AMERICAN NATIONAL STANDARDS L14.60-1964, L14.87-1964, L14.61-1964, L14.74-1964, L14.78-1964
L14.59-1964, L14.111-1964
AMERICAN NATIONAL STANDARDS INSTITUTE
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS
METHODS 22-1967, 70B-1967, 70A-1964T, 21-1967, 35-1967, 42-1967, and 18-1967

Standard Methods of Test for

WATER RESISTANCE OF TEXTILE FABRICS[1]

ASTM Designation: D 583 – 63

This Standard of the American Society for Testing and Materials is issued under the fixed designation D 583; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Most of these methods have been approved jointly by the American Association of Textile Chemists and Colorists and the American Society for Testing and Materials.

[The committee responsible for this standard has voted its withdrawal. In the absence of substantial reasons that it should be continued, the Society will approve its withdrawal from publication in November, 1971.]

Scope

1. (*a*) These methods cover procedures for determining the resistance of textile fabrics to external (surface) wetting, internal wetting (absorption), and penetration by water (Note 1).

NOTE 1.—Designations of equivalent methods issued by the American Association of Textile Chemists and Colorists and of those methods approved as USA Standard by the USA Standards Institute are noted after the title in each method.

(*b*) These methods are applicable to all fabrics, both treated and untreated, regardless of fiber composition.

(*c*) The procedures appear in the following order:

Definitions

2. (*a*) *Water Resistance (Fabric).*—A general term denoting the ability of a

[1] Under the standardization procedure of the Society, these methods are under the jurisdiction of the ASTM Committee D-13 on Textile Materials, and are the direct responsibility of Subcommittee B-1 on Chemical and Performance Test Methods. A list of committee members may be found in the ASTM Year Book.

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fabric to resist wetting and penetration of water.

(*b*) *Water Repellency (Textile).*—The ability of a textile fiber, yarn, or fabric to resist wetting.

(*c*) *Fabric, Treated.*—A fabric to which a water-resistant or water-repellent finish has been applied.

(*d*) For definitions of other terms used in these methods, refer to Definitions of Terms Relating to Textile Materials (ASTM Designation: D 123).[2]

Reagent and Material

3. (*a*) *Water*, maintained at 27 ± 1 C (80 ± 2 F). Distilled water is required for the spray, dynamic absorption, static absorption, and impact penetration tests, but tap water free from residual surface active agents may be used in the rain, drop penetration, and hydrostatic pressure tests.

(*b*) *Blotting Paper, "White AATCC Textile Blotting Paper,"*[3] conforming to the following specifications:

Property	Requirement	Method
Thickness...	0.026 to 0.030 in.	FS: UU-P-31b, Method 173[4]
Bursting strength...	45 points (minimum)	FS: UU-P-31b, Method 112[4]
Absorption...	50 ± 10 mm (each direction)	ASTM Method D 202[5]
Weight.....	230 ± 5 lb, 500 sheets 24 by 36 in.	FS: UU-P-31b Method 110[4]

Conditioning

4. Bring all test specimens and the blotters that are to be weighed from the prevailing atmosphere to moisture equilibrium for testing in the standard atmosphere for testing in accordance with the Method of Conditioning Textiles and Textile Products for Testing (ASTM Designation: D 1776).[2] It is not necessary to test the specimens in the standard atmosphere provided the test is started immediately on removal of the specimen from the standard atmosphere.

Precision

5. The specific precision of the following tests is not known, but experience through the years has indicated that the numbers of specimens called for give satisfactory results.

RESISTANCE TO EXTERNAL (SURFACE) WETTING: SPRAY TEST

(AATCC Method 22-1967)
(Approved as American National Standard L14.60-1964)

Summary of Method

6. Water is sprayed against the taut surface of the test specimen under controlled conditions and produces a wetted pattern indicative of the relative repellency or resistance to external wetting of the fabric. The fabric is rated by comparing its wetted pattern with pictures on the standard rating chart.

