

Test Method for Dye and Pigment Migration in a Pad-Dry Process

Developed in 1974 by AATCC Committee RA87; reaffirmed 1976, 1977, 1980, 2006, 2011; editorially revised and reaffirmed 1985, 1990, 2001; editorially revised 1987, 1991, 1998, 2010, 2019 (with title change); revised 1992 (with title change), 1996 (with title change), 2018. Technically equivalent to ISO 105-Z06.

1. Purpose and Scope

1.1 This test method provides a means of assessing the migration propensity of a pad liquor system containing dyes or pigments, subsequently referred to as colorants, and which may also contain different types and amounts of migration inhibitors.

1.2 When drying conditions are not constant and/or uniform, uneven migration may occur, causing shade variations during a run, or shade differences between the face and back, or between side and center of the fabric.

2. Principle

2.1 Fabric impregnated with colorant alone, or with colorant and auxiliaries, is dried while partially covered with a watch glass permitting differential drying and, therefore, migration to occur. The degree of migration is evaluated by visual examination, or by reflectance measurements of the covered and uncovered areas.

3. Terminology

3.1 **colorant**, *n.*—a material which is applied to a substrate for the express purpose of changing the transmittance or reflectance of visible light.

NOTE: Dyes, pigments, tints and optical brighteners are examples of colorants; soils are not colorants.

3.2 **dye**, *n.*—a colorant applied to or formed in a substrate, via the molecularly dispersed state, which exhibits some degree of permanence.

3.3 **migration**, *n.*—*in textile processing, testing, storage and use*, movement of a chemical, dye or pigment between fibers within a substrate or between substrates due to capillary forces (see also *transfer*).

3.4 **pigment**, *n.*—a colorant in particulate form which is insoluble in a substrate, but which can be dispersed in the substrate to modify its color.

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 Follow good laboratory practices. Wear safety glasses in all laboratory areas.

4.2 Observe padder safety. Normal safeguards on padders should not be removed. Ensure that there is an adequate guard at the nip point. A foot-operated kickoff is recommended.

4.3 Handle all chemicals with care. Use chemical goggles or face shield, impervious gloves and an impervious apron when preparing buffered mock dyebaths with concentrated acids and sodium hydroxide.

4.4 An eyewash/safety shower should be located nearby and a self-contained breathing apparatus should be readily available for emergency use.

4.5 Exposure to chemicals used in this procedure must be controlled at or below levels set by governmental authorities (e.g., Occupational Safety and Health Administration's [OSHA] permissible exposure limits [PEL] as found in 29 CFR 1910.1000; see web site: www.osha.gov for latest version). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) comprised of time weighted averages (TLV-TWA), short term exposure limits (TLV-STEL) and ceiling limits (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 13.1).

5. Uses and Limitations

5.1 This method offers two alternative procedures:

5.1.1 Procedure A. The fabric/glass assembly (see 8.2) is allowed to dry at room temperature. The procedure is very simple, but time consuming (overnight).

5.1.2 Procedure B. The fabric/glass assembly (see 8.3) is dried in a laboratory dryer or oven, either with or without air circulation. This procedure is faster, but somewhat more complicated.

5.2 The test method may be used to compare the migration propensity of dyes and the effect on migration of different types of migration inhibitors, thickeners and electrolyte.

5.3 The test method may be used to evaluate a pad liquor with which migration has been found on a continuous dye range. The pad liquor composition may be modified by varying the amount or type of migration inhibitors and tested in the laboratory prior to the application on the range. The colorant concentrations, substrate and wet pickup should be the same in the laboratory as used on the range. It is then possible to correlate the test results with the improvement experienced in practice.

