Designation: D 824 – 94 (Reapproved 2002)

An American National Standard

Standard Test Method for Rate of Absorption of Water by Bibulous Papers[1]

This standard is issued under the fixed designation D 824; 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 rate at which an unsized and absorbent paper will absorb water by measuring the time required for the paper to absorb completely a specified quantity of water **(1-4)**.[2]

1.2 This test method is not intended for sized papers or those having an absorption time of over 120 s. Such papers should be tested in accordance with Test Method D 779 or ISO 535.

1.3 For ink absorption of blotting paper, see Test Method D 2177.

1.4 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product[3]

D 685 Practice for Conditioning Paper and Paper Products for Testing[3]

D 779 Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry-Indicator Method[3]

D 1193 Specification for Reagent Water[4]

D 2177 Test Method for Ink Absorption of Blotting Paper[3]

E 122 Practice for Calculating Sample Size to Estimate, with a Specified Tolerable Error, the Average for a Characteristic of a Lot or Process[5]

2.2 *Other Standard:*

ISO 535 Paper and Board—Water Absorption (Cobb Test)[6]

3. Summary of Test Method

3.1 A measured drop of water is placed on the paper and the time to disappearance of the shine from the wet area is determined.

4. Significance and Use

4.1 The rate of water absorption is an extremely important property of most sanitary products such as paper toweling and tissues.

5. Apparatus

5.1 *Drop-Measuring Device*, for Delivery of 1-mL and 0.1-mL drops, with 1-mL capacity or more, for example, measuring pipet **(5)**, buret, or hypodermic syringe graduated in divisions of 0.01 mL.

5.2 *Drop-Measuring Device*, for Delivery of 0.01-mL drops, for example, microburet **(6)**, or syringe-style pipet, graduated in divisions of 0.001 mL.

5.3 *Specimen Support*—A nonabsorbent horizontal square surface, approximately 100 mm on a side and having at its center a hole approximately 40 mm in diameter.

NOTE 1—For a multi-ply specimen it may be necessary to modify the supporting surface by bending up two opposite edges to form a cylindrical trench. The curvature of the cylinder should be such that, when the specimen is held in place in the trench (for example, with weights near the ends), water applied to the top ply will cause it to expand downward and push against the underlying plies, wetting them as in normal use of the material.

5.4 *Timer*—Stopwatch or electric timer readable to 0.2 s or better.

5.5 *Light Source*, to reflect from the surface of unabsorbed water on the specimen, and situated far enough away so that its heat will not influence the absorption time; for example, a 1.5-V flashlight bulb, shaded from the eyes, placed about 200 mm above the end and to the rear of the support, and operated by a D-cell battery or bell transformer.

6. Test Liquid

6.1 *Reagent Water*, of Type II or better as defined in Specification D 1193.

[1] This test method is under the jurisdiction of ASTM Committee D06 on Paper and Paper Products and is the direct responsibility of Subcommittee D06.92 on Test Methods.

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This test method is related to TAPPI T 432 om-82, with which it is technically identical.

[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

[3] *Annual Book of ASTM Standards*, Vol 15.09.

[4] *Annual Book of ASTM Standards*, Vol 11.01.

[5] *Annual Book of ASTM Standards*, Vol 14.02.

[6] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

7. Sampling

7.1 Sample the paper in accordance with Practice D 585.

7.2 Where sampling is for other than acceptance testing, Practice E 122 may be used as an alternative.

8. Test Specimens

8.1 From each test unit of the sample select, so as to be representative of the unit, 10 test specimens, each approximately 100 by 100 mm. When the material to be tested is to be used as a multi-ply unit (as, for example, a triple-ply embossed napkin), cut and test multi-ply specimens; otherwise, cut single-ply specimens.

9. Conditioning

9.1 Condition and test the specimens in the atmospheric conditions in accordance with Practice D 685.

10. Procedure

10.1 In the following procedure, use test volumes of water, as follows:

Class	Volume, mL
Blotting	1.0
Toweling	0.1
Tissues and napkins	0.01

10.2 Place a test specimen on the horizontal support (modified as in Note 1 in 5.3 when necessary), centering the paper over the 40-mm hole. Make sure that there is a clear space of at least 10 mm beneath the center area of the paper. Do not stretch or in any way distort the test specimen, as this may change the results of the test. Fill the appropriate measuring apparatus with distilled or deionized water at 23 ± 2°C.

