

Test Method for Colorfastness to Crocking: Rotary Vertical Crockmeter

Developed in 1966 by AATCC Committee RA38; revised 1969, 1972, 1994, 1996, 2005, 2013, 2018; reaffirmed 1974, 1977, 1983, 1988, 1989; editorially revised 1981, 1985, 1986, 2002, 2004, 2008, 2011, 2019; editorially revised and reaffirmed 2001, 2010. Technically equivalent to ISO 105-X16.

1. Purpose and Scope

1.1 This test method is used to determine the amount of color transferred from the surface of colored textile materials to other surfaces by rubbing. It is applicable to textiles made from all fibers in the form of yarn or fabric, whether dyed, printed or otherwise colored and especially where the singling out of colored areas smaller than possible to test with the standard crockmeter (AATCC TM8, Test Method for Colorfastness to Crocking: Crockmeter) is required (see 14.1).

1.2 Test procedures employing test squares either dry or wet with water or other liquids are within the scope of this method.

2. Principle

2.1 A test specimen held at the base of the rotary vertical crockmeter is rubbed with standard test squares under controlled conditions (see 14.1).

2.2 Color transferred to the test squares is assessed by a comparison with the Gray Scale for Staining, AATCC 9-Step Chromatic Transference Scale or Instrumental Assessment of Degree of Staining (see 14.2 and 14.3).

3. Terminology

3.1 **colorfastness**, n.—the resistance of a material to change in any of its color characteristics, to transfer of its colorant(s) to adjacent materials or both, as a result of the exposure of the material to any environment that might be encountered during the processing, testing, storage or use of the material.

3.2 **crocking**, n.—a transfer of colorant from the surface of a colored yarn or fabric to another surface or to an adjacent area of the same fabric principally by rubbing.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures

and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

5. Uses and Limitations

5.1 Since manufacturing processes such as dyeing, finishing, etc., and washing, drycleaning, ironing, etc. may affect the degree of color transfer from a material, the test may be made before or after, any such treatment, depending upon the information desired.

5.2 This method is designed for use with an AATCC crocking cloth. Alternatively, other adjacent textile substrates may be used as agreed between interested parties.

6. Apparatus and Materials (see 14.4)

6.1 Rotary vertical crockmeter with 16 ± 0.1 mm diameter finger (see Fig. 1).

6.2 AATCC Crocking Cloth, cut in 50 ± 1 mm squares (see 14.5).

6.3 AATCC 9-Step Chromatic Transference Scale (AATCC EP8) (see 14.2).

6.4 Gray Scale for Staining (AATCC EP2) (see 14.2).

6.5 White AATCC Textile Blotting Paper



Fig. 1—Rotary vertical crockmeter.

per (see 14.2).

6.7 Spiral wire clip for securing crocking cloth to rotary vertical crockmeter finger.

6.8 Crockmeter verification fabric, or in-house fabric with known poor colorfastness to crocking properties, that provides repeatable and predictable crocking results.

7. Verification

7.1 Verification checks on the operation of the test and the apparatus should be made routinely and the results kept in a log. The following observations and corrective actions are extremely important to avoid incorrect test results where abnormal crock images can result and influence the rating process.

7.2 Use the crockmeter verification fabric or in-house poor crocking fabric with known predictable and repeatable crocking behavior.

7.2.1 A poor circular image with uneven dye pick-up may indicate the crocking finger needs resurfacing.

7.2.2 A double image may indicate a loose clip.

7.2.3 An uneven stained ring around the circumference may indicate that the peg is uneven.

7.2.4 Scuff marks to the sides of the specimen indicate the loops to the wire clips are positioned downwards and are not high enough to prevent rubbing the specimen surface.

7.2.5 Confirm the wet pick-up techniques (see 10.2).

7.2.6 Replace the abrasive paper on the tester base if it is smooth to the touch in the crocking area compared to the adjacent area, or if slippage of the specimen is noticed.

8. Test Specimens

8.1 Two specimens are used, one each for the dry and the wet tests.

8.1.1 Additional specimens may be used to increase the precision of the average (see 13.1).

8.2 Specimens must exceed the size of the crocking finger such that it is in full contact with the specimen during the complete rotation of the finger. Avoid seams and other raised areas.

8.3 For yarns, knit a piece of fabric, or wind yarn tightly on a suitable sample card/plate.

9. Conditioning

9.1 Prior to testing, precondition and condition the test specimens and the crocking cloth for crock testing as directed in ASTM D1776, Standard Practice for Conditioning and Testing Textiles. Condition each specimen for at least 4 h in an atmosphere of $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and $65 \pm 5\%$ RH by laying each test specimen or crock square separately on a screen or perforated shelf of conditioning rack.

10. Procedure

10.1 Dry Crocking Test.

10.1.1 Tilt the upper half of the machine away to allow access to the base of the machine. Place a test square on the end of the vertical crocking finger and fasten it with spring clip.

10.1.2 Hold the test specimen on the machine base at the point the crocking finger contacts the base. Tilt the upper half of the machine back to the operating position with the test square at the end of the finger in contact with the test specimen. Place the weight supplied with the Crockmeter on the vertical shaft to give the rubbing finger a downward force of $11.1 \text{ N} \pm 10\%$ ($40 \text{ oz} \pm 10\%$).

