



Designation: D 955 – 00

Standard Test Method of Measuring Shrinkage from Mold Dimensions of Thermoplastics¹

This standard is issued under the fixed designation D 955; 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 test method is intended to measure shrinkage from mold cavity to molded dimensions of thermoplastics when molded by compression or injection processes with specified process conditions.

1.2 This test method covers initial shrinkage measurements. The method also accommodates shrinkage at 24 and 48 h, which may be critical for some materials.

1.3 This method will give comparable data based on standard specimens and can not predict absolute values in actual molded parts with varying flow paths, wall thicknesses, pressure gradients and process conditions. Differences in mold shrinkage may also be observed between the three specimen geometries described in this test method.

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

1.5 *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—This test method is technically identical to ISO 294-4 where Type D2 specimens are used except that pressure transducers are an option in this test method and required in ISO 294-4.

2. Referenced Documents

2.1 ASTM Standards:

- D 374 Test Methods for Thickness of Solid Electrical Insulation²
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³
- D 788 Classification System for Poly(Methyl Methacrylate) (PMMA) Molding and Extension Compounds³
- D 883 Terminology Relating to Plastics³

¹ This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.09 on Specimen Preparation. Current edition approved Nov. 10, 2000. Published January 2001. Originally published as D 955 – 48T. Last previous edition D 955 – 89 (1996).

² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 08.01.

- D 3641 Practice for Injection Molding of Test Specimens of Thermoplastic Molding and Extrusion Materials⁴
- D 4066 Specification for Nylon Injection and Extrusion Materials⁴
- D 4181 Specification for Acetal (POM) Molding and Extrusion Materials⁴
- D 4549 Specification for Polystyrene Molding and Extrusion Materials (PS)⁵
- D 4703 Practice for Compression Molding of Thermoplastic Materials into Test Specimens, Plaques, Sheets⁵
- D 4976 Specification for Polyethylene Plastics Molding and Extension Materials⁵
- D 5947 Test Methods for Physical Dimensions of Solid Plastics Specimens⁵
- E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁶

2.2 ISO Standards:

- ISO 293 Plastics—Compression Moulding Test Specimens of Thermoplastic Materials⁷
- ISO 294-3 Plastics—Injection Moulding of Test Specimens of Thermoplastic Materials—Part 3: Small Plates⁷
- ISO 294-4 Plastics—Injection Moulding of Test Specimens—Part 4: Determination of Moulding Shrinkage⁷

3. Terminology

3.1 *Definitions*—General definitions of terms applying to this test method appear in Terminology D 883.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *demolding, n*—removing the specimens from the mold.

4. Summary of Test Method

4.1 The principle of this test method is to compare mold cavity dimensions with specimen dimensions and report the differences in percent.

⁴ Annual Book of ASTM Standards, Vol 08.02.

⁵ Annual Book of ASTM Standards, Vol 08.03.

⁶ Annual Book of ASTM Standards, Vol 14.02.

⁷ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

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

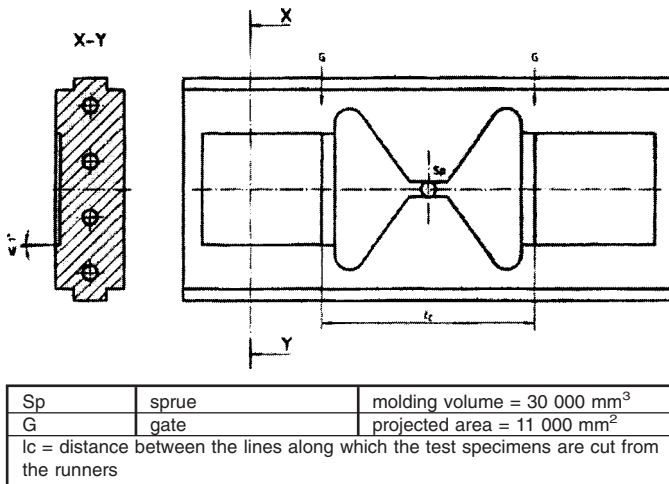


FIG. 1 Type D2

5. Significance and Use

5.1 *Injection Molding*—In injection molding, the difference between the dimensions of a mold cavity and of the molded specimen may vary according to the design of the mold and operation of the molding process. Factors such as mold and melt temperature, fill times, and packing conditions are known to affect shrinkage significantly. Adherence to the specified mold design (see 7.1) and specifications outlined in Practice D 3641 or ISO 294-4 or the appropriate material will improve the reproducibility of the test.

