



Standard Test Method for Determining the Abrasion Resistance of Inks and Coatings on Membrane Switches Using the Norman Tool “RCA” Abrader^{1,2}

This standard is issued under the fixed designation F2357; 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 describes the procedure for subjecting inks or coatings on membrane switches to an abrasive medium at a specified force.

1.2 Within certain limitations, as described in this document, this test method is applicable for materials including, but not limited to: printed or coated polyester, polycarbonate, and silicone rubber. The samples can be either flat or contoured.

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*:³
F2112 [Terminology for Membrane Switches](#)

3. Terminology

3.1 Definitions:

3.1.1 *final breakthrough*—the number of cycles until complete removal of the first surface ink or coating being tested.

3.1.2 *membrane switch*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

¹ This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.18 on Membrane Switches.

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² The Norman Tool “RCA” Abrader is covered by a patent. Interested parties are invited to submit information regarding the identification of an alternative(s) to this patented item to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

³ 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.

3.1.3 *wear limit—in testing membrane switches*, the number of cycles until an underlying layer of different color may be seen through the first layer (not applicable for transparent coatings).

4. Significance and Use

4.1 Membrane Switch keys are subjected to repeated actuations, usually by a human finger. They are also subjected to other conditions (for example, wiping, cleaning, rubbing) during handling, end-use, shipment, or storage that may cause abrasion damage. The result may be a significant removal of the coatings, text or decorative inks.

4.2 This test method is applicable to a wide range of materials. The main criterion is that the abrasion process produces visible wear or breakthrough in the surface being tested.

4.3 The amount of abrasion damage to a surface is dependent on numerous variables. This test method provides a way of comparing relative abrasion resistance of inks and coatings. In no way do the results provide a correlation value of the number of human finger touches before coating failure. It only provides a means to compare results of tests performed using the same equipment, abrasive materials and loading conditions.

4.4 The test method can be used for quality control purposes, as a research and development tool, to evaluate material combinations for a given application, or for the comparison of materials with relatively similar properties.

5. Interferences

5.1 Inconsistent wear can occur which will compromise the results. Caution is necessary to ensure the mounting method does not deflect the specimen, which may influence the wear characteristics.

5.2 Contoured surfaces can be tested but results may be more difficult to duplicate and some equipment is not designed to test non-flat surfaces.

5.3 Whenever possible, a smooth surface is preferred. Extra care should be taken when evaluating a non-uniform surface (that is, rough surface), and for the user to recognize potential variations between specimens.

6. Apparatus

6.1 Machine capable of providing cyclic or continuous abrasion to a test specimen under controlled loading conditions.

6.2 *Suggested Sources:*

6.2.1 *Norman Tool RCA Abrader.*⁴

6.3 *Specimen Mounting Fixture or Holder*, a suitable device of sufficient strength and rigidity used to secure the specimen so that it is held rigidly and perpendicular to the load during testing.

6.4 *Abrasive Media*, commonly available from Norman Tool.

6.4.1 *0.6875 in. wide Paper*, most applications.

6.4.2 *0.25 in. wide Polyester Tape*, recommended for specimens with concave surfaces and fine graphic details.

7. Conditioning

7.1 *Abrasive Media and Specimen Conditioning*—Unless otherwise agreed upon between purchaser and seller, condition the specimens for at least 24 h at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 10\%$ relative humidity.

7.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ relative humidity.

8. Pre-Test Setup

8.1 Mount the test specimen on the mounting fixture. This holding device should firmly hold the test specimen in a fixed position, without distortion, in a perpendicular position relative to the force probe.

8.2 *Cleaning of Specimen*—Specimens shall be cleaned in such a way that the surface is free from grit, grease, fingerprints or other contaminates.

8.2.1 Use a clean lint-free piece of absorbent material and either reagent grades of *n*-heptane or isopropyl alcohol.

8.2.2 Lightly wipe the surface of the test area with a moistened piece of cleaning material.

8.2.3 Allow the surface to air dry completely (minimum two hours).

8.2.4 Inspect the test area to ensure no visual damage has been caused by the cleaning process.

8.3 Inspect for residue and quality of ink or coating in area of test.

8.4 Install specified abrasive material.

8.5 Adjust applied force to specified value.

9. Procedure

9.1 Align specimen targeted test point to the applied force probe.

9.2 Adjust force to be applied to 175 g (or otherwise specified).

9.3 Gently lower the abradant onto the specimen.

9.4 Start the abrasion process.

9.5 Subject the test specimen to abrasion for the specified number of cycles; or until sought after visual change has been detected. Wear Limit is determined when an underlying layer of different color may be seen through the first layer (not applicable for transparent coatings). In determining the extent of wear, periodically interrupt the instrument at intervals for examination of the test specimen. Final Breakthrough, not wear, on a first surface printed line constitutes a failure regardless of size.

NOTE 1—**Caution:** When the test is stopped prior to achieving final end point, it is recommended the specimen not be moved. Doing so may present problems in aligning the wear path for additional testing.

9.6 Periodically remove any loose abrading that remains on the test specimen, by light brushing or compressed air.

10. Report

10.1 Report the following information:

10.1.1 Model number and description of Abrasion Tester used,

10.1.2 Abrasive material,

10.1.3 Force applied to specimen,

10.1.4 Number of cycles to wear limit (not applicable for transparent coatings),

10.1.5 Number of cycles to final breakthrough,

10.1.6 Temperature and humidity,

10.1.7 Identity of specimen, describing the material or coating,

10.1.8 Method of cleaning, if applicable, and

10.1.9 Visual evaluation of test specimen and include photos of target test area, if possible.

11. Precision and Bias

11.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method F2357 for measuring abrasion resistance because inter-laboratory studies have proven inconclusive due to insufficient participating laboratories with the appropriate equipment.

11.2 *Bias*—No information can be presented on the bias of the procedure in Test Method F2357 for measuring abrasion resistance because no standard sample is available for this industry.

12. Keywords

12.1 abrasion; breakthrough; coatings; inks; membrane switch; Norman Tool; RCA; Taber; wear

⁴ Available from Norman Tool Co., 15415 Old State Road, Evansville, IN 47725.

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