



Standard Specification for Epoxy Molding Compounds¹

This standard is issued under the fixed designation D 3013; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This specification covers requirements for epoxy thermosetting molding compounds. It provides for their identification, quality control, and purchase in such a manner that the purchaser and the seller can agree on the substantial similarity of different commercial lots or shipments.

1.2 The compounds covered under this specification consist of mixtures or blends of epoxy resins and curing agents intimately combined, in an unreacted or partially reacted condition, with fillers, reinforcements, colorants, and other chemical agents.

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

NOTE 1—The properties included in this specification are those required to identify the kinds of molding compounds covered. There may be other requirements necessary to define particular characteristics. These will be added to the specification as their inclusion becomes generally desirable and the necessary test data and methods become available.

NOTE 2—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

- D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies²
- D 150 Test Methods for A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials²
- D 256 Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics³
- D 495 Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation²
- D 570 Test Method for Water Absorption of Plastics³
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³
- D 638 Test Method for Tensile Properties of Plastics³

¹ 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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² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 08.01.

D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load³

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials³

D 883 Terminology Relating to Plastics³

D 1896 Practice for Transfer Molding Specimens of Thermosetting Compounds³

D 2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)⁴

D 3892 Practice for Packaging/Packing of Plastics⁴

2.2 Military Standard:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes⁵

3. Terminology

3.1 *Definitions*—Definitions of terms used in this specification are in accordance with Terminology D 883.

4. Classification

4.1 *Grades*—This specification is subdivided into various grades of epoxy molding compounds based on physical properties. This specification provides for a system of characterization and identification which enables coverage for all commercially available grades having properties within the range of the possible combinations as may be selected from Table 1. A grade is designated by the cell numbers for each property in the order in which they are listed in Table 1. When a property is not specified, a “0” is entered as the cell number.

4.2 *Classes*—Each of the grades of epoxy molding compound may be further subdivided into classes according to special requirements. A class is designated by a capital letter followed by cell designation corresponding to the requirements detailed in Table 2. Where no special requirements, in addition to grade properties, are needed, no class designation is shown.

NOTE 3—An example of this classification system would be grade 12324-D-00200-F-3 an epoxy molding compound having the following requirements (see Table 1 and Table 2):

⁴ Annual Book of ASTM Standards, Vol 08.02.

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

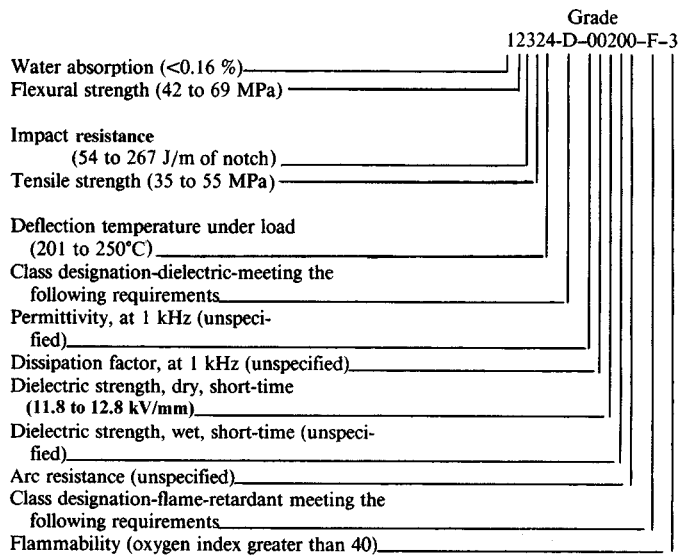
*A Summary of Changes section appears at the end of this standard.

TABLE 1 Detail Grade Requirements for Epoxy Molding Compounds

Designation Order No.	Property and Unit	Grades (Cell Limits)					
		0	1	2	3	4	5
1	Water absorption, % in 24 h	unspecified	<0.16	0.16 to 0.30	0.31 to 1.0	1.1 to 3.0	>3.0
2	Flexural strength, MPa	unspecified	<42	42 to 69	70 to 103	104 to 207	>207
3	Impact resistance, J/m of notch	unspecified	<22	22 to 53	54 to 267	268 to 534	>534
4	Tensile strength, MPa	unspecified	<35	35 to 55	56 to 103	104 to 138	>138
5	Deflection temperature under load, °C	unspecified	70 to 100	101 to 150	151 to 200	201 to 250	>250

TABLE 2 Detail Class Requirements for Epoxy Molding Compounds

Class	Class Designation	Designation Order No.	Property and Unit	Classes (Cell Limits)					
				0	1	2	3	4	5
Dielectric	D	1	permittivity	unspecified	<3.81	3.81 to 4.50	4.51 to 5.00	5.01 to 6.00	>6.00
		2	dissipation factor	unspecified	<0.016	0.016 to 0.03	0.04 to 0.10	0.11 to 0.20	>0.20
		3	dielectric strength, V/mil (short-time):	unspecified	<301	301 to 325	326 to 350	351 to 400	>400
		4	dry	unspecified	min 80 % of dry value using same test				
		5	wet	unspecified	min 80 % of dry value using same test				
Flame-retardant	F	1	arc resistance, s	unspecified	<61	61 to 110	111 to 140	141 to 180	>180
			flammability	unspecified	<25	25 to 40	>40



NOTE 4—Although the values listed in Table 1 and Table 2 are necessary to include the range of properties available in existing materials, they should not be interpreted as implying that every possible combination of the properties exists or can be obtained commercially.

