Designation: D7189 – 12

Standard Test Method for Relative Mileage of News Ink on Newsprint[1]

This standard is issued under the fixed designation D7189; 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 the laboratory procedure for determining the relative mileage of news inks on newsprint. The test method utilizes a proofing press, analytical balance and a reflection densitometer.

1.2 This test method is intended for black oil-based news inks that dry by penetration (that is, letterpress or web offset) and for which a suitable reference standard is available. With appropriate optical instrumentation, it is also applicable to colored news inks.

1.3 This test method may also be used to determine the relative ink receptivity of test newsprints versus a reference standard.

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

1.5 *This test method 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 to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D528 Test Method for Machine Direction of Paper and Paperboard (Withdrawn 2010)[3]

D685 Practice for Conditioning Paper and Paper Products for Testing (Withdrawn 2010)[3]

D5039 Test Methods for Identification of Wire Side of Paper (Withdrawn 2009)[3]

D7305 Test Method for Reflection Density of Printed Matter

3. Terminology

3.1 *Definitions:*

3.1.1 *ink mileage, n*—weight per unit area of ink required to achieve a given reflection density, laboratory units are g/m^2.

3.1.2 *ink receptivity, n*—weight per unit area of ink required to achieve a target reflection density when comparing different newsprint stocks, units are g/m^2.

3.1.3 *news ink, n*—a pigmented paste composition that is applied to newsprint by printing machinery.

3.1.4 *newsprint, n*—paper substrate made from wood pulp used chiefly for printing newspapers.

3.1.5 *reflection density, n*—the light absorbing ability of a material, expressed as the logarithm of the reciprocal of the reflectance factor (that is, higher reflection density indicates more light is absorbed).

3.2 *Symbols:*

A = weight of inked plate after printing, g
B = weight of inked plate before printing, g
C = coverage (weight of ink) on the print, g
C_T = C required to achieve the target reflection density, g
D = reflection density
M = mileage of an ink, or ink receptivity of a paper, g/m^2
S = printed area on the paper specimen, cm^2

4. Summary of Test Method

4.1 Laboratory prints of the test news ink on the designated newsprint are made at various ink film weights giving reflection densities that span the target value.

4.2 The weight of ink on the print corresponding to the target density is determined graphically or by regression analysis. The resulting value for mileage, expressed as g/m^2, is compared to that obtained with the reference news ink tested in the identical fashion.

4.3 When the test method is used to compare different newsprint stocks with a reference newsprint, the relationship is called ink receptivity.

5. Significance and Use

5.1 Ink mileage on a production press is of economic importance of the user of printing inks, the lower the mileage figure, the less ink is required to produce a job. This test

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.56 on Printing Inks.

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

[3] The last approved version of this historical standard is referenced on www.astm.org.

method provides a procedure by which news inks can be assessed for mileage or newsprint stocks for ink receptivity in the laboratory.

5.2 Because of the many variables that exist among laboratory and production presses, this test method is apt to yield more meaningful information when results are expressed on a relative rather than an absolute basis.

6. Apparatus

6.1 *Laboratory Print Maker*—preferably a motor driven printability tester capable of setting print pressure and having a readily removable printing plate that can be accommodated on an analytical balance.

6.2 *Printing Plate*—typically a solid-faced disk composed of aluminum, rubber-covered aluminum, or rubber-covered nylon. Resulting prints are about 3.5 to 5 cm wide and 20 cm (1½ by 8 in.) long.

6.3 *Analytical Balance*—accurate to 0 .0001 g with minimum 160 g capacity to accommodate the typical disc in 6.2.

6.4 *Reflection Densitometer*—conforming to Test Method D7305.

NOTE 1—The filter systems in typical densitometers are suitable only for use with black, white, and the three process colors (yellow, magenta and cyan).

6.5 *Tongs or Rubber Gloves (without powder)*—for handling the printing plate.

6.6 *Ink Spatula*—small.

7. Materials

7.1 For measuring mileage of news inks.

7.1.1 *Reference news ink*—having a known mileage, to be used as the basis for rating the test news ink.

7.1.2 *Newsprint*—cut to appropriate size appropriate to the print maker and consistent for printing side (felt or wire) and cut in machine direction.

7.1.3 *Target reflection density specification.*

7.1.4 *Backing material*—for use while making reflection density measurements. Unprinted newsprint stock in sufficient thickness to guarantee 99 % opacity is the standard. Typically, six or more sheets are required to achieve the opacity requirement. Other backing materials such as a matte black may be used by agreement between supplier and customer but this must be clearly noted in the report.

7.1.5 *Clean-up materials*—such as mineral spirits and lint-free rags or tissues.

8. Hazards

8.1 **Warning**—Since solvents may be hazardous to the skin and eyes, wear rubber gloves and safety glasses during cleanup to avoid solvent contact with skin and eyes. See suppliers Material Safety Data Sheets for further information on each solvent used.

9. Test Specimen

9.1 Less than one gram of news ink is sufficient to make the required 4 to 6 prints for a mileage or ink receptivity test.

TABLE 1 Guidelines for Test Materials

Printability Tester	Size of newsprint cm	Size of print cm	Surface area of distribution cm^2	Initial ink added to rollers g
Prufbau	4.5 × 28	4 × 20	570	0.10 – 0.15
IGT C-Type	4 × 25	3.5 × 20	720	0.16–0.25
IGT A-Type	5.5 × 30	5 × 20	1200	0.20 – 0.35

Before removing the ink specimen from a container, insert a spatula and hand stir thoroughly, taking care that air bubbles are not introduced.

