



Designation: D 756 – 93

Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions¹

This standard is issued under the fixed designation D 756; 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 to replace Method 6011 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 practice covers the determination of the weight and shape changes occurring in plastics under various conditions of use, not where exposure to direct sunlight, weathering, corrosive atmospheres, or heat alone is involved, but where changes in atmospheric temperature and humidity are encountered. This embraces the interior of buildings, and the interior of transport facilities such as motor vehicles, airplane cargo spaces or wing interiors, holds of ships, and railroad cars. Procedures are provided for exposing plastics to combinations of extreme humidity and temperature that will accelerate the changes taking place in the materials kept in sheltered spaces but subject to humidity and temperature variation (see Explanatory Note).

1.2 Seven test procedures are provided which prescribe conditions for different types of exposure. Six of the procedures cover exposures at graduated levels of temperature and extremes of humidity; the seventh prescribes conditions involving alternate exposure to high and low temperatures. Insofar as weight and shape changes, embraced under the general term of dimensional stability, are concerned, these procedures provide a method of test. Further use of any of the conditions set up in the procedures is suggested, such as conditioning schedules prior to physical testing of the plastic either to test it at the particular condition involved, or to study changes resulting from exposure to that condition.

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

1.4 *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.

¹ This practice is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D 20.50 on Permanence Properties.

Current edition approved Feb. 15, 1993. Published April 1993. Originally published as D 756 – 44 T. Last previous edition D 756 – 78 (1983) ^{ϵ 1}.

2. Referenced Documents

2.1 ASTM Standards:

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²

D 883 Terminology Relating to Plastics²

3. Terminology

3.1 *Definitions*—Definitions of terms applying to this practice appear in Terminology D 883.

4. Significance and Use

4.1 The test conditions covered in this practice represent a start towards organizing a group of test procedures for determining the effects of specified changes of atmospheric temperature and humidity upon plastic articles. These procedures have been used for testing both thermosetting and thermoplastic materials.

NOTE 2—The test procedures covered in this practice have been drawn from various tests used in branches of the plastics industry, and by government agencies in procurement of materials.

4.2 While several of the testing temperatures are not used in other ASTM standards, they have a background of several years experience in portions of the plastics industry. Especially in Procedures D and E (Sections 13 and 14) the accelerating effect of temperature in prompting changes caused by a rise in humidity leads to temperatures that are well above those encountered in normal service, and they are used simply to accelerate change.

4.3 Procedure A (Section 10) has been found to develop warping, weight change, and exudation² in plastic parts. Procedure B (Section 11) is designed to reveal poorly cured plastics by developing cracks in them. Procedures C and D are more severe measures of the same tendencies developed in Procedure A; the conditions of Procedure D will produce noticeable chemical decomposition in many plastics. Procedure E (Section 14) is especially valuable in testing the behavior of plastic parts with metallic inserts and laminates, for cracking on

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

exposure to temperature change. Procedures F and G are modifications of Procedure A, applying to impact-resistant and low heat-distortion temperature types of thermoplastics, respectively.

5. Apparatus

5.1 *Balance*—A balance capable of weighing accurately to 0.05 % a test specimen weighing 100 g or less, and to 0.1 % a test specimen weighing over 100 g.

5.2 *Oven*—A circulating-air oven capable of maintaining the required temperature of test within $\pm 1^\circ\text{C}$ (1.8°F).

5.3 *Containers*—Noncorroding containers with a shelf to support the test specimen above the solution used for maintaining the required humidity. The container shall be tightly sealed except for a small capillary which permits release of vapor pressure that might otherwise lift the top off the container. Each test specimen shall be tested preferably in a separate container.

5.4 *Desiccator*—A clean, dry, uncharged desiccator or equivalent closed container in which to bring test specimens to room temperature.

5.5 *Absorbent Cloth*—Clean, nonlinting absorbent cloth for use in wiping exudation or condensed moisture from test specimens.

5.6 *Micrometer*—A micrometer capable of measuring dimensions of test specimens to 0.025 mm (0.001 in.).

