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Standard Test Method for Abrasion Resistance of Printed Materials by the Sutherland Rub Tester[1]

This standard is issued under the fixed designation D 5264; 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 a procedure for determining the abrasion resistance of printed materials using the Sutherland Rub Tester, or its equivalent, equipped with full-width rubber pads and using standardized receptors.

1.2 This test method is applicable to labels, folding cartons, corrugated boxes, inserts, circulars, and other packaging materials having applied graphics on a flat substrate.

1.3 *This standard does not purport to address all of the safety problems, 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 996 Terminology of Packaging and Distribution Environments[2]

D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing[2]

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality of a Lot or Process[3]

3. Terminology

3.1 General definitions for packaging and distribution are found in Terminology D 996.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *abrasion resistance*—ability of a printed surface to resist mechanical destruction.

3.2.2 *abrasiveness*—the degree to which another material can abrade the surface of the test specimen.

3.2.3 *receptor*—film or paper of a specified abrasiveness onto which coatings (for example, ink or protective coating) removed from the specimen are deposited during the abrasion test.

4. Summary of Test Method

4.1 The test specimen is mounted on top of the rubber pad on the Sutherland base and the receptor is cut to fit the 0.91 kg (2 lb) or the 1.81 kg (4 lb) weight (depending on which one is being used). The receptor is mounted to the weight. The test duration is determined by the number of strokes (a stroke is one back-and-forth cycle) the sample is rubbed. The number of strokes desired is preset on the Sutherland Timer. The weight is mounted on the Sutherland and the machine is turned on. The Sutherland will shut off automatically when the desired number of strokes is completed.

4.2 The test specimen is removed from the Sutherland base and examined for degree of print degradation. The receptor is analyzed for the amount of ink transferred from the specimen. Results are related to a reference standard tested in an identical fashion.

4.3 As an option, the amount of abrasion may be determined by a densitometer or a spectrophotometer to obtain a quantitative value.

5. Significance and Use

5.1 Abrasion resistance is a desirable and sometimes critical property of printed materials. Abrasion damage can occur during shipment, storage, handling, and end use. The result is a significant decrease in product appearance and legibility of product information. The amount of abrasion damage to a printed substrate is dependent on shipping conditions, possibly temperature and humidity, time, and many other variables. This test method provides a way of comparing abrasion resistance of printed materials under laboratory conditions.

5.2 This test method also can be used to evaluate the relative abrasion resistance of printed inks, coatings, laminates, and substrates.

5.3 This test method can be modified to measure the effects of the product (detergent powder, food, beverages, etc.) on abrasion resistance, as may occur in spillage or leakage in transit.

5.4 The intention of this practice is to provide a reasonably simple test method document that can be used by both buyer and seller of printed materials to determine if the product offered for sale meets some predetermined specification for abrasion or scuff resistance.

6. Apparatus

6.1 *Sutherland Rub Tester*,[4] or its equivalent. See Fig. 1 for a photograph of the Sutherland Tester and its attachments.

7. Materials

7.1 Standard receptors cut to fit the Sutherland Receptor Block 51 by 178 mm (2 by 7 in.). The receptor is then

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This test method is under the jurisdiction of ASTM D-10 on Packaging and is the direct responsibility of Subcommittee D10.18 on Labeling.

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

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

[4] Available from DANILEE COMPANY, P.O.BOX 30384, CORPUS CHRISTI, TX 78463-0384

creased, using the scoring block that comes with the Sutherland Rub Tester. If not available, the receptor can be cut to 51 mm by 102 mm (2 by 4 in.) and fastened with pressure-sensitive tape outside the test area. An appropriate receptor from the following list should be selected in accordance with paragraph 8.2:

7.1.1 *Unprinted Sheet of Substrate.*

7.1.2 *Printed Sheet Identical to Substrate* (face-to-face).

7.1.3 *C-1 Standard Receptor*[5] (least abrasive) with glossy coated paper suitable for use with samples having low abrasion resistance.

7.1.4 *A-1 Standard Receptor*[5,6] (intermediate abrasiveness) is made of Imperial Lapping Film™ with aluminum oxide 9 μm particles.

7.1.5 *A-6 Standard Receptor*[5,6] (most abrasive) is made of wet or dry, Tri-um-ite™ 600.

7.1.6 Pressure-sensitive tape or any tape suitable for holding the sample or receptor without interfering with the operation of the tester.

NOTE 1—Other receptors may be substituted provided they have equal abrasiveness on the same test specimens. Further research and experience may indicate the need for additional grades of standard receptors to simulate various surfaces. Additionally, it may be possible or desirable, or both, to mount other receptors with techniques other than those specified in 7.1.

8. Preparation of Apparatus

8.1 Set the Sutherland rub Tester on a sturdy bench, preferably in a room conditioned at 23 ± 1°C (73.4 ± 2°F) and 50 ± 2 % relative humidity, as described in Practice D 4332.

8.2 If test criteria have not been specified, select an appropriate receptor by running an agreed-upon reference material for the number of strokes required to achieve a visible level of degradation. If testing for failure, start with receptor C-1. If the test length exceeds 200 strokes, then use of a more abrasive receptor may be desirable.

NOTE 2—An excessively high number of strokes should be avoided because this condition can generate heat which may alter the results.