10.1.3 Hold the test specimen in position on the base. Rotate the crank 20 times at approximately 1 rotation per second. This produces approximately 40 reciprocal turns of the vertical shaft.

10.1.4 Tilt the upper part of the machine back and remove the test specimen and the test square, condition as in 9.1 and evaluate as in Section 11.

10.2 Wet Crocking Test.

10.2.1 Weigh the conditioned dry crock square. Using a syringe tube, graduated pipette or automatic pipette, draw water in mL to 0.65 times the weight of crocking square. Example: If the crocking square weight equals 0.24 g, the mL used would be $0.24 \times 0.65 = 0.16 \text{ mL}$. Lay the crocking square on white plastic mesh over a dish. Apply water evenly over the crocking square to achieve a $65 \pm 5\%$ wet pickup when weighed. Calculate wet pickup by multiplying the original dry conditioned weight by 1.65. If needed, adjust the amount of water used to wet the square and using a new crocking square, repeat steps. When $65 \pm 5\%$ wet pickup is achieved, record the amount of water used. Draw up the recorded amount of water into the syringe tube, graduated pipette or automatic pipette for each wet crocking performed during the current day. Repeat this process each day (see 14.6).

10.2.2 Avoid evaporative reduction of the moisture content on the crock square below the specified level of $65 \pm 5\%$ before the actual crock test is run.

10.2.3 Continue as directed in 10.1.

10.2.4 Air dry the crock test square,

then condition (see 9.1) before evaluating. When loose fiber might interfere with the rating, remove the extraneous fibrous material by pressing lightly on the crock circle with the sticky side of cellophane tape before evaluating.

11. Evaluation (see 14.7)

11.1 Back the crocked test square with three layers of clean AATCC Crocking Cloth for evaluating.

11.2 Rate by means of the Gray Scale for Staining (AATCC EP2), the AATCC 9-Step Chromatic Transference Scale (AATCC EP8) or Instrumental Assessment of Degree of Staining (AATCC EP12), and record the numerical rating (see 14.3 and 14.8).

11.3 It will be noted that the color transfer is usually greater near the edge of the tested circle than the center.

11.4 Rate the color transfer at the edge of the tested circle.

11.5 Average individual results to the nearest 0.1 grade when multiple specimens are tested or when a panel of evaluators rate color transfer.

12. Report

12.1 Report the grade determined in 11.5.

12.2 Indicate whether dry or wet test was performed.

12.3 Indicate whether Gray Scale for Staining, AATCC 9-Step Chromatic Transference Scale or Instrumental Assessment of Staining was used.

13. Precision and Bias

13.1 *Precision.* In 2017, 5 laboratories participated in an interlaboratory study to rate the colorfastness of fabrics after dry crocking and wet crocking. All 5 labs conducted colorfastness testing of 3 fabrics, following this test method. Fabrics tested included 2 vat-dyed denim fabrics, and 1 basic-dyed cotton fabric. Each lab used 2 operators, and each operator performed 10 replications by both

dry and wet crocking. Each of the stained crock squares were rated instrumentally using a spectrophotometer to determine the Gray Scale for Staining grade. The basic-dyed cotton fabric (Fabric 1) exhibited a grade of 3.5, as a result of dry crocking, and 1.5 as a result of wet crocking. The denim fabrics (Fabric 1 and 2) exhibited a grade of 4.5 and 5, as a result of dry crocking, respectively; and 1 and 1.5 as a result of wet crocking, respectively. Table I gives the *within-lab* and *between-lab* precision values for this study.

13.2 *Bias.* The true value of colorfastness to crocking can be defined only in terms of a test method. There is no independent method for determining the true value. As a means of estimating this property, the method has no known bias.

14. Notes

14.1 The rotary vertical crockmeter provides a reciprocating rotary motion to the test finger and a selected pressure on the test finger. Specimens tested by AATCC TM8 versus AATCC TM116 may show dissimilar results. There is no known correlation between the two methods.

14.2 Available from AATCC, PO Box 12215, Research Triangle Park NC 27709, USA; +1.919.549.8141; ordering@aatcc.org; www.aatcc.org.

14.3 It has been noted that different grades may result depending upon whether the Gray Scale for Staining or AATCC 9-Step Chromatic Transference Scale is used for the evaluation. It is, therefore, important to report which scale was used. For very critical evaluations and in cases of arbitration, ratings must be based on the Gray Scale for Staining.

14.4 For potential equipment information pertaining to this test method, please visit the online *AATCC Buyer's Guide* at www.aatcc.org/bg. AATCC provides the possibility of listing equipment and materials sold by its Corporate members, but AATCC does not qualify, or in any way approve, endorse or certify that any of the listed equipment or materials meets the requirements in its test methods.

14.5 AATCC Crocking Cloth should meet the following specifications:

Table I—Precision Values

<i>n</i>	Dry		Wet	
	Within-Laboratory	Between-Laboratory	Within-Laboratory	Between-Laboratory
1	0.116	0.4006	0.307	1.067
2	0.082	0.2837	0.218	0.7557
3	0.067	0.2313	0.178	0.6160
4	0.058	0.2003	0.154	0.5335
5	0.052	0.1792	0.138	0.4772
6	0.047	0.1635	0.126	0.4356
7	0.044	0.1515	0.116	0.4034
8	0.041	0.1417	0.109	0.3773
9	0.039	0.1335	0.103	0.3557
10	0.037	0.1267	0.097	0.3374