A</sup>	Unspecified	30	40	50	55	60	70	75	85	Specify value
2	Flexural Strength, (D 790) <sup>A</sup> min, MPa	Unspecified	50	60	70	75	85	90	95	100	Specify value
3	Izod Impact, (D 256) <sup>B</sup> min, J/m	Unspecified	15	25	50	100	200	300	400	500	Specify value
4	Deflection Temp., (D 648) min (1820 kPa), °C	Unspecified	120	135	150	175	200	230	260	300	Specify value
5	To be determined	Unspecified	...	...	...	...	...	...	...	...	...

<sup>A</sup> MPa × 145 = psi.

<sup>B</sup> J/m × 18.73 × 10<sup>-3</sup> = ft.(ft-lbf/in. of notch).

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