



Standard Test Method for Water Absorption of Plastics¹

This standard is issued under the fixed designation D 570; 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 covers the determination of the relative rate of absorption of water by plastics when immersed. This test method is intended to apply to the testing of all types of plastics, including cast, hot-molded, and cold-molded resinous products, and both homogeneous and laminated plastics in rod and tube form and in sheets 0.13 mm (0.005 in.) or greater in thickness.

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

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 and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—ISO 62 is technically equivalent to this test method.

2. Referenced Documents

2.1 ASTM Standards:

D 647 Practice for Design of Molds for Test Specimens of Plastic Molding Materials²

2.2 ISO Standard:

ISO 62 Plastics—Determination of Water Absorption³

3. Significance and Use

3.1 This test method for rate of water absorption has two chief functions: first, as a guide to the proportion of water absorbed by a material and consequently, in those cases where the relationships between moisture and electrical or mechanical properties, dimensions, or appearance have been determined, as a guide to the effects of exposure to water or humid conditions on such properties; and second, as a control test on the uniformity of a product. This second function is particularly applicable to sheet, rod, and tube arms when the test is made on the finished product.

3.2 Comparison of water absorption values of various plastics can be made on the basis of values obtained in accordance with 7.1 and 7.4.

3.3 Ideal diffusion of liquids⁴ into polymers is a function of the square root of immersion time. Time to saturation is strongly dependent on specimen thickness. For example, Table 1 shows the time to approximate time saturation for various thickness of nylon-6.

3.4 The moisture content of a plastic is very intimately related to such properties as electrical insulation resistance, dielectric losses, mechanical strength, appearance, and dimensions. The effect upon these properties of change in moisture content due to water absorption depends largely on the type of exposure (by immersion in water or by exposure to high humidity), shape of the part, and inherent properties of the plastic. With nonhomogeneous materials, such as laminated forms, the rate of water absorption may be widely different through each edge and surface. Even for otherwise homogeneous materials, it may be slightly greater through cut edges than through molded surfaces. Consequently, attempts to correlate water absorption with the surface area must generally be limited to closely related materials and to similarly shaped specimens: For materials of widely varying density, relation between water-absorption values on a volume as well as a weight basis may need to be considered.

4. Apparatus

4.1 *Balance*—An analytical balance capable of reading 0.0001 g.

4.2 *Oven*, capable of maintaining uniform temperatures of $50 \pm 3^\circ\text{C}$ ($122 \pm 5.4^\circ\text{F}$) and of 105 to 110°C (221 to 230°F).

5. Test Specimen

5.1 The test specimen for molded plastics shall be in the form of a disk 50.8 mm (2 in.) in diameter and 3.2 mm ($\frac{1}{8}$ in.) in thickness (see Note 2). Permissible variations in thickness are ± 0.18 mm (± 0.007 in.) for hot-molded and ± 0.30 mm (± 0.012 in.) for cold-molded or cast materials.

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² Discontinued 1994; replaced by D 1896, D 3419, D 3641, D 4703, and D 5227. See 1994 *Annual Book of ASTM Standards*, Vol 08.01.

³ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁴ Additional information regarding diffusion of liquids in polymers can be found in the following references: (1) *Diffusion, Mass Transfer in Fluid Systems*, E. L. Cussler, Cambridge University Press, 1985, ISBN 0-521-29846-6, (2) *Diffusion in Polymers*, J. Crank and G. S. Park, Academic Press, 1968, and (3) "Permeation, Diffusion, and Sorption of Gases and Vapors," R. M. Felder and G. S. Huvar, in *Methods of Experimental Physics*, Vol 16C, 1980, Academic Press.