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Standard Test Method for Molding Index of Thermosetting Molding Powder[1]

This standard is issued under the fixed designation D 731; 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

~~1.1This test method covers the measurement of the molding index of thermosetting plastics ranging in flow from soft to stiff by selection of appropriate molding pressures within the range from 4.1 to 31.9 MPa.~~

~~1.2The values stated in SI units are to be regarded as standard.~~ *

1.1 This test method covers the measurement of the molding index (plasticity) of thermosetting plastics ranging in flow from soft to stiff by selection of appropriate molding pressures within the range from 530 to 5300 psi (3.7 to 36.5 MPa).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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.*

NOTE 1—There is no ISO standard equivalent to this test method.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 256 ~~Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials~~ Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

D 883 Terminology Relating to Plastics

D 957 Practice for Determining ~~Mold~~ Surface Temperature of Molds for Plastics

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

~~3.1*Definitions:* Definitions are in accordance with Terminology D883~~

3.1 Definitions are in accordance with Terminology D 883, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.3 *plasticity*—a measure of the resistance of a molten thermosetting material to flow under heat and pressure. A measure of the apparent viscosity of the material.

4. Summary of Test Method

4.1 A cup mold is mounted in a semi-automatic type press. A predetermined quantity of test sample is charged into the mold, controlled at a temperature dependent upon the test material. The minimum force required to mold a cup having a flash or fin thickness within a specified tolerance is determined. This force along with the mold closing time is reported as molding index.

5. Significance and Use

5.1 This test method provides a guide for evaluating the moldability of thermosetting molding powders. This test method does not necessarily denote that the molding behavior of different materials will be alike and trials may be necessary to establish the

~~[1] This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D 20.30 on Thermal Properties (Section D20.30.08).~~

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[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.30 Thermal Properties.30 on Thermal Properties (Section D20.30.08).

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~~[2] Annual Book of ASTM Standards, Vol 08.01.~~

[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.

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

appropriate molding index for each material in question.

5.2 The sensitivity of this test diminishes when the molding pressure is decreased below ~~66 MPa,~~764 psi (5.3 MPa), so pressures lower than this are not ordinarily recommended. This is due to the friction of moving parts and the insensitivity of the pressure switch actuating the timer at these low pressures.

6. Apparatus

6.1 *Mold*—A cup mold[3] of the flash type, to produce a molded cup as shown in Fig. 1, operated under controlled pressure and temperatures and provided with stops so that flash or fin thickness cannot be less than 0.0055 in. (0.14 mm). The area of the mold casting creating the molded flash shall be located on top of the cup, flat, perpendicular to the axis of the cup, and in the form of an annular ring ~~3.17 mm (0.125 in.)~~0.125 in. (3.17 mm) in width.

