Designation: D 1042 – 01

An American National Standard

Standard Test Method for Linear Dimensional Changes of Plastics Under Accelerated Service Conditions[1]

This standard is issued under the fixed designation D 1042; 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 test method is designed to provide a means for measuring in plastic specimens the dimensional changes resulting from exposure to service conditions. In particular, this test method is suitable for measuring shrinkage or elongation developed in accordance with the procedures described in Practice D 756.

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

1.3 *This standard does not purport to address all of the safety problems, 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 similar or comparable ISO standard.

2. Referenced Documents

2.1 *ASTM Standards:*

D 756 Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions[2]

D 883 Terminology Relating to Plastics[2]

D 1898 Practice for Sampling of Plastics[3]

3. Terminology

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

4. Significance and Use

4.1 This test method is intended only as a convenient test method for measurement of linear dimensional changes in plastics subjected to defined conditions of test as outlined in Practice D 756. When all precautions are observed, measurements are reproducible to ±0.02 %.

5. Apparatus

5.1 *Scriber*, so constructed that two sharp needle points are rigidly separated by 100 ± 0.2 mm. A very satisfactory scriber, as shown in Fig. 1, consists of two sharp steel phonograph needles (approximately 1.5 mm in diameter) inserted in holes drilled with their axes parallel to each other and perpendicular to and intersecting the long axis of a stainless steel rod, 7.9 mm (5⁄16 in.) in diameter by 125 mm (5 in.) in length. The needle points extend 6 mm beyond the supporting rod and are held in position by two set screws inserted through the ends of the rod. Thickness of arc lines should not exceed 0.02 mm.

NOTE 2—Phonograph needles may be used as a satisfactory scriber.

NOTE 3—For calibration of the scriber, a stainless steel gage with reference points consisting of a center and two short concentric arcs (R_1 = 99.80 ± 0.02 mm, and R_2= 100.20 ± 0.02 mm) has been found acceptable.

5.2 *Measuring Microscope*, graduated to read to 0.1 mm or better. (A Brinell microscope 20×, for measuring Brinell hardness, is very satisfactory.) For more precise measurements, a micrometer microscope may be used.

6. Sampling

6.1 Sampling shall be in accordance with the present considerations outlined in Practice D 1898.

7. Test Specimens

7.1 The test specimens shall be similar to those prescribed in Practice D 756 with the additional requirement that in the direction of test the length should be not less than 110 mm. In practice, specimens 150 by 25 mm and of the full thickness of the material are desirable. These specimens may be suspended individually in the specified environment by wire hooks inserted in a hole punched in one end of the specimen. When one type of plastic is to be compared with another type, a standard thickness of 3.2 mm (0.125 in.) is preferred.

8. Procedure

8.1 Immediately following the preconditioning period of the test, scribe an arc of 100-mm radius on the surface of the test specimen. Press one needle firmly into the specimen to form a center for this and subsequent measurements. The other needle scribes the arc which is used as a reference for all subsequent measurements (see Fig. 2). Draw the arcs smoothly, using a pressure consistent with the surface hardness and test conditions to which the specimen is subjected. It is desirable to depress rather than scratch or tear the surface with the needle,

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.50 on Permanence Properties.

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

[3] *Annual Book of ASTM Standards*, Vol 08.02.

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

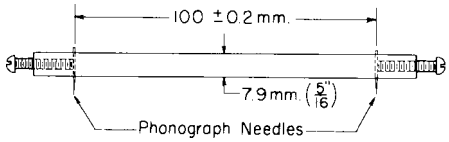
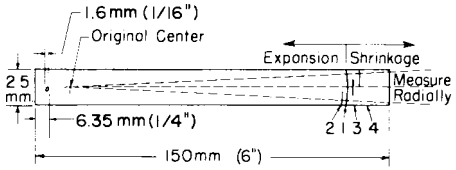


FIG. 1 Scriber



1—Original arc
2—After 37.7°C (100°F) and 100 % humidity
3—After 60°C (140°F)
4—Final conditioning

NOTE 1—The arcs in this specimen illustrate the steps to use for Procedure VI of Practice D 756.

FIG. 2 Scribing Test Specimens for Measurement

although harder surfaced materials and those subjected to extreme test conditions may require deeper scratching of the surface.

8.2 At each phase of the test where it is desirable to measure linear changes, reinsert one needle in the original center and draw a short arc with the other. Measure the distance between the original arc and the new arc with the microscope. Measure the separation of the arcs between corresponding positions, for example, center to center.

8.3 If the test specimen is not flat, flatten it by pressing or clamping it against a plane surface before scribing the arcs and making the measurements. In no case shall the specimen be clamped or otherwise confined during the period of exposure to accelerated service conditions.

9. Calculation and Precision

9.1 Measure the distance between arcs to 0.1 mm and estimate to the nearest 0.01 mm (0.01 mm corresponds to a linear change of 0.0 %). Measurements made on materials not moisture sensitive at other than constant temperature will be corrected for differential thermal expansion by the following amount:

$$C = (\alpha_p - \alpha_s)(T_f - T_i) \times 100 \quad (1)$$

where:

C = correction to add to calculated percent shrinkage or subtract from calculated percent expansion,
α_p = coefficient of linear thermal expansion of the plastic specimen,
α_s = coefficient of linear thermal expansion of the steel,
T_f = temperature when final arc is scribed, and
T_i = temperature when initial arc is scribed.

10. Precision and Bias

10.1 A meaningful precision and bias statement cannot be developed at this time because of the small number of laboratories presently known to be using this test method.[4]

11. Keywords

11.1 accelerated service conditions; linear dimensional changes; plastics

[4] To participate in the development of precision and bias data, contact the staff manager of ASTM Committee D20 at ASTM Headquarters.

SUMMARY OF CHANGES

This section identifies the location of selected changes to this test method. For the convenience of the user, Committee D20 has highlighted those changes that may impact the use of this test method. This section may also include descriptions of the changes or reasons for the changes, or both.

D 1042–01:

(*1*) Notes 2 and 3 were added. Note 3 replaced wording formerly in 5.1.