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Standard Test Method for Abrasion Resistance of Printed Matter by the GA-CAT Comprehensive Abrasion Tester¹

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1. Scope*

1.1 This test method covers the procedure for determining the abrasion resistance of printed matter using a GA-CAT Comprehensive Abrasion Tester.

1.2 This test method is applicable to packaging labels, book, catalog, and magazine covers, bar codes, corrugated boxes, and other containers having applied graphics on any flat substrate. It is not recommended for powder coatings.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:*²

E171 [Specification for Atmospheres for Conditioning and Testing Flexible Barrier Materials](#)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *abrasion resistance, n*—resistance against the act of scraping, smudging, or rubbing off.

3.1.2 *abrasiveness, n*—the degree to which a product tends to cause abrasion by the act of rubbing or scraping.

3.1.3 *receptor, n*—film or paper of standard abrasiveness onto which material removed from the specimen is deposited during the abrasion testing process. Alternatively, printed paper from which material is removed onto the specimen that has a higher degree of abrasiveness than the receptor (in case of testing abrasiveness).—film or paper of standard abrasiveness onto which material removed from the specimen is deposited during the abrasion testing process.

4. Summary of Test Method

4.1 The test print and a receptor are sandwiched in the panel holder of the GA-CAT Comprehensive Abrasion Tester, clamped together with a known force, and made to slide over each other at a known frequency and over a known distance for a predetermined time period.

4.2 The test specimen is examined for degree of print degradation and the receptor for amount of ink or other material transferred from the specimen surface. Results may be rated relative to a comparative control run in the identical manner, or they may be quantified by comparison to a ranking scale numbered from zero to ten (zero being the most abrasion resistant and ten the least abrasion resistant):

4.2 The test specimen is examined for degree of print degradation and the receptor for amount of ink or other material transferred from the specimen surface.

5. Significance and Use

5.1 Abrasion resistance during transport and storage is essential to prevent marring of type matter, designs, or protective coatings on the exterior of labels and other printed materials. Recognizing that the actual amount of abrasion occurring in the field

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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.

*A Summary of Changes section appears at the end of this standard.

depends on relative humidity, temperature, tightness of packing, and a host of other variables, this test method provides a rapid means for comparing the abrasion resistance of test surfaces under laboratory conditions. It is useful for specification acceptance between the supplier and the customer.

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

6. Apparatus

6.1 *GA-CAT Comprehensive Abrasion Tester.*

~~6.2 Ranking Book,³ containing specimens whose degree of ruboff is ranked from 0 (no ruboff) to +10 (most ruboff).~~

7. Materials

7.1 *Standard Receptors*, approximately 102 by 114 mm (4 by 4½ in.), of an appropriate grade, as follows:

7.1.1 *C-1³ (least abrasive)*—Glossy coated paper suitable for use with samples of low abrasion resistance.

7.1.2 *A-1, A-3, and A-4 (intermediate abrasiveness)*—Imperial lapping film with aluminum oxide abrasive particles of different sizes (9, 12, and 30 µm, respectively):

7.1.3 *A-6 (most abrasive)*, wet or dry, tri-um-ite 600.

7.1.4 *B-2³ (intermediate abrasion resistance)*—Printed single color paper suitable for measuring abrasiveness of samples of average abrasiveness (corrugated).

~~NOTE 1—Other receptors may be substituted provided they have equal abrasiveness on the same test specimens. Further research and experience may indicate a need for additional grades of standard receptors. Receptors, can be an unprinted sheet of the same substrate or a printed sheet of the identical substrate for face-to-face testing cut to approximately 102 by 114 mm (4 by 4½ in.).~~

7.2 *Foam Sheeting*, 2 pieces, each approximately 2 mm in thickness and cut to 102 by 114 mm (4 by 4½ in.).

~~NOTE 2—Use 1—Use of foam sheeting as a backing for the test specimen and the receptor is recommended to provide uniform pressure over the test surfaces and to prevent ink, varnish, or other particles from becoming imbedded in the sensitive surface of the panel holders.~~

7.3 *Comparative Control*, a production or laboratory print preferably having known abrasion resistance. The comparative control must have the same substrate, color(s), and subject matter as the test print.

8. Test Specimen and Conditioning

8.1 The specimen size in the grain direction (or flute in the case of corrugated board) must not exceed 114 mm (4½ in.). The specimen size in the cross-grain direction is less critical; 102 mm (4 in.) is recommended. Care should be taken to avoid contaminating the test surface with fingerprints during specimen cutting and handling.

8.2 Condition the specimens at 23 ± 2°C (73.5 ± 3.6°F) and 50 ± 5 % relative humidity in accordance with Specification E171.

9. Preparation of Apparatus

9.1 Set the abrasion tester on a sturdy bench, preferably in a room conditioned at the temperature and relative humidity prescribed in 8.2. Make sure that the three-prong power cord is correctly connected.

9.2 Periodically, check the liquid level in the hydraulic pressure system. If not full, follow the instructions in the manufacturer's manual.

9.3 If test conditions have not been specified, select an appropriate receptor by running the reference standard for the length of time required to achieve a visible level of degradation. Start with ~~receptor C-1 (7.1.1)~~ receptor. If the test time exceeds 2 min, use a receptor with a higher level of abrasiveness.

~~NOTE 3—Excessively long rubbing times are to be avoided because they introduce uncontrollable heat development that can alter the results.~~

10. Procedure for Abrasion Testing

10.1 *Loading the Instrument:*

10.1.1 Move the tray containing the four panel holders to the front black support shelf. Make sure that the inscribed “L” appears on the upper left side of the left panel holder and the “R” in the upper right side of the right panel holder (see Fig. 1). There should be space of at least ½ in. between the two center panel holders.

10.1.2 Face the test specimen on the receptor (selected in 9.3) and sandwich between the foam sheets. Place the sandwich between the two center panel holders so that the grain direction of the specimen is vertical. Take care that the sandwich does not extend below the bottom of the panel holders.

10.1.3 Push the four panel holders together into an upright parallel position. Make sure that the sandwich is not pinched at the bottom of the panel holders; otherwise, it will tend to slide down during the test. Grab the pins and move the tray inside the instrument so that the two retaining pins drop into the carriage holes. If the pins do not drop into their respective holes, recenter the panel holders on the sample tray.

10.1.4 Apply side pressure by turning the lower black spindle until the corresponding dial reads 20 pounds per square inch (psi). Do not apply top pressure at this time.