9. Specimen Preparation and Conditioning

9.1 The specimen should preferably be a flat sample with no scoring, ridges, or other surface irregularities. Further, in testing multiple samples, it is important that each has comparable, if not identical, ink coverage and ink density.

9.2 Cut the specimen 76 by 152 mm (3 by 6 in.) whenever possible. Smaller samples may be tested as long as they are mounted to a 76 by 152 mm (3 by 6 in.) template. (Smaller samples such as 20 mm (0.79 in.) round die-cut labels may not give the same results as a full size sheet (76 by 152 mm) (3 by 6 in.).

9.2.1 The machine direction of the sample should be parallel to the 76 mm (3 in.) width. The intent of this method is to rub across the machine direction.

9.2.2 Care should be taken to avoid contaminating the sample with fingerprints during handling.

9.3 Condition the specimen at 23 ± 1°C (73.4 ± 2°F) and 50 ± 2 % relative humidity, as described in Practice D 4332, unless otherwise agreed upon.

10. Procedure

10.1 Mount a 76 by 152 mm (3 by 6 in.) rubber pad[4] both on top of the Sutherland base as well as to the bottom face of the detectable receptor block.

NOTE 3—This pad will need periodic replacing as the rubber becomes brittle due to oxidation or if the rubber wears off the pad. This periodic replacing is also true of the pads that come with the Sutherland receptor block. Failure to replace worn pads could result in distorted test results. The pad face should be uniformly flat (level) with a Shore A durometer of 15 ± 5.

10.2 Mount the receptor to the rubber pad of the receptor block with pressure sensitive tape, outside the test area [only if using the 51 by 102 mm (2 by 4 in.) receptor].

10.3 Attach the test specimen to the rubber pad on the Sutherland base with the test surface face exposed.

NOTE 4—The choice of receptor block is based on the type of substrate being tested. The heavier block, 1.82 kg (4.0 lb), is appropriate for samples that experience severe shipping and handling conditions.

10.4 Attach the receptor to the receptor block. The 51 by 178 mm (2 by 5 in.) receptor is held in place by the clamps on the sides of the block, while the 51 by 102 mm (2 by 4 in.) receptor is held in place by the pressure-sensitive tape.

10.5 Lightly brush the sample and receptor with a camel's hair anti-static brush to remove any potentially abrasive particles from the surface.

10.6 Place the receptor block in the receptor block holder.

10.7 Preset the dial on the Sutherland Rub Tester to the desired number of strokes.

10.8 Turn the Sutherland on. It will automatically shut off when the preset number of strokes has been completed.

10.9 Repeat 10.1 through 10.8 with each test specimen.

10.10 Repeat 10.1 through 10.8 with the reference standard.

11. Evaluation

11.1 Examine each specimen for degree of degradation and each receptor for the amount of material transferred from the print, versus the reference standard (see 4.2).

11.2 Report test conditions and results for abrasion using predetermined criteria established by the interested parties.

12. Precision and Bias

12.1 Precision and bias have not been determined at this time but will be developed by the subcommittee.

13. Keywords

13.1 abrasion; bar codes; circulars; corrugated boxes; folding cartons; Gavarti; insets; labels; printed matter; printing inks; protective coatings; rub; Sutherland

FIG. 1 Sutherland Rub Tester and Attachments

- NOTES ON THE SUTHERLAND™ HEATED WEIGHT -

Before putting the weight into service, replace the natural rubber pads on the SUTHERLAND™ Rub Tester base with the silicone pad furnished. Peel the cloth cover from the adhesive and apply the pad directly to the clean base.

The lamp in the end of the heat shield functions with the contacts in the thermostat. "Templesticks" or a pyrometer may be used to occasionally check temperature control knob setting.

When using the weight, have trichlorethylene or similar fireproof solvent and toweling handy for removing foreign material from the heated shoe between tests.

SUGGESTED PROCEDURE FOR TESTING FOR "Hot Abresion" Resistance:

Test each sample at 200° F, 300° F, 400°F and with 10 and 20 rubs at each temperature.

Start the machine oscillating at once after placing the heated weight on the sample and remove the weight immediately after oscillation ceases.

The tested specimens may be rated for wear and smear using a scale of "none, very slight, moderate and severe".

Consideration must be given to the time interval between printing and testing, as well as to the cleanliness of the surface of the sample.

This procedure does not purport to address safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices.

Direct correspondence relating to the instrument to:

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WARRANTY AND REPAIR POLICY
DANILEE COMPANY 01/95

The SUTHERLAND® Ink Rub Tester has a two-year limited warranty.

Our warranty only covers failures due to defects in materials or workmanship which occur during normal use. It does not cover damage which occurs in shipment or failures which result from accident, misuse, abuse, neglect, mishandling, misapplication, alteration, modification, line power surge, introduction of sand, dust, and liquids, or service by anyone other than Danilee Company.

Due to recent events, applying to SUTHERLAND® Ink Rub Testers being shipped to Danilee Company for repairs, upgrades, or warranty work, we have found it necessary to inform our customers that Danilee Company will no longer receive any items other than those shipped by UPS insured. We are also strongly recommending the customer retain the original shipping container to return said units for future upgrades or warranty work.

Should you have any questions regarding the above, please contact Debra Foster, Danilee Company. 800-853-9614

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