ASTM D 570 Standard Test Method for Water Absorption of Plastics- Testing Equipment

Description

Apparatus

4.1 Balance—An analytical balance capable of reading 0.0001 g.
4.2 Oven, capable of maintaining uniform temperatures of 50 ± 3°C [122 ± 5.4°F] and of 105 to 110°C [221 to 230°F].

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 [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.

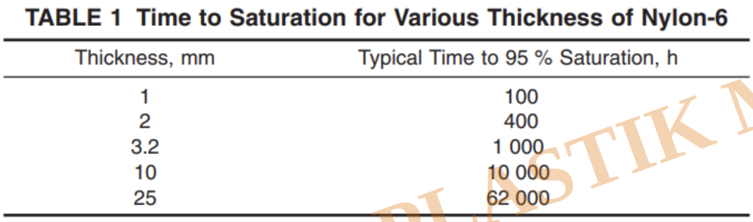

TABLE 1 Time to Saturation for Various Thickness of Nylon-6

Thickness, mm	Typical Time to 95 % Saturation, h
1	100
2	400
3.2	1 000
10	10 000
25	62 000

5.2 ISO Standard Specimen—The test specimen for homogeneous plastics shall be 60 by 60 by 1 mm. Tolerance for the
60-mm dimension is ±2 mm and ±0.05 mm for the 1-mm
thickness. This test method and ISO 62 are technically equivalent when the test specimen described in 5.2 is used.

5.3 The test specimen for sheets shall be in the form of a bar 76.2 mm [3 in.] long by 25.4 mm [1 in.] wide by the thickness of the material. When comparison of absorption values with molded plastics is desired, specimens 3.2-mm [1?8-in.] thick should be used. Permissible variations in thickness shall be 0.20 mm [±0.008 in.] except for materials which have greater standard commercial tolerances.

5.4 The test specimen for rods shall be 25.4-mm [1-in.] long for rods 25.4 mm in diameter or under and 12.7-mm [1?2-in.] long for larger-diameter rods. The diameter of the specimen shall be the diameter of the finished rod.
5.5 The test specimen for tubes less than 76 mm [3 in.] in inside diameter shall be the full section of the tube and 25.4-mm [1-in.] long. For tubes 76 mm [3 in.] or more in inside diameter, a rectangular specimen shall be cut 76 mm in length in the circumferential direction of the tube and 25.4 mm in width lengthwise of the tube.

5.6 The test specimens for sheets, rods, and tubes shall be machined, sawed, or sheared from the sample so as to have smooth edges free from cracks. The cut edges shall be made smooth by finishing with No. 0 or finer sandpaper or emery cloth. Sawing, machining, and sandpapering operations shall be slow enough so that the material is not heated appreciably.

5.7 The dimensions listed in the following table for the various specimens shall be measured to the nearest 0.025 mm [0.001 in.]. Dimensions not listed shall be measured within 0.8 mm [±1?32 in.].

Type of Specimen	Dimensions to Be Measured to the Nearest 0.025 mm [0.001 in.]
Molded disk	thickness
Sheet	thickness
Rod	length and diameter
Tube	inside and outside diameter, and wall thickness

Conditioning

6.1 Three specimens shall be conditioned as follows:
6.1.1 Specimens of materials whose water-absorption value would be appreciably affected by temperatures in the neigh borhood of 110°C [230°F], shall be dried in an oven for 24 h
at 50 ± 3°C [122 ± 5.4°F], cooled in a desiccator, and immediately weighed to the nearest 0.001 g.

6.1.2 Specimens of materials, such as phenolic laminated plastics and other products whose water-absorption value has been shown not to be appreciably affected by temperatures up to 110°C [230°F], shall be dried in an oven for 1 h at 105 to 110°C [221 to 230°F].
6.1.3 When data for comparison with absorption values for other plastics are desired, the specimens shall be dried in an oven for 24 h at 50 ± 3°C [122 ± 5.4°F], cooled in a desiccator, and immediately weighed to the nearest 0.001 g.