Uses and Significance

7. (*a*) This method provides a qualitative measure of the resistance to wetting of the textile surface, regardless of its construction. The method is especially suitable for measuring the water repellency of finishes applied to fabrics, particularly plain-woven fabrics. The portability and simplicity of the instrument, and the shortness and simplicity of the test procedure make this method of test especially suitable for control of mill production.

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[2] Appears in this publication.

[3] Blotting paper conforming to these specifications may be purchased from Standard Paper Mfg. Co., Richmond, Va., by specifying "White AATCC Textile Blotting Paper."

[4] Available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

[5] *Annual Book of ASTM Standards*, Parts 15 and 29.

(*b*) The method is not intended for use in predicting the probable rain penetration resistance of fabrics, since it does not measure penetration of water through the fabric.

FIG. 1.—Spray Tester.[6]

Apparatus

8. (*a*) *Spray Tester* (Figs. 1, 2, and 3),[6] consisting of a standard spray nozzle (19 holes, drill No. 65, 0.035 in. in diameter) connected by means of ⅜-in. rubber or other flexible tubing to the funnel tube of a 6-in. laboratory funnel; and a laboratory ring support which holds the funnel directly over the center of a 6-in. diameter metal embroidery hoop mounted on a block of wood so that the plane of a specimen held on the hoop makes an angle of 45 deg with the horizontal. The distance from the nozzle to the center of the hoop-mounted specimen must be 6.0 in.

(*b*) *Rating Chart* (Fig. 4).[6]

Preparation of Specimens

9. Cut at least three test specimens approximately 7 by 7 in., representative of the fabric being tested.

Procedure

10. (*a*) Fasten the conditioned (Section 4) test specimen securely in the metal hoop so that the face of the fabric is up and presents a smooth wrinkle-free surface. Place the hoop on the stand of the tester so that the fabric is uppermost in such a position that the center of the spray pattern coincides with the center of the hoop. In the case of twills, gabardines, piques or fabrics of similar ribbed construction, place the hoop on the stand in such a way that the ribs are diagonal to the flow of water running off the fabric specimen.

(*b*) Pour 250 ml of water (Section 3(*a*)) into the funnel of the tester and permit it to spray on the fabric, which will take approximately 25 to 30 sec. Upon completion of the spraying period, grasp the hoop at one edge and tap the other edge smartly against a solid object, with the fabric facing the object during tapping. Then rotate the hoop 180 deg, grasp it at the edge opposite the one first held and tap smartly at the point previously held.

Evaluation of Results

11. After tapping, compare the spotted or wetted pattern on the fabric face

[6] A kit containing one standard spray nozzle, one metal hoop, and two rating charts is available from the American Association of Textile Chemists and Colorists, P. O. Box 12215, Research Triangle Park, N. C., 27709.

