Designation: D5224 – 00 (Reapproved 2006)

# Standard Practice for Compression Molding Test Specimens of Thermosetting Molding Compounds[1]

This standard is issued under the fixed designation D5224; 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.

## 1. Scope

1.1 This practice covers the general principles to be followed when compression molding test specimens of thermosetting molding compounds, such as phenolics, aminoplastics, melamine phenolics, epoxies, and unsaturated polyesters.

NOTE 1—This standard is similar in content (but not technically equivalent) to ISO 295-1974 (E).

1.2 Molding conditions are given for amino, phenolic, and allyl molding compounds. Materials specification standards should always be consulted to determine whether the material to be molded has any special requirements.

1.3 The values stated in SI units are to be regarded as standard. The values in brackets are given for information only.

1.4 *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.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D638 Test Method for Tensile Properties of Plastics

D883 Terminology Relating to Plastics

D958 Practice for Determining Temperatures of Standard ASTM Molds for Test Specimens of Plastics[3]

2.2 *ISO Standard:*

ISO 295 Plastics—Compression Molding Test Specimens of Thermosetting Materials[4]

ISO 3167 Plastics—Multipurpose—Test Specimens[4]

## 3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *breathe step*, *n*—in plastics molding, the part of the molding cycle in which the mold halves are opened momentarily, prior to curing, to release volatiles from the molded part.

3.2.2 *skin*, *n*—in plastics molding, the thin resin-rich layer (skin) on the surface of the molded part.

3.2.3 *skin effect*, *n*—in plastics testing, the positive or negative effect the skin may have on the results of some standard tests.

## 4. Summary of Practice

4.1 Compression molded test specimens are produced by loading a mold cavity with some form of the molding material, applying a specified pressure to the mating surface for a specified time and at a specified temperature, and then removing the part from the cavity.

## 5. Significance and Use

5.1 The conditions at which compounds are molded are known to influence the properties of the specimens. The degree of cure, elimination of knit-lines between particles, density of the part, and degradation of the polymer are among those factors which will be affected by the molding conditions. Thus it is important to hold to a standard set of conditions in order to have a valid comparison of properties between different compounds and different batches of the same compound.

5.2 If the molded specimens show evidence of low-density areas due to trapped gases, they should be discarded. A breathe step may be necessary to eliminate this situation. It is critical that the breathe step be as brief as possible to avoid precuring of the compound before full pressure is applied. This would lead to poorly "knitted" areas and lower strength in the molded specimen.

## 6. Apparatus

6.1 *Molds*:

6.1.1 The mold shall be made of steel, able to withstand the molding temperatures and pressures. The mold shall be designed such that the compressive mold force is transferred to

[1] This practice is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.09 on Specimen Preparation.

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[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] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

[4] *ISO Standards Handbook 21*, Vol 2, Plastics, 2nd Ed., 1990, available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

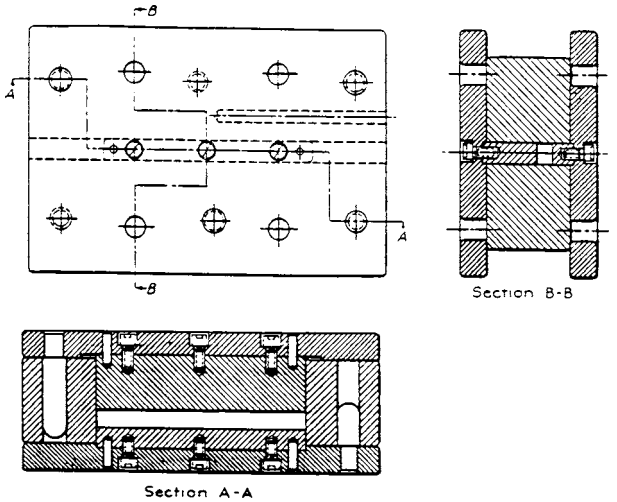
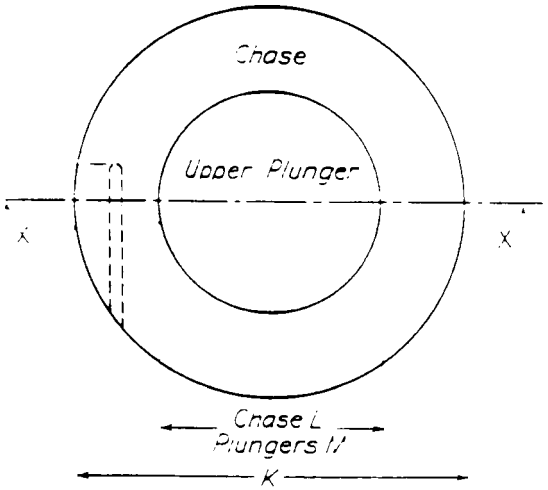



