Designation: D704 – 99 (Reapproved 2012)

Standard Specification for Melamine-Formaldehyde Molding Compounds[1]

This standard is issued under the fixed designation D704; 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 compression molding, thermosetting, melamine-formaldehyde molding compounds as further defined in 4.1, resin binder, with or without other resins, intimately combined with fillers, pigments, and any chemical agents needed.

1.2 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 types of molding compounds covered. There may be other requirements necessary to identify particular characteristics. These will be added to the specification as their inclusion becomes generally desirable and the necessary test data and methods become available. Transfer or injection molding will usually result in different physical and electrical characteristics than compression molding.

NOTE 2—ISO 2122-1977(E) is similar but not equivalent to this specification. Product classification and characterization are not equivalent.

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

D495 Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation

D570 Test Method for Water Absorption of Plastics

D618 Practice for Conditioning Plastics for Testing

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

D731 Test Method for Molding Index of Thermosetting Molding Powder

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

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D883 Terminology Relating to Plastics

D1895 Test Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials

D1896 Practice for Transfer Molding Test Specimens of Thermosetting Compounds

D3638 Test Method for Comparative Tracking Index of Electrical Insulating Materials

D3795 Test Method for Thermal Flow, Cure, and Behavior Properties of Pourable Thermosetting Materials by Torque Rheometer

D3892 Practice for Packaging/Packing of Plastics

D5224 Practice for Compression Molding Test Specimens of Thermosetting Molding Compounds

D6289 Test Method for Measuring Shrinkage from Mold Dimensions of Molded Thermosetting Plastics

2.2 *ASTM Manual:*

Manual 7 Manual on Presentation of Data and Control Chart Analysis, 8th Edition[3]

2.3 *ISO Standard:*

ISO 2122-1977(E) Plastics—Aminoplastic Molding Materials—Specification[4]

3. Terminology

3.1 *Definitions*—For definitions of technical terms pertaining to plastics used in this specification see Terminology D883.

4. Classification

4.1 The molding compounds covered by this specification shall be designated by types, based upon their principal characteristics and the fillers used.

[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 Dec. 1, 2012. Published December 2012. Originally approved in 1943. Last previous edition approved in 2004 as D704 - 99(2004). DOI: 10.1520/D0704-99R12.

[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 ASTM International Headquarters. Request MNL7–8TH.

[4] 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**

4.1.1 *Type 1*—General-purpose compound with cellulose filler, available in colors, white, and black. Suitable for general, mechanical, and electrical applications.

4.1.2 *Type 2*—A mineral- and flock-filled compound for industrial uses involving elevated-temperature and electrical applications.

4.1.3 *Type 3*—A compound with chopped cotton-cloth filler, having greater impact strength than the other Types 1 through 7.

4.1.4 *Type 5*—Unreinforced molding compound with high translucency, particularly suited for small pearlescent moldings.

4.1.5 *Type 6*—A wood-filled compound for general industrial uses involving mechanical and electric applications.

4.1.6 *Type 7*—Similar to Type 6, but with cellulose filler and improved insert-holding properties.

4.1.7 *Type 8*—A glass-fiber-reinforced compound with high impact strength and good electrical properties.

4.1.8 *Type 9*—Short-fiber, glass-filled compound with good dimensional stability and mechanical properties.

4.1.9 *Type 10*—A glass fiber-filled compound, with medium impact strength.

4.1.10 *Type 11*—A glass-filled, chopped strand compound with extremely high impact strength and good arc resistance.

4.1.11 *Type 12*—A fabric-filled compound with medium impact strength.

NOTE 3—Melamine molding compounds are of a limited storage stability. Melamine resins advance rapidly when stored at elevated temperatures.

5. Ordering Information

5.1 The order for the compound shall specify name, type, color, and plasticity.

NOTE 4—Compounds with a higher bulk factor than specified in Table 1 may be available.

6. Property Requirements

6.1 The molding compounds covered by this specification, when molded in accordance with Practice D5224, shall conform to the requirements prescribed in Table 1.

6.2 The required plasticity shall be agreed upon between the purchaser and producer or supplier. Test Methods D731 and D3795 are suggested for measuring plasticity and rate of cure.

6.3 The requirements in Table 1 shall be considered as minimum or maximum average values. Individual test results may vary ±10 % from the average, in most cases (Note 5). In the case of arc resistance, all test results must be averaged, when practicable, and the range of test results must always be reported. For all other tests, a single result beyond the range of four times the estimated standard deviation must be discarded, retests made, and the resulting value substituted for the discarded value (Note 6).

NOTE 5—The moisture content of the molding compound and the molded part, as well as mold design, molding process, and molding conditions, also influence test results.

NOTE 6—A method for determining 99 % confidence limits is given in Manual 7.