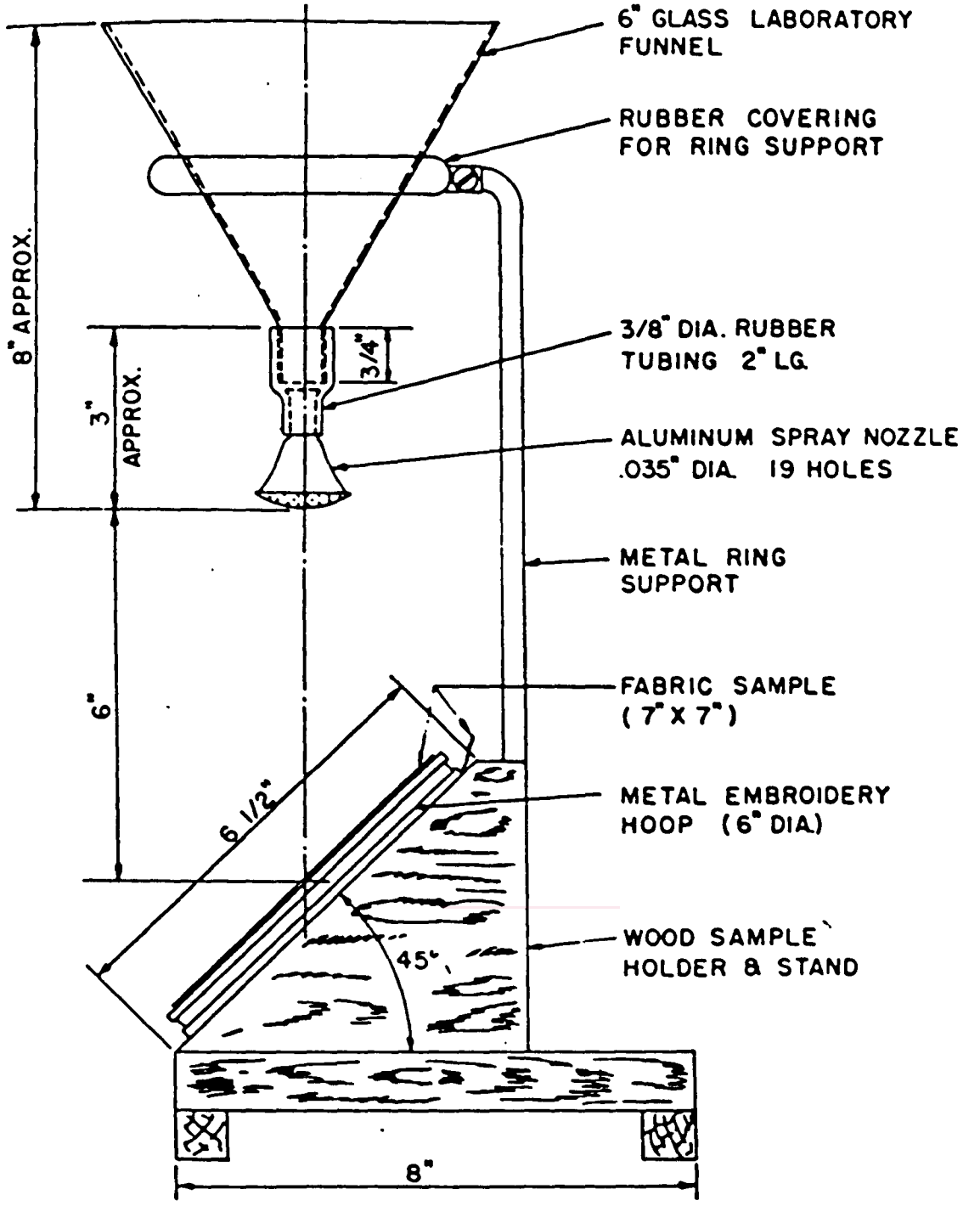

FIG. 2.—Spray Tester Construction Details.[6]

with the pictures in the rating chart, Fig. 4. Observe the wetting of the upper and lower surfaces but disregard passage of water through porous fabrics due to open construction. Assign the fabric a rating corresponding to the nearest standard rating. Do not attempt to assign intermediate ratings. Calculate

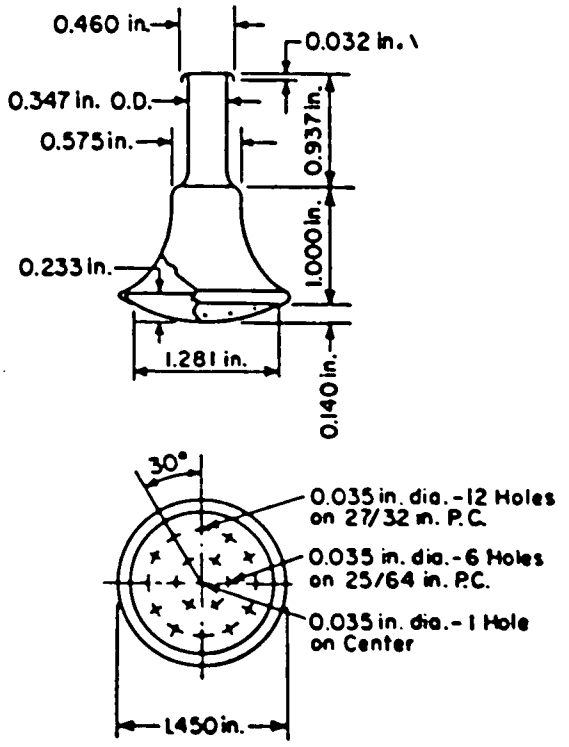

FIG. 3.—Details of Spray Nozzle.[6]

the average spray rating for all specimens tested.

