This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D1042 – 26

Standard Test Method for Linear Dimensional Changes of Plastics Caused by Exposure to Heat and Moisture[1]

This standard is issued under the fixed designation D1042; 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 the dimensional changes of plastic specimens such as shrinkage or expansion, developed under specific heat and water conditionings.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This standard and ISO 2796 address the same subject matter but differ in technical content.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D883 Terminology Relating to Plastics

D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens

E456 Terminology Relating to Quality and Statistics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E2935 Practice for Evaluating Equivalence of Two Testing Processes

2.2 *ISO Standards:*[3]

ISO 2796 Cellular plastics, rigid—Test for dimensional stability

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms that appear in this practice relating to plastics, refer to Terminology D883.

3.1.2 For definitions of terms that appear in this practice relating to quality and statistics (such as precision and bias), refer to Terminology E456.

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 Sections 7 and 8.

5. Apparatus

5.1 *Scriber,* so constructed that two sharp needle points are rigidly separated by 100 ± 0.2 mm. The scriber, as shown in Fig. 1, consists of two sharp steel needles, approximately 1.5 mm in diameter. The needles are to be inserted in drilled holes with their axes parallel to each other and perpendicular to and intersecting the long axis of a stainless steel rigid rod or bar stock, 125 ± 5 mm in length. The needles' points shall extend 6 ± 2 mm beyond the supporting rod and are held in position by setscrews inserted through the ends of the rod. The scriber shall be calibrated by scribing an arc onto an unconditioned sample and measuring this initial scribed distance with a calibrated caliper to the nearest 0.1 mm. Thickness of arc lines shall not exceed 0.02 mm.

NOTE 2—Phonograph needles have been used as a satisfactory scriber.

5.2 *Measuring Microscope,* having a magnification of at least 20× and graduated to have a resolution of 0.01 mm.

NOTE 3—For more precise measurements, a micrometer microscope is preferred.

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

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 1180 Avenue of the Americas, 10th Floor, New York, NY 10036, http://www.ansi.org.

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

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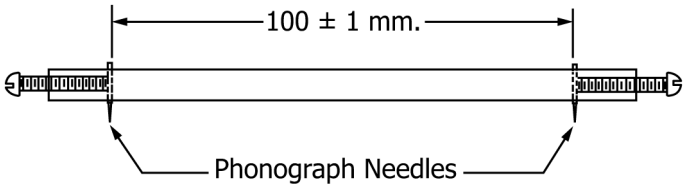


FIG. 1 Scriber

5.3 *Caliper, 6-in.,* with a readability of 0.01 mm and an illuminated desk magnifier, 1.75× to 2.0× to assist with the placement of the caliper points onto the scribed lines

5.4 *Beaker,* having a suitable size for the number of specimens to be evaluated and is constructed of a material that is stable under the test conditions.

5.5 *Room or Conditioning Chamber,* capable of being maintained at 23 ± 2°C and 50 ± 10 % RH.

5.6 *Conditioning Oven,* full draft air-circulating oven, capable of being maintained within ±2°C of the set temperature.

5.7 *Absorbent Material,* cloth or paper suitable for drying.

6. Test Specimens

6.1 Specimens shall not be less than 110 mm in length in the direction of test. The preferred specimen size is 125 ± 5 mm in length by 13 ± 0.5 mm wide by 3.0 (-0.0 + 0.2) mm thick. Refer to Test Method D5947 for guidance on measuring physical dimensions of solid plastic specimens.

6.2 Three specimens shall be tested for each conditioning.

6.3 Individual specimens shall be positioned vertically in the specified environment.

NOTE 4—A wire hook inserted in a hole drilled in one end of the specimen has been found acceptable.

7. Conditioning and Exposure

7.1 *Preconditioning*

7.1.1 Unless otherwise specified in the appropriate material specification, precondition specimens at 23 ± 2°C and 50 ± 10 % relative humidity for a minimum of 40 h prior to initial scribing.

NOTE 5—If moisture equilibrium is required prior to preconditioning, refer to the specific material specifications.

7.1.2 After removal from the pre-conditioning environment, specimens shall be tested within 30 min.

7.2 *Method A—Water Immersion Conditioning*

7.2.1 Specimens shall be immersed in water maintained at 23 ± 2°C for 168 ± 1 h.

7.2.2 The specimens shall be wiped dry with the absorbent cloth after removal from the water and tested within 3 min.

7.3 *Method B—Oven Conditioning*

7.3.1 Specimens shall be conditioned in an oven at 70 ± 2°C for 25 ± 1 h.

7.3.2 After removal from the oven, the specimens shall be tested within 3 min.

7.4 Other conditionings for specific service conditions can be used if agreed upon by all parties.

7.5 Conduct tests in a standard laboratory atmosphere of 23 ± 2°C and 50 ± 10 % relative humidity.

8. Procedure

8.1 Immediately following the preconditioning, 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 that 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 lightly scratch the surface with the needle so that a sharp, clear arc is defined.

NOTE 6—A contrasting colored, permanent type marker on the surface of the specimen, in the area of the scribe has been found useful to aid in defining a sharp, clear arc.

8.2 After conditioning, reinsert one needle in the original center and draw a short arc with the other. Measure the distance (D_B) between the original arc and the new arc with either a caliper or 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 Measurement

9.1 Measure the distance between arcs to the nearest 0.01 mm.

9.2 Determine the amount of linear expansion or shrinkage by the following:

$$L_C = D_B \ / \ D_I \times 100 \quad (1)$$

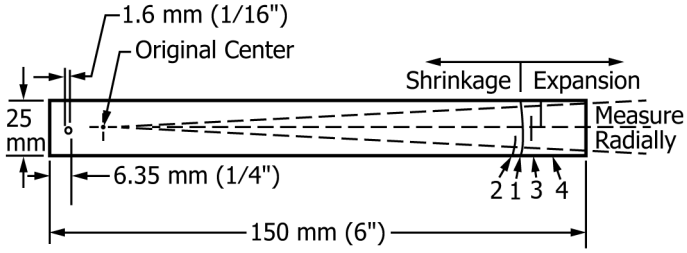
where:

L_C = percent of linear change,
D_B = distance between the scribed arcs, that is, expansion or shrinkage, and
D_I = initial scribed distance (100 mm).

10. Report

10.1 The test report shall include the following information:

10.1.1 A reference to this standard;



1—Original arc
2—After 23 °C (73.4°F)
3—After immersion in water at –23 °C (–9.4°F)
4—After 70 °C (158°F)

FIG. 2 Scribing a Test Specimen for Measurement (Example)

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