Procedure

7.1 Twenty-Four Hour Immersion—The conditioned specimens shall be placed in a container of distilled water maintained at a temperature of 23 ± 1°C [73.4 ± 1.8°F], and shall rest on edge and be entirely immersed. At the end of 24, +1?2 , ?0 h, the specimens shall be removed from the water one at a time, all surface water wiped off with a dry cloth, and weighed to the nearest 0.001 g immediately. If the specimen is 1?16 in. or less in thickness, it shall be put in a weighing bottle immediately after wiping and weighed in the bottle.
7.2 Two-Hour Immersion—For all thicknesses of materials having a relatively high rate of absorption, and for thin specimens of other materials which may show a significant weight increase in 2 h, the specimens shall be tested as described in 7.1 except that the time of immersion shall be reduced to 120 ± 4 min.
7.3 Repeated Immersion—A specimen may be weighed to the nearest 0.001 g after 2-h immersion, replaced in the water, and weighed again after 24 h.
NOTE 5—In using this test method the amount of water absorbed in 24 h may be less than it would have been had the immersion not been interrupted.
7.4 Long-Term Immersion—To determine the total water absorbed when substantially saturated, the conditioned specimens shall be tested as described in 7.1 except that at the end of 24 h they shall be removed from the water, wiped free of surface moisture with a dry cloth, weighed to the nearest 0.001 g immediately, and then replaced in the water. The weighings shall be repeated at the end of the first week and every two weeks thereafter until the increase in weight per two-week period, as shown by three consecutive weighings, averages less than 1 % of the total increase in weight or 5 mg, whichever is greater; the specimen shall then be considered substantially saturated. The difference between the

substantially saturated weight and the dry weight shall be considered as the water absorbed when substantially saturated.

7.5 Two-Hour Boiling Water Immersion—The conditioned specimens shall be placed in a container of boiling distilled water, and shall be supported on edge and be entirely immersed. At the end of 120 ± 4 min, the specimens shall be removed from the water and cooled in distilled water maintained at room temperature. After 15 ± 1 min, the specimens shall be removed from the water, one at a time, all surface water removed with a dry cloth, and the specimens weighed to the nearest 0.001 g immediately. If the specimen is 1?16 in. or less in thickness, it shall be weighed in a weighing bottle.
7.6 One-Half-Hour Boiling Water Immersion—For all thicknesses of materials having a relatively high rate of absorption and for thin specimens of other materials which may show a significant weight increase in 1?2 h, the specimens shall be tested as described in 7.5, except that the time of immersion shall be reduced to 30 6 1 min.
7.7 Immersion at 50°C—The conditioned specimens shall be tested as described in 7.5, except that the time and temperature of immersion shall be 48 ± 1 h and 50 ± 1°C [122.0 ± 1.8°F], respectively, and cooling in water before weighing shall be omitted.
7.8 When data for comparison with absorption values for other plastics are desired, the 24-h immersion procedure described in 7.1 and the equilibrium value determined in 7.4 shall be used.

Reconditioning
8.1 When materials are known or suspected to contain any appreciable amount of water-soluble ingredients, the specimens, after immersion, shall be weighed, and then reconditioned for the same time and temperature as used in the original drying period. They shall then be cooled in a desiccator and immediately reweighed. If the reconditioned weight is lower than the conditioned weight, the difference shall be considered as water-soluble matter lost during the immersion test. For such materials, the water-absorption value shall be taken as the sum of the increase in weight on immersion and of the weight of the water-soluble matter.

Calculation and Report
9.1 The report shall include the values for each specimen and the average for the three specimens as follows:
9.1.1 Dimensions of the specimens before test, measured in accordance with 5.6, and reported to the nearest 0.025 mm[0.001 in.],
9.1.2 Conditioning time and temperature,

$$\text{Increase in weight, \%} = \frac{\text{wet weight} - \text{conditioned weight}}{\text{conditioned weight}} \times 100$$

9.1.6 Percentage of soluble matter lost during immersion, if determined, calculated to the nearest 0.01 % as follows (see Note 6):

9.1.3 Immersion procedure used,
9.1.4 Time of immersion (long-term immersion procedure only),
9.1.5 Percentage increase in weight during immersion, calculated to the nearest 0.01 % as follows:

$$\text{Soluble matter lost, } \% = \frac{\text{conditioned weight} - \text{reconditioned weight}}{\text{conditioned weight}} \times 100$$

NOTE 6—When the weight on reconditioning the specimen after immersion in water exceeds the conditioned weight prior to immersion, report “none” under 9.1.6.

9.1.7 For long-term immersion procedure only, prepare a graph of the increase in weight as a function of the square root of each immersion time. The initial slope of this graph is proportional to the diffusion constant of water in the plastic. The plateau region with little or no change in weight as a function of the square root of immersion time represents the saturation water content of the plastic.

NOTE 7—Deviation from the initial slope and plateau model indicates that simple diffusion may be a poor model for determining water content. In such cases, additional studies are suggested to determine a better model for water absorption.

9.1.8 The percentage of water absorbed, which is the sum of the values in 9.1.5 and 9.1.6, and

9.1.9 Any observations as to warping, cracking, or change in appearance of the specimens

Hot Air Oven 55 Lit

- Up to 250C
- Forced air circulation
- 55lit internal capacity
- Inside chamber SS304
- Digital temp control 0.1C
- Digital timer included
- Inside dimension 47*38*51 Cm
- Insulated walls

Precise Balance 0.1 mg

- Resolution 0.1 mg
- 200 gr capacity
- Digital
- With sample cabin

Category

1. Equipment for Standards
2. Standards