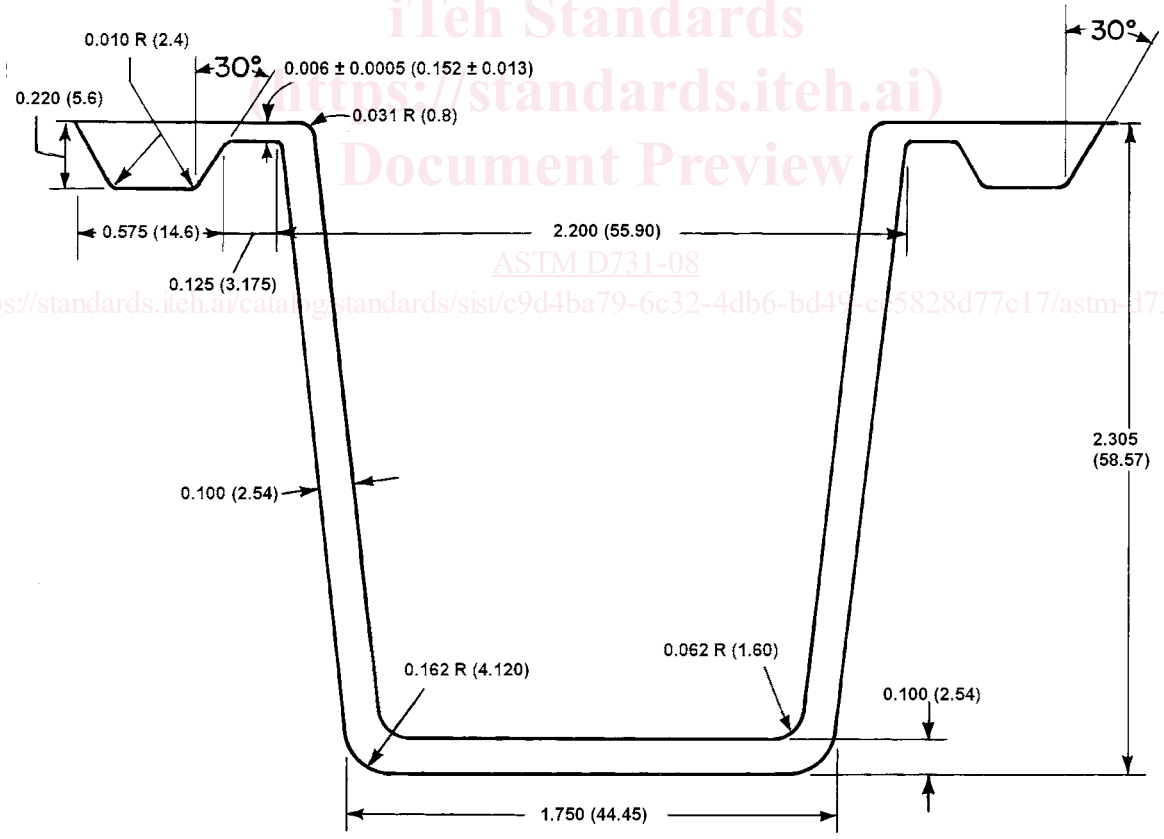
6.2 ~~*Thermometer*—A 32-mm partial-immersion mercury thermometer having a diameter just under 4.8 mm and a temperature scale of not more than 20°C/25.4 mm of length. A pyrometer may be used to determine the temperature of the mold surfaces. For properly measuring mold temperatures, reference should be made to Practice D957~~Pyrometer—A calibrated pyrometer, traceable to a National Institute of Standards and Technology (NIST) standard and accurate to ±1.8°F (1°C) shall be used to determine the temperature of the mold surfaces. For properly measuring mold temperatures, reference should be made to Practice D 957.

6.3 *Heating System*—Any conventional means for heating the press platens, provided the heat source is constant enough to maintain the molding temperature within ±1.8°F (±1°C) of the specified temperature (see 9.2).

6.4 *Pressure System*—A semiautomatic press with a fixed mold and fully insulated to minimize heat losses shall be used. The use of hand molds is not recommended but may be used to give an estimate of the molding index. The hydraulic system shall be

~~[3] Annual Book of ASTM Standards, Vol 08.03.~~

[3] A detailed drawing of the mold design is available from ASTM Headquarters. Order Adjunct: ADJD0731.



Note:
All surfaces polished to SPE/SPI #2 Finish
Steel: D-2 Hardened to 62 RC
Dimensions in inches (mm)
Tolerance ± 0.001 (0.25) Except where noted

FIG. 1 Cup Mold

provided with a means of pressure regulation so that the load on the mold shall differ by not more than ~~±56.2 N~~ ±250 lbf (±1112 N) from the stated value. The capacity of the hydraulic system shall permit a ram travel of approximately ~~25 mm/s. It is recommended that the~~ 1 in./s (25 mm/s). The ram diameter should not exceed 4 in. (100 mm).