Report

12. Report the spray rating to the nearest standard rating for each specimen tested as well as the average for all specimens tested.

RESISTANCE TO INTERNAL WETTING

Summary of Methods

13. Preweighed specimens are tumbled (dynamic absorption tests) or immersed (static absorption test) under prescribed conditions. The specimens are then reweighed after the excess water has been removed from them. The percentage increase in weight is taken as a measure of the absorption or resistance to internal wetting.

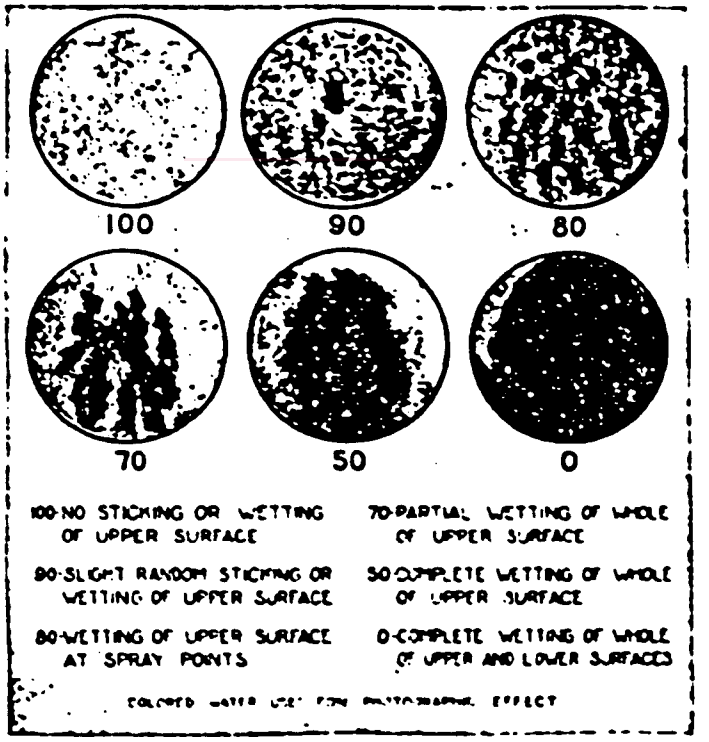

FIG. 4.—Spray Test Rating Chart.[6]

Dynamic Absorption Test, Tumble-Jar Method

(AATCC Method 70B-1967)
(Approved as American National Standard L14.87-1964)

Uses and Significance

14. This method is used to measure the resistance of fabrics to sorption of and wetting by water, and is the referee method for the dynamic absorption test. The tumble-jar method is particularly suitable for measuring the water repellency of finishes applied to fabrics, since it subjects the treated fabrics to dynamic conditions, such as flexing and rubbing,

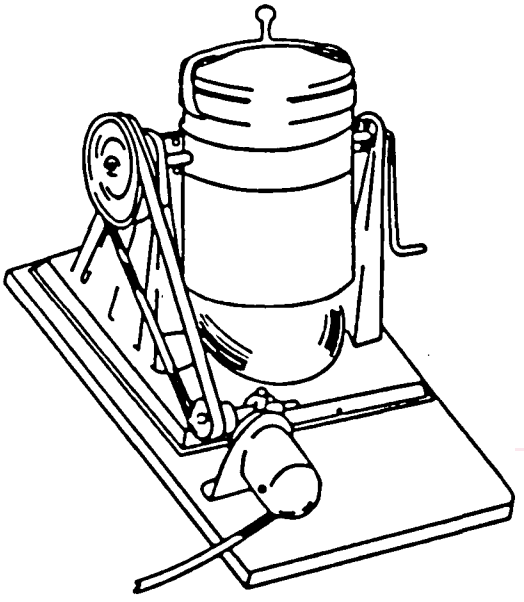

FIG. 5.—Dynamic Absorption Tester (Tumble-Jar Method).[7]

which are similar to those often encountered during actual use. The results obtained depend primarily on the water resistance of the fibers and yarns in the fabric and not upon the construction of the fabric. The method is not suitable for predicting probable rain penetration resistance since it measures penetration of water into, but not through the fabric.