5. General Requirements

5.1 The molding compounds shall be of uniform composition and so formulated as to conform to the requirements of this specification.

5.2 The apparent density, bulk factor, flow, particle size, and color of the compounds shall be as agreed upon between the purchaser and the seller in the order or contract. Properties other than those specified in this specification may also be agreed upon.

6. Detail Requirements

6.1 Test specimens molded by transfer in accordance with Practice D 1896, or compression methods in accordance with the supplier's recommendations shall conform to the requirements prescribed in Section 4 and Table 1 and Table 2 for the grade and classes specified.

7. Sampling

7.1 A batch or lot shall be considered as a unit of manufacture and may consist of a blend of two or more production runs of a resin.

7.2 Adequate statistical sampling procedures shall be used.

8. Specimen Preparation

8.1 Unless otherwise agreed between the purchaser and the seller, test specimens shall be molded by transfer or compression methods in accordance with the supplier's recommendations. The method of sample preparation shall be reported.

9. Conditioning

9.1 Unless otherwise specified in the test methods or in this specification for those tests where conditioning is required, the molded test specimen shall be conditioned in accordance with Procedure B of Practice D 618.

9.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ relative humidity, unless otherwise specified in the test methods or in this specification. In cases of disagreement, the tolerances shall be $\pm 1^\circ\text{C}$ and $\pm 2\%$ relative humidity.

10. Test Methods

10.1 The properties enumerated in this specification shall be determined in accordance with the following test methods:

10.2 *Water Absorption*—Test Method D 570. Test specimens shall be 51 by 3.2-mm disks. The 24-h immersion test shall be used.

10.3 *Flexural Strength*—Test Method D 790. Procedure A shall be used with test specimens, 6.4 by 12.7 by 127-mm bars.

10.4 *Impact Resistance (Izod)*—Test Method D 256, Method A. Specimens shall be 12.7 by 12.7 by 63.5 mm.

10.5 *Tensile Strength*—Test Method D 638. The Type I specimen, 3.2 ± 0.4 -mm thick, shall be used.

10.6 *Deflection Temperature Under Load*—Test Method D 648. Test specimens shall be 12.7 by 12.7 by 127-mm bars tested at a fiber stress of 1.8 MPa.

10.7 *Permittivity and Dissipation Factor*—Test Methods D 150. Measure the permittivity and dissipation factor at 1 kHz using 102 by 3.2-mm disks.

10.8 *Dielectric Strength (Dry)*—Test Methods D 149. Specimens shall be 102 by 3.2-mm disks tested under oil

between cylindrical brass electrodes 25.4 mm in diameter, with edge rounded to a radius of 3.2 mm.

10.9 *Dielectric Strength (Wet)*—Same test as for dielectric strength (dry) only using test specimens conditioned in accordance with Procedure E of Practice D 618.

10.10 *Arc Resistance*—Test Method D 495, using tungsten rod electrodes.

10.11 *Flammability*—Test Method D 2863.

11. Number of Tests

11.1 Routine testing of each batch or lot shall be limited to the specified properties chosen from Table 1 and Table 2 of this specification *unless* otherwise designated.

11.2 One set of specimens for those tests in Section 11 that are designated shall be considered sufficient for testing the batch or lot. If the number of that specimen should not be stipulated in the test methods, the number required may be agreed upon between the purchaser and the seller. The average results for those specimens shall comply with the requirements prescribed in this specification.

12. Packaging and Package Marking

12.1 *Packaging*—The material shall be packaged in airtight standard commercial containers, so constructed as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery, unless otherwise specified in the contract or order.

12.2 *Package Marking*—Unless otherwise agreed upon between the purchaser and the seller, shipping containers shall identify the material and its supplier, the batch or lot number, its type, and the quantity contained.

12.3 All packing, packaging, and marking provisions of Practice D 3892 shall apply to this specification.

13. Keywords

13.1 epoxy; molding compounds (thermosetting)

SUMMARY OF CHANGES

This section identifies the location of selected changes to this specification. For the convenience of the user, Committee D-20 has highlighted those changes that may impact the use of this specification. This section also may include descriptions of the changes or reasons for the changes, or both.

D 3013–94:

(1) Revised to include an ISO equivalency statement and keywords, to remove sections regarding purchaser/producer agreements outside Practice D 1898, and to remove quality assurance (QA) provisions for government/military procurement.

D 3013–99:

(1) Added 1.3 concerning SI units to the scope.
(2) Removed inch-pound units throughout.

(3) Deleted references to Test Method D 651 as it was discontinued without replacement. Test Method D 638 shall be used.

(4) Deleted references to Practice D 1898, as it was discontinued without replacement.

(5) Modified 7.2, deleting the reference to Practice D 1898.

(6) Modified 10.5, deleting the reference to Test Method D 651.

(7) Added the Summary of Changes section.

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