10.2.1 For the 1.0-mL drop, hold the measuring device at an angle of 30 or 45° to the horizontal with its tip nearly in contact with the central portion of the paper. Then in 6 s or less, allow the specified amount of water to flow onto the specimen, keeping the tip of the apparatus in the drop until delivery is completed.

10.2.2 For the 0.1 or 0.01-mL drop, wipe the tip of the applicator with a trace of water-repellent grease. Hold the tip vertical, express a volume of 0.1 or 0.01 mL, and apply the drop directly to the specimen.

10.3 Start the timer as soon as the water contacts the specimen and measure the time for the drop to be completely absorbed to the nearest 0.2 s or better, as indicated by no further visual specular reflection of light (or the moment of disappearance of the glossy or shiny area from the wet spot).

10.4 Conduct the test where neither heat from the light nor a strong current of air might influence the test.

10.5 Repeat the procedure on the other nine specimens, making five tests on each side of the paper.

10.6 Papers having an absorption time greater than 120 s cannot be tested by this test method.

11. Report

11.1 Report the average absorption time in seconds, to the nearest second if over 10 s, or to the nearest 0.1 s if less than 10 s. Report each side separately if there is a significant difference.

11.2 Also report the maximum and minimum absorption times.

11.3 Report if the modified support (Note 1 in 5.3) is used.

12. Precision and Bias

12.1 *Precision*:

12.1.1 It is impracticable to give extensive information regarding the precision of the procedure in this test method, as the precision is highly dependent upon the manufacturing process (whether the paper is wet-creped or dry-creped and the degree of creping) the type fiber used in the product (chemical or mechanical fiber, or both), type of chemical treatment following the pulping process, if any, and the design of the tissue product itself (single-ply, double-ply, or triple-ply, and whether embossed or printed).

12.1.2 Repeatability studies on samples of various paper towels gave absorbency values from 2 to 88 s when tested by the procedure in this test method.

12.1.3 Repeatability studies on samples of various tissues gave absorbency values from 5 to 23 s when tested by the procedure in this test method.

12.1.4 The repeatability standard deviation and the 95 % repeatability limits for rate of absorption of water by bibulous papers for the samples tested in 12.1.2 and 12.1.3, both calculated as the percentage coefficient of variation (the standard deviation and the 95 % repeatability limit, respectively, divided by the mean value and multiplied by 100) ranged from 3 to 11 % and from 10 to 30 %, respectively.

12.1.5 The repeatability standard deviation and the 95 % repeatability limits for rate of absorption of water by blotting paper based on 100 tests on the same sample having a mean value of 41 s were 1.9 and 5.3 s respectively. The respective coefficients of variation, calculated as described in 12.1.4 are 5 and 14 %, respectively.

12.1.6 *Reproducibility*—For the reasons stated in 12.1.1, and the wide range of materials for which reproducibility studies might be undertaken, reproducibility studies for this test method are impracticable. Reproducibility studies should be done if data on the specific materials of interest is required.

12.2 *Bias*—This test method has no bias because the value for rate of absorption of water by bibulous papers specified in this test method is defined only in terms of the specific procedure required.

REFERENCES

(**1**) Reed, E. O., "Determining the Absorbency of Paper," *Paper*, Vol 21, No. 19, Jan. 16, 1918, p. 14.
(**2**) Carson, F. T., and Worthington, F. V., "New Types of Equipment for Testing Paper," *Paper Trade Journal*, Vol 95, No. 16, Oct. 20, 1932, p. 59.
(**3**) Carson, F. T., "Testing Paper for Permeability to Liquid," *Paper Trade Journal*, Vol 80, No. 10, March 5, 1925, p. 59.
(**4**) Scribner, B. W., "Standards for Paper Towels," *Circular No. 407*, National Institute of Standards and Technology, 1935.
(**5**) Reese, S. W., and Voutz, M. A., "A Water Absorbency Tester Using 0.1 cc of Water," *Paper Trade Journal*, Vol 100, No. 7, Feb. 14, 1935, p. 33.
(**6**) Carson, F. T., "A Microburette for Testing the Absorptiveness of Thin Paper," *Journal of Research*, National Institute of Standards and Technology, Vol 18, No. 1, January 1937, p. 41 (*RP* 959).