5.7 *Cold Box*—A cold box capable of maintaining the required temperature of test within $\pm 3^\circ\text{C}$ (5.4°F).

6. Test Specimens

6.1 The general term plastics is used to describe the samples tested, since it is the intent of this practice to provide testing procedures that apply with equal validity to finished articles comprising plastics components together with other materials, to plastics parts, to plastics articles, to test specimens molded from plastics, and, if shape and nature of the material permit, to sheets, rods, tubes, or other plastic shapes furnished in a finally processed form. The shape, size, and process of forming greatly influence the behavior of plastic objects; hence a standard size test specimen is not prescribed in these procedures, but the type of test specimen to be used shall be specified by the purchaser. Each test shall be made in duplicate.

7. Conditioning

7.1 *Conditioning*—Condition the test specimens at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D 618, for those tests where conditioning is required. In cases of disagreement, the tolerances shall be 1°C (1.8°F) and $\pm 2\%$ relative humidity.

7.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity, unless otherwise specified in the test methods or in this practice. In cases of disagreement, the tolerances shall be 1°C (1.8°F) and $\pm 2\%$ relative humidity.

8. Measurements of Test Specimens

8.1 The following measurements shall be made on conditioned test specimens prior to testing, after reconditioning at

the end of a test procedure, and at any intermediate stage as prescribed in the test procedures:

8.1.1 *Weight*—The weight within 0.05 % if the specimen weighs 100 g or less, and within 0.1 % if the specimen exceeds 100 g in weight.

8.1.2 *Dimensions*—The thickness to 0.025 mm (0.001 in.), the plane dimension in the direction of injection or transfer to 0.025 mm, and the plane dimension across the direction of injection or transfer to 0.025 mm.

8.1.3 *Dimensions of Compression Molded Specimen*—The thickness to 0.025 mm (0.001 in.), and the perpendicular dimensions in the plane at right angles to the direction of molding to 0.025 mm.

8.2 Specimens shall be brought to room temperature in the uncharged desiccator, which will require 10 to 30 min. Then the specimen shall be weighed in less than 10 min after exposure to room conditions. The dimensions shall be measured immediately after weighing the specimen.

8.3 At the discretion of the purchaser, requirements for weights and measurements at intermediate stages given in the procedures may be omitted.

9. Visual Examination

9.1 Noticeable qualitative changes in surfaces, outline, and general appearance of the test specimen shall be recorded after each stage of the testing procedure. These changes include color, surface irregularities, odor, and splits, in accordance with Terminology D 883. Changes shall also be noted as they occur, especially those which alter the shape so that intended dimensions are no longer significant.

10. Procedure A

10.1 The test cycle for Procedure A shall be as follows:

24 h at 60°C (140°F) and 88 % relative humidity, followed by 24 h at 60°C in the oven.

10.2 Condition the specimen, weigh, and measure dimensions in accordance with Sections 7 and 8.

10.3 Expose the specimen for 24 h on the shelf of a container maintained at $60 \pm 1^\circ\text{C}$ ($140 \pm 1.8^\circ\text{F}$) in the oven, and containing a saturated solution of sodium sulfate to maintain a relative humidity of 85 to 89 %.

10.4 Remove the specimen from the container, place it in the uncharged desiccator, and bring to room temperature in accordance with 8.2.

10.5 Wipe the specimen with the absorbent cloth, and then weigh, measure dimensions, and examine visually in accordance with Sections 8 and 9.

10.6 Within 2 h after completion of the operation described in 10.3, expose the specimen for 24 h in the oven at $60 \pm 1^\circ\text{C}$ ($140 \pm 1.8^\circ\text{F}$).

10.7 Place the specimen in the uncharged desiccator, and bring to room temperature in accordance with 8.2.

10.8 Weigh the specimen, measure dimensions, and examine visually in accordance with Sections 8 and 9.

10.9 Recondition the specimen, weigh, and measure dimensions in accordance with Sections 7 and 8.

10.10 The specimen may be subjected to physical tests in accordance with Section 17.