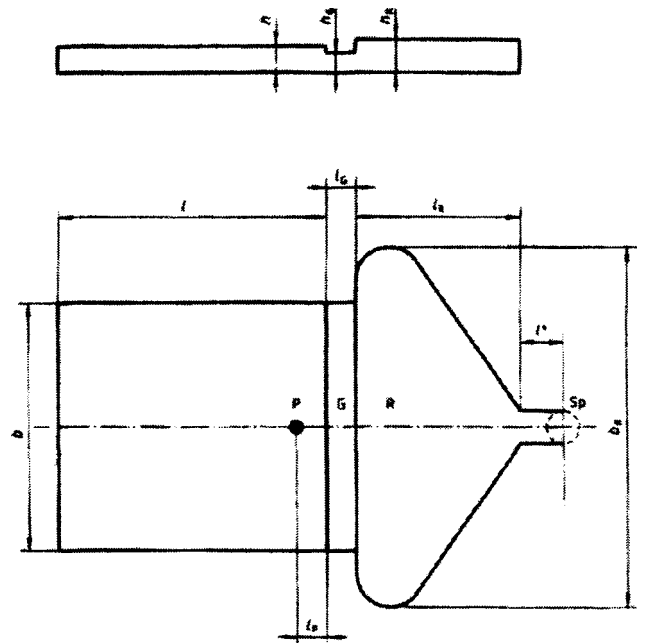
5.2 *Compression Molding*—In compression molding, the difference between the dimensions of a mold cavity and of the molded specimen may vary according to the design of the mold and operation of the molding process. Factors, such as the amount of material in charge, cooling time, and pressure application are known to affect shrinkage significantly. Adherence to the specified mold design (see 7.2) and specifications outlined in Practice D 4703 or ISO 293 or the appropriate material specifications will improve the reproducibility of the test.

6. Sample Preparation

6.1 Some materials require special treatment before they are molded. For example, thermoplastics, which absorb moisture must be dried before molding. Refer to the manufacturer's recommendations for required conditions or appropriate material specification. The preparation given to the material prior to molding shall be recorded and reported.

7. Apparatus

7.1 *Injection Mold*—Specimens shall be molded in a two cavity mold conforming with dimensions as shown in Figs. 1 and 2 for the 60 × 60-mm plaque specimen (Type D2), Fig. 3 for the 12.7 × 127-mm bar specimen (Type A) and Fig. 4 for the 100mm × 3.2-mm disk specimen (Type B). The mold may have scribe marks included for the measurement of shrinkage. The scribe marks shall be 1.0 mm long by .01 mm wide located 1.0 mm from each edge on one side of the mold. Pressure transducers for monitoring the pressure in at least one cavity are mandatory for Type D2. Mold shrinkage measurements



Sp	sprue	
G	gate	
R	runner	
P	pressure sensor	dimensions in mm
l	length of plate	60 ± 2
b	width of plate	60 ± 2
h	thickness of plate	2.0 ± 0.1
lg	length of gate	4.0 ± 0.1
hg	height of gate	(0.75 ± 0.05) × h ³
lR	length of runner	25 to 40
bR	width of runner	≥ (b + 6)
hg	depth of runner at gate	h + (1.5 ± 0.5)
l*	unspecified distance	...
lP	distance of pressure sensor from gate	5 ± 2

FIG. 2 Type D2

should be made on specimens that have been molded at one of the following cavity pressures ± 3 % from the selected pressure: 20 MPa, 40 MPa, 60 MPa, 80 MPa, 100 MPa, or as specified in the appropriate material specification. Pressure transducers are recommended, but not mandatory for specimens Type A and Type B.

7.2 *Compression Mold*—A single cavity positive mold having cavity dimensions conforming to the dimensions of Fig. 2 for the 60 × 60-mm plaque (Type D2) Fig. 3 for the 12.7 × 127-mm bar specimen (Type A) and Fig. 4 for the 100-mm × 3.2-mm disk specimen (Type B), not including the sprue, runner or gate. The mold may have scribe marks included for the measurement of shrinkage. The scribe marks shall be 1.0 mm long by 0.1 mm wide located 1.0 mm from each edge on one side of the mold.

7.3 *Injection Press*—A suitable injection molding machine that will fill the test molds when it is operated in the range from 20 to 80 % of its rated shot capacity at the molding parameters specified in Practice D 3641, ISO 294-3 or the appropriate material specification.

NOTE 2—If the injection machines of appropriate capacity are not available, the requirements of 7.3 may be met in machines of larger capacities by providing test molds with multiple cavities (maximum of four) to be filled from a common sprue and having a balanced filling