[7] The tumble-jar tester can be made by any firm or organization possessing a machine shop equipped for routine construction and repair work.

Apparatus and Materials

15. (*a*) *Dynamic Absorption Tester (Tumble-Jar)*,[7] consisting of a motor-driven, 6-liter, cylindrical- or hexagonal-shaped jar, approximately 6 in. in diameter and 12 in. in length, mounted so as to rotate end over end at 55 ± 2 rpm with a constant tangential velocity, as shown in Fig. 5. The jar may be of glass, corrosion-resistant metal, or chemical stoneware. It must be free from all extraneous chemical matter, particularly soaps, detergents, and wetting agents.

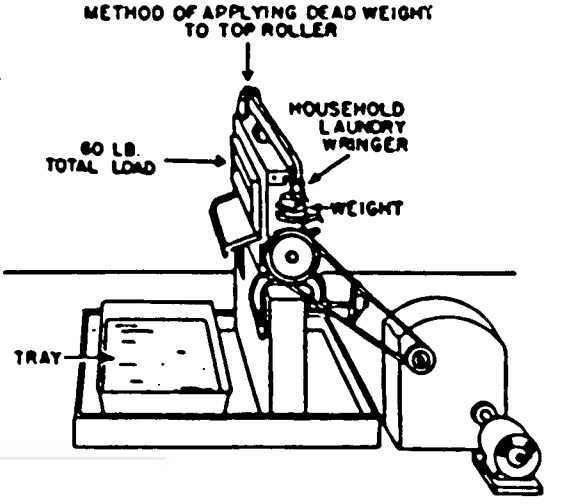

FIG. 6.—Wringer for Dynamic and Static Absorption Tests.[8]

(*b*) *Wringer*[8] (Fig. 6), power-driven, household laundry type, equipped with soft rubber squeeze rolls, 2 to 2½ in. in diameter and 11 to 12 in. in length, with a hardness of 70 to 80 when measured using the *A* scale of a Shore Durometer. The wringer shall be so constructed that the pressure on the top of the piece of fabric is maintained by a dead weight or lever system such that the total pressure (resulting from the total of the dead weight or lever system and the weight of the roller) is 60 ± 1 lb. It

[8] The Atlas motorized laboratory wringer, manufactured by Atlas Electric Devices Co., Chicago, Ill., has been found satisfactory for this purpose.

must be power-driven so that the piece of fabric passes through the rolls at the rate of 1 in. per sec (see the Appendix for calibration and verification techniques).

(*c*) *Blotting Paper* (Section 3(*b*)), cut 10 by 10 in.

(*d*) *Laboratory Balance*, sensitive to 0.1 g.

(*e*) *Weighing Containers*, tared, weighing not more than twice the total weight of the five pieces (Note 2).

NOTE 2.—Containers made of heavy-gauge plastic hermetically sealed on three sides are suitable. In use, the opened end of this plastic container should be folded on itself at least three times to make a closure, and the closure secured with a suitable spring clip or paper clip.

Preparation of Specimens

16. For a single specimen, cut five test pieces 8 by 8 in. on a 45-deg bias. Remove the loose corner yarns and spread a drop of liquid latex or rubber cement on the yarns at each corner to prevent subsequent fraying. Prepare two specimens of five pieces each, using suitable marks to differentiate the two sets (Note 3).

NOTE 3.—Should it be necessary to run only one specimen, a specimen of similar material with respect to weight should be run as ballast with the specimen undergoing test. The cloth in the jar during any run should be the equivalent of two specimens (ten pieces).

