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Standard Test Method for Measuring the Flow Properties of Thermoplastic Molding Materials¹

This standard is issued under the fixed designation D 569; 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 test method has been approved for use by agencies of the Department of Defense to replace Method 2041 of Federal Test Method Standard 406. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This test method covers the measurement of the following flow properties of thermoplastic molding materials:

1.1.1 *Procedure A*—The temperature at which a thermoplastic material attains a defined degree of flow when subjected to a prescribed pressure for a prescribed time in a specified extrusion mold, or

1.1.2 *Procedure B*—The degree of flow that a thermoplastic material attains when subjected to a prescribed pressure and temperature for a prescribed time in a specified extrusion mold.

1.2 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

1.3 *This standard does not purport to address the safety problems 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 Document

2.1 *ASTM Standard:*
D 883 Definitions of Terms Relating to Plastics²

3. Terminology

3.1 Definition:

3.1.1 For definitions of some of the technical terms used in this standard refer to Definitions D 883.

4. Significance and Use

4.1 The equilibrium state of the material in this test is not necessarily representative of the state at which the material is molded commercially. The indicated temperature of the heat-transfer medium in an injection or extrusion machine cylinder generally is in excess of that of the material itself and of the flow temperature of the material. Thus, the chief use of this test is for control and identification purposes rather than for prediction of molding conditions or physical properties.

5. Apparatus

5.1 The apparatus for the flow test (see Fig. 1) shall be a

constant-force, vertical-orifice type machine³ consisting essentially of the following:

5.1.1 *Orifice*—A vertical orifice 3.18 ± 0.013 mm (0.125 ± 0.0005 in.) in diameter and 38 mm ($1\frac{1}{2}$ in.) in length, 1, Fig. 1 into which the material flows. The orifice is machined into a split cone 25.4 mm (1 in.) in diameter at the base which is clamped into a steam-heated block, 3. A thermometer well 4.76 mm ($\frac{3}{16}$ in.) in diameter and 32 mm ($1\frac{1}{4}$ in.) in depth is drilled into the split cone. Temperature readings are taken at this point.

5.1.2 *Thermometer*—A 32-mm ($1\frac{1}{4}$ in.) immersion mercury thermometer having a diameter just under 4.76 mm ($\frac{3}{16}$ in.) and a temperature scale of not more than 20°C/in. of length.

5.1.3 *Charge Chamber*—Below the orifice and concentric with it is the charge chamber, 2, 9.5 mm ($\frac{3}{8}$ in.) in diameter and 19 mm ($\frac{3}{4}$ in.) in length.

5.1.4 *Block*—A steam-heated block, 3. Heat is supplied by steam at a line pressure of 620 to 1030 kPa (90 to 150 psi), passing through an accurate reducing valve; if the line pressure fluctuates too widely, two reducing valves in series may be used. The temperature is controlled by regulating the steam pressure.

5.1.5 *Ram*—A steam-heated ram, 4, so arranged that it applies pressure to the charge chamber from the bottom, forcing the material into the orifice. The steam line is so arranged that the steam passes through the reducing valve, the ram, the block, and finally through a suitable trap or small vent.

5.1.6 *Pressure System*—A mechanical system, 5, for applying a net pressure of 10.3 MPa (1500 psi) to the ram. The pressure system illustrated in Fig. 1 is built so that any pressure up to 20.7 MPa (3000 psi) may be applied in increments of 690 kPa (100 psi).

5.1.7 *Flow Measuring Device*—Means for measuring the flow of material into the orifice. Measurements shall be accurate to ± 0.25 mm (± 0.01 in.). The following measuring systems are suitable:

5.1.7.1 A follower rod, guided by loose bearings in a swing arm, rests on the material in the orifice. A flexible chain attached to the upper part of the follower rod is passed part way around and fastened to the small diameter of a two-step pulley having a 3:1 ratio and mounted on the swing arm. A second flexible chain passing part way around and fastened to the larger diameter is attached to a sliding indicator and a counterweight. The indicator travels over a calibrated scale

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.30 on Thermal Properties (Section D20.30.08).

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² Annual Book of ASTM Standards, Vol 08.01.

³ Rossi-Peakes flow tester as described in U. S. Patent 2,066,016.