7. Test Specimen

7.1 To determine the weight of the test specimen for materials having an Izod impact strength of 0.50 ft-lb/in. (27 J/m) of notch, or less, a cup having a flash or fin thickness of ~~0.15~~0.006 to 0.008 in (0.15 to 0.20 mm) shall be molded (see Note ~~3~~2). The adhering fin shall be removed and the cup weighed to the nearest 0.1 g. This weight multiplied by 1.1 shall be the weight of the test specimen used. For materials having an impact above 0.50 ft-lb/in. (27 J/m) of notch, the specimen weight is determined in a similar manner, except that cup flash shall not be more than 0.026 in. (0.66 mm) or less than 0.020 in. (0.51 mm), and the amount of material shall be 1.05 times the weight of this cup. The test specimen shall be in the form of loose powder unless preforming is necessary for materials of high bulk. Minimum pressure shall be employed in the preforming operation to minimize the increase in closing time resulting from the use of preforms.

NOTE 2—While the mold is provided with stops so that the flash or fin thickness cannot be less than ~~0.15~~0.006 ± 0.0005 in. (0.15 ± 0.013 mm), the molded cup itself may have a flash thickness of 0.006 ± 0.0008 in. (0.15 to 0.20 mm) as the micro switch controlling the closing time must have a tolerance in which to operate.

8. Conditioning

8.1 Materials are normally tested in the "as received" condition, except in referee tests, when they shall be conditioned in accordance with 8.2 ~~(see Note 2~~(see Note 3).

8.2 For referee testing, all materials shall be shipped and stored in sealed moisture barrier containers. These materials shall be stored for a minimum period of 48 h at standard laboratory temperature before breaking the seal on the carton. A representative sample shall be taken from this carton immediately after opening and tested within 3 min in order to preserve the original moisture content. Alternative methods of conditioning samples may be used provided they are mutually agreed upon between the manufacturer and the purchaser.

NOTE 3—Conditioning may alter the moisture content of most materials and thereby change their molding index or molding behavior.

9. Procedure

9.1 Mount the mold in a press of the semi-automatic type. Past experience has shown that the rate of flow is sensitive to the condition of the mold surfaces; preceding materials may have deposited a film that influences the mold surfaces to the extent that erroneous results may be obtained unless properly conditioned prior to testing. A suggested procedure is to discard the first few cups molded and accept the flow time as correct when two successive cups molded under test do not differ by more than 1 s in time of flow.

9.2 The preferred mold temperature for testing the molding index for the following materials shall be:

~~°C~~	~~°F (°C)~~
	°F (°C)
~~Phenolic~~	~~165 ± 1~~
Phenolic	330 ± 1.8 (165 ± 1)
~~Melamine~~	~~155 ± 1~~
Melamine	310 ± 1.8 (155 ± 1)
~~Urea~~	~~150 ± 1~~
Urea	300 ± 1.8 (150 ± 1)
~~Epoxy~~	~~150 ± 1~~
Epoxy	300 ± 1.8 (150 ± 1)
~~Diallyl phthalate~~	~~150± 1~~
Diallyl phthalate	300 ± 1.8 (150± 1)
~~Alkyd~~	~~150 ± 1~~
Alkyd	300 ± 1.8 (150 ± 1)

Other temperatures may be used as agreed upon between the manufacturer and the purchaser.

9.3 First determine the proper weight to be used as outlined in 6.1. Then begin the test with a load sufficient to close the mold to the fin thickness specified for the type of material being tested as defined in 6.1. For example, if a ~~2248 N~~ 10,000 lb (44482 N) load is applied on the mold to make the initial cup and the required fin thickness is obtained, the next lower load, ~~1686 N~~ 7500 lb (33362 N) is applied as indicated in the following table. If the mold closes to the required thickness again, then the ~~1124 N~~ 5000 lb (22241 N) load is applied. If the mold then does not close, the "molding index" is the closing time obtained with the ~~1686 N~~ 7500 lb (33362 N) load. It is recommended that the mold loads used be selected from the following table (see Note 4):