Designation: D 2482 – 97 (Reapproved 2002)

An American National Standard

Standard Test Method for Surface Strength of Paper (Wax Pick Method)[1]

This standard is issued under the fixed designation D 2482; 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 uncoated and coated papers. It is designed to measure the surface strength of paper or its resistance to picking. It is not applicable to loosely felted papers such as blotters or roofing felts, nor to some coated papers containing thermoplastic resins in the coating adhesive.

1.2 This test method is technically similar to TAPPI T 459.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Products[2]

D 685 Practice for Conditioning Paper and Paper Products for Testing[2]

D 1968 Terminology Relating to Paper and Paper Products[2]

2.2 *TAPPI Documents:*

T 459 Surface Strength of Paper (Wax Pick Test)[3]

Collaborative Reference Program for Paper[3]

3. Terminology

3.1 *Definitions*—Definitions shall be in accordance with Terminology D 1968 and the *Dictionary of Paper.*[3]

4. Summary of Test Method

4.1 In this test method, calibrated sealing waxes with increasing adhesive power are pulled from the surface of the specimens. The highest number of the wax in the series that does not disturb the surface of the paper is the numerical rating of the pick.

5. Significance and Use

5.1 Many printing and converting operations require the surfaces of the paper to have sufficient transverse strength to give satisfactory results. Since no absolute values are obtained with this test method, test results should be correlated with actual performance of the material during the subsequent coating, converting, printing, or packaging operation.[4]

5.2 For coated paper, where a significant portion of the casein or starch coating adhesive has been replaced with a thermoplastic resin, there is very little, if any, correlation between printing press performance and wax test results. The molten wax forms a stronger bond with the coating containing thermoplastic resin and the resulting pick causes the paper to appear weak, when in fact it is not.

5.2.1 For those sheets containing latex and similar substances, a more direct method employing the actual medium to be applied is recommended.

6. Apparatus

6.1 *Heating Device*, such as a bunsen burner, alcohol lamp, propane torch, or electric heat element.

6.2 *Wooden Block*, approximately 90 by 40 by 10 mm (3½ by 1½ by ⅜ in.) having a 30-mm (1¼-in.) diameter hole with an edge approximately 3 mm (⅛ in.) from one end.

6.3 *Work Surface*, smooth, hard, and a poor conductor of heat, such as wood. (Glass, metal, or artificially cooled surfaces are unsuitable.)

7. Materials

7.1 *Waxes*—A series of hard-resin, non-oily waxes numbered respectively from 2A to 26A. Each wax is made up in accordance with a specific formula and molded in stick form with a cross-sectional area of 18 by 18 mm (11⁄16 by 11⁄16 in.). Each higher numbered wax in the series is more adhesive than the previous one.

8. Sampling and Test Specimens

8.1 Select a number of specimens, usually 10, each 100 by 100 mm (4 by 4 in.) or larger, from each test unit of a sample

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

[3] Available from the Technical Association of the Pulp and Paper Industry, P.O. Box 105113, Atlanta, GA 30348.

[4] Kirkpatrick, W. A., "The Use of Waxes and Case Testing Ink In Testing Printing Papers," *Paper Trade Journal*. PTJOA, Vol 109, No. 12, pp 36–38; *Technical Association Papers*, Vol 22, pp 322–324.

of paper obtained in accordance with Practice D 585, so that five replicate critical waxes may be determined for each tested surface (wire and felt).

9. Calibration

9.1 The sealing wax sticks used in this method are calibrated by the manufacturer against retained wax sticks and paper standards. Not only does each wax stick equal the corresponding standard stick but will effectively distinguish the surface strength when compared with adjacent wax numbered sticks. The tester can calibrate any series of wax sticks by noting whether the surface is progressively more ruptured with ascending wax stick numbers and by checking new boxes of waxes against retained wax sticks or paper standards, or both.

10. Procedure

10.1 Precondition, condition, and test the specimens in an atmosphere in accordance with Practice D 685.

10.2 Place a test specimen on the work surface. Select a wax stick estimated to have less adhesiveness than will disturb the surface of the specimen. Clean the end with a sharp blade or if necessary by melting off any paper or coating residue.

10.3 Heat the end in a low flame, or by electrical heat element, rotating the stick slowly between the thumb and finger until several drops of melted wax have fallen, but do not let the stick catch fire. The entire surface should be molten wax.

10.4 Quickly place the melted end of the wax stick on the surface of the paper specimen with firm, but not undue, pressure so that the end spreads out to an approximate 20-mm diameter, and withdraw the fingers immediately, allowing the wax stick to stand vertically on the paper.

10.5 Allow the wax to cool for at least 15 min and not more than 30 min. Place the wooden block with the hole over the vertical stick of wax so that the stick protrudes through the hole; firmly press the block down with one hand to prevent the paper from wrinkling or tearing, and with the other, pull the wax from the sheet with a quick jerk at right angles to the paper surface.

10.6 Examine both the tip of the wax and the paper specimen under normal reading illumination and with no magnification. There must be a definite indication of fibers or coating disturbed to be called a pick or surface rupture.

10.7 If the surface is not ruptured, repeat the test, using the same specimen with waxes of ascending numerical order until the surface of the paper specimen blisters, breaks, picks, or lifts. Test a minimum of five specimens on their wire side and five other specimens on their top side, or if not identifiable as such, five each from the two different sides of the paper.

10.8 Record the highest numerical designation of the wax that does not disturb the surface of the paper and average the results on each side to the nearest wax number.

11. Report

11.1 Report the following information:

11.1.1 Average highest numerical designation of the wax that does not disturb the surface of the paper as the Critical Wax Strength Number (CWSN),

11.1.2 Number of tests made on each side as well as the range of highest numerical designation of the wax for the specimens on each side of the paper, and

11.1.3 With coated papers, state whether the picking of lifting occurred on the coating or on the bodystock, or both. If desired, also include the degree of surface disturbance with waxes more adhesive than for the critical strength. For example, a paper may have a CWSN of 14A, a blister at 16A, a partial fiber pick at 18A, and complete rupture at 20A.

12. Precision and Bias

12.1 *Precision*:

12.1.1 *Repeatability*—0.56. This is 4.0 % of an average pick of 14.

12.1.2 *Comparability*—Not known.

12.1.3 *Reproducibility*—2.85.

12.1.4 These estimates of precision were obtained in the TAPPI Collaborative Reference Program for Paper, on eight types of paper, with pick values ranging from 6.6 to 18.1.

12.1.5 The user of this precision data is advised that it is based on actual mill testing or laboratory testing, or both. There is no knowledge of the exact degree to which personnel skills or equipment were optimized during its generation. The precision provides an estimate of typical variation in test results that may be encountered when this test method is routinely used by two or more parties.

12.2 *Bias*—Since there is no accepted reference material for determining bias for the procedure in this test method, bias has not been determined.

13. Keywords

13.1 printability; surface strength; wax pick