Procedure

17. (*a*) Place 2 liters of water (Section 3(*a*)) in the tumble jar. Roll together a set of five conditioned (Section 4) test pieces (constituting a single specimen) and weigh to the nearest 0.1 g. Repeat with a second set of five pieces from the same sample suitably differentiated from the first set. Place both sets in the tumble jar, one piece at a time, crumpling each one before dropping it into the jar. Start the rotation of the jar and a timer. At the end of 20 min, remove the pieces of one set (first specimen), one at a time, pass each piece through the wringer once without blotters, with the edge of the piece parallel to the rolls of the wringer; then immediately pass it through the wringer between two unused blotters. After running each piece through the wringer first without and then with blotters, leave it between the blotters until the five pieces from one set have been through the wringer. Then remove the blotters, roll the set of five pieces together again, and weigh in a tared closed container to the nearest 0.1 g.

(*b*) Repeat the squeezing, blotting, and weighing operations described in Paragraph (*a*) for the second set of five pieces (second specimen).

Calculation of Results

18. (*a*) Calculate the amount of water absorbed, as a percentage of the weight of the original specimen, as follows:

$$\text{Water absorbed, per cent} = \frac{A - B}{B} \times 100$$

where:

A = weight of specimen after test, and
B = weight of original conditioned specimen.

(*b*) Calculate the average per cent increase in weight for all the specimens tested.

Report

19. Report the average per cent of water absorbed by the two specimens to the nearest 1.0 per cent as the dynamic absorption of the fabric, tumble-jar method.

Dynamic Absorption Test, Launder-Ometer Method

(AATCC Method 70A-1964 T)
(Approved as American National Standard L14.111-1964

Uses and Significance

20. This method is the same in prin-

ciple as the dynamic absorption test, tumble-jar method (Sections 14–19). The results secured with the Launder-Ometer are similar but not equal in absolute value to those of the tumble-jar test. The Launder-Ometer method uses less test fabric, smaller blotters, and less distilled water.

Apparatus and Materials

21. (*a*) *Launder-Ometer*,[9] or equivalent machine, operating at 42 ± 1 rpm with provision for mounting metal specimen containers (Paragraph (*b*)) horizontally at right angles to the shaft. Provision must be made for maintaining the initial temperature of the jars throughout the test.

(*b*) *Standard Stainless-Steel Specimen Containers*,[9] 3½ in. in diameter by 8 in. long.

(*c*) *Stainless Steel Balls*,[9] ½ in. in diameter.

(*d*) *Wringer*,[8,9] motor-driven, household laundry type as described in Section 15(*b*).

(*e*) *Laboratory Balance*, sensitive to 0.1 g.

(*f*) *Blotting Paper* (Section 3(*b*)), cut 4 by 4 in.

(*g*) *Weighing Containers*, tared, as described in Section 15(*e*).

Preparation of Specimens

22. For a single specimen, cut ten test pieces 3 by 3 in. on a 45-deg bias. Remove the loose corner yarns and spread a drop of liquid latex or rubber cement on the yarns at each corner to prevent subsequent fraying. Prepare two specimens of ten pieces each, using suitable marks to differentiate the two sets.

[9] Equipment and materials meeting these specifications manufactured by Atlas Electric Devices Co., Chicago Ill., have been found satisfactory for this purpose.

Procedure

23. (*a*) Prepare two standard stainless steel containers, each with 300 ml of water (Section 3(*a*)) and 200 steel balls. Roll together a conditioned (Section 4) specimen (ten pieces) and weigh to the nearest 0.1 g. Repeat with the second specimen of ten pieces. Place each set into a separate stainless steel container, one piece at a time, crumpling each one before dropping it into the container.

(*b*) Mount the containers in the Launder-Ometer and operate for 20 min. Then quickly remove the pieces of one specimen, one at a time, pass each piece through the wringer once without blotters, with one edge of the piece parallel to the rolls of the wringer; then immediately pass it through the wringer between two unused blotters. After running each piece through the wringer first without and then with blotters, leave it between the blotters until the ten pieces from one set have been passed through the wringer. Then roll the set of pieces together again and weigh in a tared closed container to the nearest 0.1 g.

(*c*) Repeat the squeezing, blotting, and weighing operations described in Paragraph (*b*) for the second set of ten pieces (second specimen).