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 compound.

7.2 Adequate statistical sampling shall be used.

8. Test Specimen Preparation

8.1 Where molded specimens are required, Practice D5224 shall be followed as applicable (Note 7). Molds shall be constructed in accordance with Practice D1896.

NOTE 7—Some melamine compounds may not feed, plasticize, or mold satisfactorily at the designated temperatures of Practice D5224. In such cases the recommendation of the manufacturer shall be followed.

9. Conditioning

9.1 Measure the plasticity on compounds in the "as received" condition. However, for referee tests, store and condition the samples as described in Test Method D731.

9.2 Condition molded test specimens in accordance with Procedure B of Practice D618.

TABLE 1 Requirements for Compression-Molded Test Specimens[A]

Property	Types										
	1	2	3	5	6	7	8	9	10	11	12
Bulk factor, max	2.7	3.0	...	...	2.9	...	...	4.0	5.0	10.0	14.0
Specific gravity, max	1.60	1.80	1.60	1.55	1.60	1.55	2.00	1.90	2.20	2.00	1.55
Water absorption, max, weight gain %	0.40	0.25	0.60	0.35	0.60	0.60	0.20	0.15	0.20	0.20	0.50
Impact resistance, min, J/m of notch	13.3	16.0	29.4	7.5	16.0	16.0	170.8	32.0	48.0	1066	53.3
Flexural strength, min, MPa	68.9	51.0	82.7	65.5	44.8	40.0	68.9	96.5	82.7	137.8	96.5
Deflection temperature, min, ° C	177	168	162.7	148.8	166	166	204	196	166	204	202
Dielectric strength, min, S/S, kV/mm	9.8	9.8	3.9	...	7.9	7.9	6.7	9.45	9.06	...	6.89
Dissipation factor, max, 1 MHz	0.05	0.060	...	...	0.055	...	...	0.02	0.02	...	0.07
Arc resistance, min, s	120	180	125	...	180	70	180	180	180	180	140
Shrinkage, max, m/m	0.008	0.006	0.005	0.012	0.008	0.008	0.003	0.004	0.003	0.004	0.005
CTI, min, V	500	...	600	...	400	...	...	...	...	700	...

[A] The values shown herein were obtained under specified conditions. Any other conditions may significantly alter these values.

9.3 Conduct all testing in the Standard Laboratory Atmosphere as specified in Practice D618, unless otherwise specified in the referenced test methods or in this specification.

10. Test Methods

10.1 Determine the properties enumerated in this specification in accordance with the following methods:

10.1.1 *Bulk Factor*—Test Methods D1895, using the appropriate method for the compound involved.

10.1.2 *Specific Gravity*—Method A of Test Methods D792. A 3.2 by 51-mm disk is a recommended specimen for compounds containing long-fiber fillers that are subject to resin-squeeze-out and flow under pressure.

10.1.3 *Water Absorption*—Test Method D570, 24-h immersion procedure.

10.1.4 *Impact Resistance (Izod)*—Method A of Test Methods D256, using a 12.7 by 12.7 by 63.5-mm bar.

10.1.5 *Flexural Strength*—Method I, Procedure A of Test Methods D790, using a 6.4 by 12.7 by 127-mm bar, tested parallel to molding pressure.

10.1.6 *Deflection Temperature*—Test Method D648, at a fiber stress of 1.82 MPa on a 12.7 by 12.7 by 127-mm bar, loaded perpendicular to molding pressure at a 102-mm span.

10.1.7 *Dielectric Strength*—Test Methods D149, using specimens 3.2 by 102 mm or larger, tested under transformer oil between cylindrical brass electrodes 25.4 mm in diameter, with edges next to specimen rounded to a radius of 3.2 mm and a length of 25.4 mm. The rate of rise for the short-time test shall be 0.5 kV/s (Note 8). For the step-by-step test the increment of voltage increase shall be 2 kV and shall be applied for a period of 1 min.

NOTE 8—The short-time test determines the initial voltage for the step-by-step test.

10.1.8 *Permittivity and Dissipation Factor*—Test Method D150, using a 3.2 by 102-mm specimen for all frequencies up to and including 1 MHz.

10.1.9 *Arc Resistance*—Test Method D495, using tungsten electrodes.

10.1.10 *Shrinkage*—Test Method D6289.

10.1.11 *Comparative Tracking Index (CTI)*—Test Method D3638.

11. Packaging and Package Marking

11.1 All packing, packaging, and marking provisions of Practice D3892 shall apply to this specification.

12. Keywords

12.1 formaldehyde; melamine-formaldehyde; molding compounds (thermosetting)

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this specification since the last issue, D704 - 99(2004), that may impact the use of this specification. (December 1, 2012)

(1) Five year review. Reapproval without change.