



Designation: D704 – 99 (Reapproved 2020)

Standard Specification for Melamine-Formaldehyde Molding Compounds¹

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 U.S. 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.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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

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, 2020. Published December 2020. Originally approved in 1943. Last previous edition approved in 2012 as D704 - 99(2012). DOI: 10.1520/D0704-99R20.

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.

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/D1896M 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 Edition³
- ### 2.3 ISO Standard:
- ISO 2122-1977(E) Plastics—Aminoplastic Molding Materials—Specification⁴

3. Terminology

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

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. Classification

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

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 $\pm 10\%$ 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/D1896M.

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.

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.