Calculation of Results

24. (*a*) Calculate the amount of water absorbed, as a percentage of the weight of the original specimen, as follows:

$$\text{Water absorbed, per cent} = \frac{A - B}{B} \times 100$$

where:

A = weight of specimen after test, and
B = weight of original conditioned specimen.

(*b*) Calculate the average per cent increase in weight for all the specimens tested.

Report

25. Report the average per cent of water absorbed by the two specimens to the nearest 1 per cent as the dynamic absorption of the fabric (Launder-Ometer method).

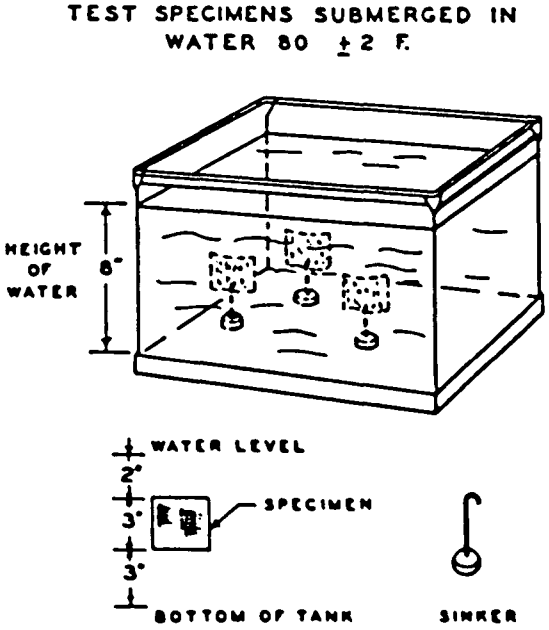

FIG. 7.—Immersion Tank and Sinkers for Static Absorption Test.

Static (Immersion) Absorption Test

(AATCC Method 21-1967)
(Approved as American National Standard L14.61-1960)

Uses and Significance

26. This method is used to measure the resistance of fabrics to sorption of and wetting by water. It is especially suitable for measuring the water repellency of finishes applied to fabrics, especially wool fabrics and napped fabrics of various fibers which are sometimes difficult to rate by means of the standard spray test. The test conditions simulate those sometimes encountered in use when fabrics are immersed in water under static conditions. The results obtained depend primarily on the water resistance of the fibers and yarns in the fabric and not upon the construction of the fabric. The method is not suitable for predicting probable rain penetration resistance since it measures penetration of water into, but not through the fabric. It requires less test fabric than the spray or dynamic absorption tests.

Apparatus and Materials

27. (*a*) *Immersion Tank*, Fig. 7, of sufficient depth to provide an average hydrostatic head of 3.5 in. acting on the immersed specimen during test.

(*b*) *Sinkers*, Fig. 7, consisting of rigid inverted *J*-shaped metal hooks, or equivalent, fastened to weights (100 to 150 g) sufficiently heavy to sink to the bottom of the tank when the sinker is attached to the specimen.

(*c*) *Wringer*,[8] motor-driven, household laundry type as described in Section 15(*b*).

(*d*) *Laboratory Balance*, sensitive to 5 mg.

(*e*) *Blotting Paper* (Section 3(*b*)), cut 7 by 7 in.

(*f*) *Weighing Containers, tared*, as described in Section 15(*e*).

Preparation of Specimens

28. Cut a minimum of three test specimens 3.0 by 3.0 in.

Procedure

29. (*a*) Weigh each of the conditioned test specimens to the nearest 5 mg. Attach it to a sinker and place in the immersion tank containing distilled water (Section 3(*a*)), the depth of which was adjusted so that the test specimen is immersed under an average hydrostatic head of 3.5 in. (Fig. 7).

