



Standard Practice for Abrasion Resistance of Printed Materials by the Sutherland Rub Tester¹

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1. Scope

1.1 This practice 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 practice 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 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:²

- D 996 Terminology of Packaging and Distribution Environments
- D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing
- E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality of a Lot or Process

3. Terminology

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

3.2 Definitions 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 Practice

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 compared to an agreed upon standard sample tested in the identical fashion.

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 practice provides a way of comparing abrasion resistance of printed materials under laboratory conditions.

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

5.3 This practice 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.

¹ This practice is under the jurisdiction of ASTM D-10 on Packaging and is the direct responsibility of Subcommittee D10.14 on Tapes and Labels.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

5.4 This practice can provide a reasonably simple procedure that can be used by both the buyer and the seller of printed materials to determine if the product offered for sale meets some predetermined standard for abrasion or scuff resistance.

6. Apparatus

6.1 *Sutherland Rub Tester*,³ 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 creased, using the scoring block that comes with the Sutherland Rub Tester. If not available, the receptor can be cut to 51 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 8.2:

- 7.1.1 *Unprinted Sheet of Substrate*,
- 7.1.2 *Printed Sheet Identical to Substrate* (face-to-face),

³ Available from James River Corp., Mechanical Services Dept., 243 E. Paterson Street, Kalamazoo, MI 49007.



FIG. 1 Sutherland Rub Tester and Attachments

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

8. Preparation of Apparatus

8.1 Set the Sutherland Rub Tester on a sturdy bench, preferably in a room conditioned at $23 \pm 1^\circ\text{C}$ ($73.4 \pm 2^\circ\text{F}$) and $50 \pm 2\%$ 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.

NOTE 1—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 test 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 $23 \pm 1^\circ\text{C}$ ($73.4 \pm 2^\circ\text{F}$) and $50 \pm 2\%$ 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 pad³ both on top of the Sutherland base as well as to the bottom face of the detectable receptor block.

NOTE 2—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 3—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.

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

12. Keywords

12.1 abrasion; bar codes; inserts; labels; printed matter; printing; printing inks; rub; Sutherland

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