Designation: D3013 – 13

Standard Specification for Epoxy Molding Compounds[1]

This standard is issued under the fixed designation D3013; 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 U.S. 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 known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation

D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

D570 Test Method for Water Absorption of Plastics

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D883 Terminology Relating to Plastics

D1896 Practice for Transfer Molding Test Specimens of Thermosetting Compounds

D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

D3892 Practice for Packaging/Packing of Plastics

2.2 *IEC Standards:*

IEC 61621 Dry Solid Insulating Materials—Resistance Test to High-Voltage, Low-Current Arc Discharges[3]

3. Terminology

3.1 *Definitions*—Definitions of terms used in this specification are in accordance with Terminology D883.

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):

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.16 on Thermosetting Materials.

Current edition approved Sept. 1, 2013. Published September 2013. Originally approved in 1972. Last previous edition approved in 2012 as D3013 - 99(2012). DOI: 10.1520/D3013-13.

[2] 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.

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

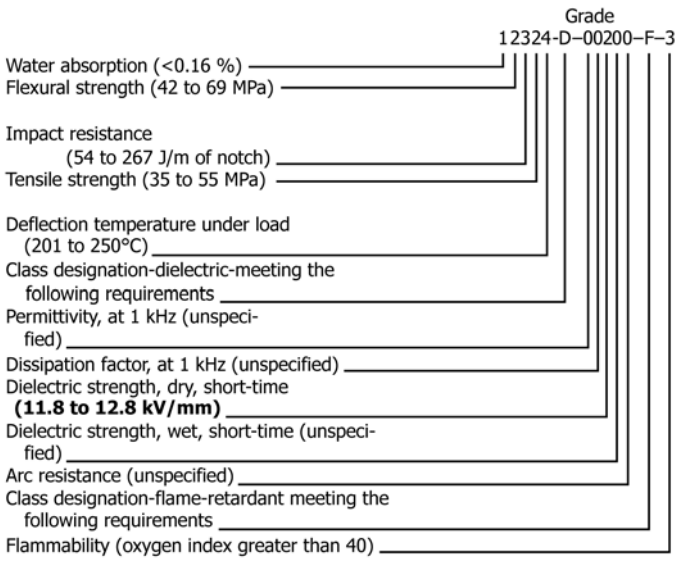
***A Summary of Changes section appears at the end of this standard**

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
			dielectric strength, V/mil (short-time):						
		3	dry	unspecified	<301	301 to 325	326 to 350	351 to 400	>400
		4	wet	unspecified	min 80 % of dry value using same test				
		5	arc resistance, s	unspecified	<61	61 to 110	111 to 140	141 to 180	>180
Flame-retardant	F	1	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 D1896, 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 D618.

9.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of 23 ± 2°C and 50 ± 10 % relative humidity, unless otherwise specified in the test methods or in this specification. In cases of disagreement, the tolerances shall be ±1°C and ±5 % 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 D570. Test specimens shall be 51 by 3.2-mm disks. The 24-h immersion test shall be used.

10.3 *Flexural Strength*—Test Method D790. Procedure A shall be used with test specimens, 6.4 by 12.7 by 127-mm bars.

10.4 *Impact Resistance (Izod)*—Test Method D256, Method A. Specimens shall be 12.7 by 12.7 by 63.5 mm.

10.5 *Tensile Strength*—Test Method D638. The Type I specimen, 3.2 ± 0.4-mm thick, shall be used.

10.6 *Deflection Temperature Under Load*—Test Method D648. 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 D150. Measure the permittivity and dissipation factor at 1 kHz using 102 by 3.2-mm disks.

10.8 *Dielectric Strength (Dry)*—Test Methods D149. 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 D618.

10.10 *Arc Resistance*—IEC 61621, using tungsten rod electrodes.

10.11 *Flammability*—Test Method D2863.

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 D3892 shall apply to this specification.

13. Keywords

13.1 epoxy; molding compounds (thermosetting)

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue, D3013 - 99(2012), that may impact the use of this standard. (September 1, 2013)

(1) Updated humidity tolerances in 9.2.
(2) Replaced references to Test Method D495, which was withdrawn, with IEC 61621.