**FIG. 1 Single-Cavity Positive-Compression Mold for Bar Test Specimens**



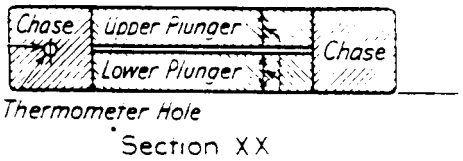




**FIG. 2 Compression Mold for Disk Test Specimens**

the molding material with no appreciable loss. The molds shown in Figs. 1 and 2 are recommended for maintaining the maximum force on the material. They are of the three-plate design; consisting of a shell or floating plate, with upper and lower compression plates. Molds may be of single or multiple cavity design.

NOTE 2—Semi-positive molds may be used, and for materials such as amino compounds, may even be preferred.

6.1.2 Although the actual mold cavity may have various forms, the majority of tests will use bars 12.7 mm [0.5 in.] in width by 127 mm [5 in.] or 64 mm [2.5 in.] in length, discs 51 mm [2 in.] or 102 mm [4 in.] in diameter or an appropriate tensile bar as described in Test Method D638. The multi-purpose design from ISO 3167 may also be used. The mold shall be capable of molding thickness from 1.5 mm [0.06 in.] to 12.5 mm [0.5 in.]. If the specimens are to be used for flame testing, even thinner specimens may be needed. In all cases the ASTM Standard Test Procedure to be used shall be consulted for the dimensions of the required test specimens.

NOTE 3—If at all possible, specimens shall be molded directly to dimension, rather than machined from a plaque. This maintains the integrity of any skin effect.

NOTE 4—If specimens are to be machined from plates or plaques, they should not be taken from the edge of the plaque. A minimum margin of 10 mm [0.5 in.] is recommended.

6.1.3 A cavity draft angle not exceeding 3° may be used to facilitate specimen removal.

6.1.4 The clearance between the vertical wall of the cavity and that of the force shall not exceed 0.1 mm [0.004 in.].

6.1.5 Mold surfaces should be finished to a roughness of 0.4 to 0.8 µm (SPI-SPE #2 or equivalent[5]), unless it is known that the particular test is not affected by a coarser surface finish. Chrome plating is recommended but not necessary. All cavity surfaces should be draw polished in the direction parallel to the force to facilitate specimen removal.

6.1.6 If ejector pins are used, they shall not deform the specimens and their placement shall be such that the pin marks are not in the area of test.

6.1.7 The mold shall have a loading chamber of sufficient volume to allow the introduction of the entire charge of material in a single loading. Preforms may be used to decrease the required loading volume of high bulk materials. The conditions of such preforming shall be included in the report.

6.1.8 As the specimen surface facing the lower die is heated for a longer time and at a higher temperature in the time interval between filling and compression, it is recommended that a mark be placed on one cavity face in such a position that it will not interfere with the testing. When reporting the results of tests that affect the surfaces unequally, the tested surface shall be indicated.

6.2 *Press*—The hydraulic press shall have a range of pressures sufficient to insure that the specified pressure is applied and maintained during the entire molding operation, and of maintaining that pressure within ±1.5 MPa (±218 psi).

6.2.1 In order to prevent precure, the press shall be capable of closing within 15 s after the placement of the material in the mold. A two-speed press is preferred for this purpose. The fast approach speed can be in the range of 200 to 400 mm/s [8 to 16 in./s] while the slow closing speed of 5 mm/s [0.2 in./s] is used to prevent gas entrapment.

6.3 *Heating System*—The molds may be heated by conduction from heated platens, heaters inserted into the mold itself, or by hot fluids circulated through passageways in the mold. The heating system shall be capable of controlling the mold temperature to ±3°C [±5°F] from point-to-point on the mold and for the duration of the molding time.

[5] Mold comparison kits are available from the D-M-E Company, 29111 Stephenson Highway, Madison Heights, MI 48071.