9.2 For each mileage or ink receptivity test, prepare 6 newsprint specimens by cutting the paper to the size appropriate for the print maker; see guidelines in Table 1. The longer dimension should preferably be in the machine direction, which can be determined by Test Method D528. Determine the felt and wire side of the newsprint by Test Methods D5039 and mark on each specimen. Unless otherwise specified, the felt side will be the printing side.

NOTE 2—When handling the test newsprint, be careful not to touch the surface with bare fingers, as localized changes in absorbency may result.

10. Conditioning

10.1 The adsorbency properties of paper and ink are highly sensitive to relative humidity and temperature. For these reasons, reproducible printing requires that the test and reference samples be conditioned at the same conditions; Practice D685 specifies 50 ± 2 % relative humidity and 23 ± 1.0°C temperature.

11. Prepare the Print Maker

11.1 Preset the operating conditions of the laboratory print maker. Typical for newsprint are a printing pressure of 650 N, a printing speed of 0.2 m/s and a temperature of 25°C.

11.2 Set the composition roller of the distribution system in place.

11.3 Select the printing disk to be used and position it on the disk holder out of contact with the top roller.

NOTE 3—Avoid any operation that will scratch the metal distribution and printing plates or damage the rubber blanket on the impression cylinder.

12. Procedure

12.1 Apply to the composition roller of the distribution system the amount of ink necessary to obtain a print reflection density about 0.15 units above the target value. See guidelines in Table 1. Using a small spatula, spread the ink uniformly across the roller.

12.2 Turn the distribution system on, let distribute one minute.

12.3 Lower the printing disk onto the top roller, let distribute for 15 s.

12.4 Raise the disk holder. Turn the distribution system off.

12.5 Using tongs or rubber gloves, transfer the inked disk to the analytical balance. Weigh to the nearest 0.0001 g. Record as B1, the weight before making the first print.

12.6 Using tongs or rubber gloves, transfer the weighed disk to the print maker. Insert the news print specimen, proper side up, into the sled (or mount on the impression cylinder).

12.7 Turn the print maker on, pull the print, and turn the print maker off.

12.8 Immediately remove the print and position on the designated backing (7.1.4). With the proper filter in place on the densitometer, measure the reflection density in at least three places. Compute the average value and record as D1.

12.9 Using tongs or rubber gloves, remove the disk from the print maker, place it on the analytical balance, record the "after weight" to the nearest 0.0001g as A.1.

12.10 If D1 is not at least 0.15 units higher than the target reflection density, dab a small quantity of ink across a distribution roller and repeat 12.2-12.6 without cleaning the disk. If it is determined that paper lint has adhered to the disk during the test sequence, the test must be repeated using a slower printing speed in 12.7.

12.11 When D1 (or D2) is at least 0.15 units higher than the target density, continue making prints by 12.2-12.6 without cleaning the disk or distribution rollers until the reflection density falls below the target value. Ideally, there should be 2 or 3 sets of data above and 2 or 3 sets of data below the target value.

12.12 At the conclusion of the testing, clean up the disk and distribution system with appropriate solvent. Make sure both are dry before continuing.

12.13 Repeat 12.1-12.12 with the reference news ink (or reference newsprint).

12.14 Run replicate tests by repeating 12.1-12.13.

13. Calculation

NOTE 4—The starting reflection density should be approximately 0.15 units above the target reflection density. Compute C, the ink on the print, from the difference on weight of the inked plate before and after each printing as follows:

$$C1 = B1 - A1, \text{ g} \quad (1)$$

repeat for Print 2 through print n.

13.1 Obtain the value of CT, the ink on the print required to achieve the target reflection density, by interpolation of a graph of each D versus the corresponding C or by regression analysis, or both.

13.2 Compute mileage per unit area by dividing CT by S, the area of the printed specimen in CM^2, as follows:

$$M = \frac{C_T}{S} \times 10^4, \text{ g/m}^2 \quad (2)$$

13.3 Compute relative mileage (or relative ink receptivity) by dividing the results for the test material by that of the reference material. A lower result means better efficiency.

NOTE 5—Customers may want the test method results expressed as the reciprocal of the results given in this calculation as the reciprocal result could be an indicator of how much finished printed matter could be produced from a given amount of ink (at 100 % coverage).

14. Report

14.1 Report the following information:

14.1.1 Test results for relative mileage an ink or relative ink receptivity of a newsprint.

14.1.2 Identity of the test and reference material.

14.1.3 Color of the ink and the target density.

14.1.4 Printing conditions such as type of print maker, pressure, speed and the type of printing plate.

14.1.5 Paper side used for printing (wire or felt).

14.1.6 The backing material used for reflection density measurements, if other than an opaque thickness of the unprinted newsprint.

14.1.7 Deviations from this test method.

15. Precision and Bias[4]

15.1 *Precision*—An interlaboratory study of this test method was conducted in which one operator in each of four laboratories participated in round robin testing of five samples of news ink blacks of varying percentages of carbon black pigmentation. The following criteria should be used for judging the acceptability of results at the 95 % confidence level:

15.1.1 *Repeatability*—Duplicate results obtained by the same operator should be considered suspect if they differ by more than 6.42 % of the mean g/m^2.

15.1.2 *Reproducibility*—Duplicate results obtained by operators in different laboratories should be considered suspect if they differ by more than 8.00 % of the mean g/m^2.

15.2 *Bias*—No information can be presented on the bias of the procedure in Test Method D7189 for measuring Relative Mileage of News Ink on Newsprint because no material having an accepted reference value is available.

16. Keywords

16.1 ink mileage; ink receptivity; news print; reflection density

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D01-1133.