(*b*) After 20 min, remove the specimen from the water and detach it from the sinker. Quickly place it between two 7 by 7 in. pieces of unused blotting paper to form a sandwich and squeeze once through the wringer at a surface speed

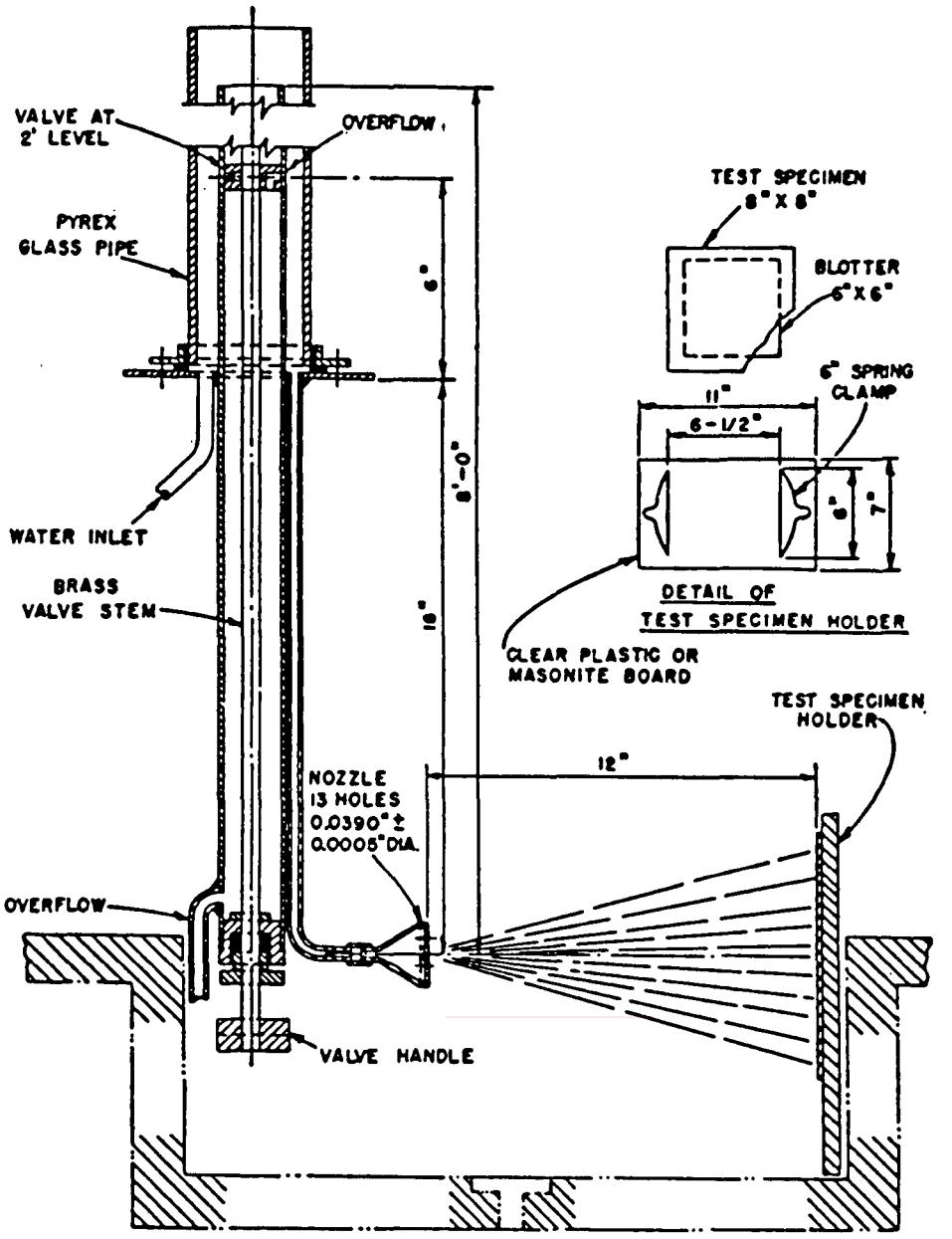

FIG. 8.—Rain Tester.[10]

of 1.0 in. per sec. If the specimen is napped or is 100 per cent wool (napped or unnapped), squeeze it once through the wringer without blotters and then once with blotters.

(*c*) As soon as possible after squeezing, remove the blotters and reweigh the specimen in a tared closed container to the nearest 5 mg.

Calculation of Results

30. (*a*) Calculate the amount of water absorbed, as a percentage of the weight of the original specimen as follows:

$$\text{Water absorbed, per cent} = \frac{A - B}{B} \times 100$$