6. Apparatus and Materials

6.1 Laboratory padder.

6.2 Glass plate, 600 × 350 mm (Procedure A).

6.3 Watch glasses (90 mm), 22 mm arch punch.

6.4 Aluminum rings: 110 mm outer diameter, 80 mm inner diameter and 1 mm thickness (Procedure B).

6.5 Clips (Procedure B).

6.6 Laboratory dryer or oven (Procedure B).

6.7 Gray Scale for Color Change (AATCC EP1) (for visual evaluation) (see 13.2).

6.8 Spectrophotometer (AATCC EP7) (see 13.2).

6.9 Fabric swatches (see 13.3 and 8.2.1 or 8.3.1).

7. Test Specimen

7.1 Colorant(s) in required concentration(s).

7.2 Migration inhibitors, thickening agents and other auxiliaries (e.g., electrolyte for reactive dyes) may be used as appropriate.

8. Procedure

8.1 Pad Bath Preparation.

8.1.1 Prepare a pad bath appropriate to the colorant(s) with or without a migration inhibitor.

8.2 Procedure A: Drying in Air at Room Temperature.

8.2.1 Pad a 150 × 300 mm swatch of fabric at 20 ± 2°C (68 ± 4°F). Other padding temperatures may be used, but must then be stated in the report. Generally,

use a wet pickup of 60%, but adjust as necessary to simulate wet pickup of a particular fabric to be run on a particular range (see 13.4).

8.2.2 Immediately after padding place the fabric on a flat glass plate. Place the watch glass on the fabric as shown in Fig. 1 and leave the fabric to dry at room temperature. Record the room temperature and relative humidity during drying.

8.2.3 Remove the watch glass.

8.3 Procedure B: Pin Frame Oven Drying.

8.3.1 Pad a 110 × 220 mm swatch of fabric at 20 ± 2°C (68 ± 4°F). Other padding temperatures may be used, but must then be stated in the report. Generally, use a wet pickup of 60%, but adjust as necessary to simulate wet pickup of a particular fabric to be run on a particular range (see 13.4).

8.3.2 Immediately after padding mount the fabric taut on a pin frame, and sandwich it between two watch glasses, one on the fabric face and one directly underneath on the back of the fabric. Hold the watch glasses in place with two aluminum rings and clamps as shown in Fig. 2.

8.3.3 Dry the fabric horizontally at 100 ± 2°C (212 ± 5°F) for approximately 7 min (or until dry) in a laboratory dryer or oven, with or without air circulation.

8.3.4 Remove the watch glasses.

9. Gray Scale Evaluation

9.1 Reference the following evaluation procedures.

9.1.1 AATCC EP1, Evaluation Procedure for Gray Scale for Color Change.

9.2 AATCC EP7, Evaluation Procedure for Instrumental Assessment of the Change in Color of a Test Specimen.

10. Report

10.1 Report substrate, pad liquor composition, including dyes, chemicals, auxiliaries, etc. and wet pickup.

10.2 For Procedure A, report room temperature and relative humidity during drying.

10.3 For Procedure B, report whether dried with or without air circulation.

10.4 For visual examination, report assessment on a scale of 1-5 by reference to the Gray Scale for Color Change.

10.5 For reflectance measurements, report percent migration using the outer dyed area as reference.

11. Precision and Bias

11.1 Precision for this test method has not been established. Until a precision statement is generated for this test method, use standard statistical techniques in making any comparisons of test results for either *within-laboratory* or *between-laboratory* averages.

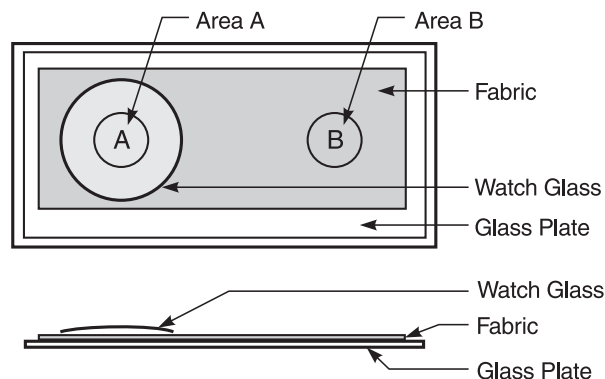


Fig. 1—Layout of apparatus for inducing colorant migration using procedure A.

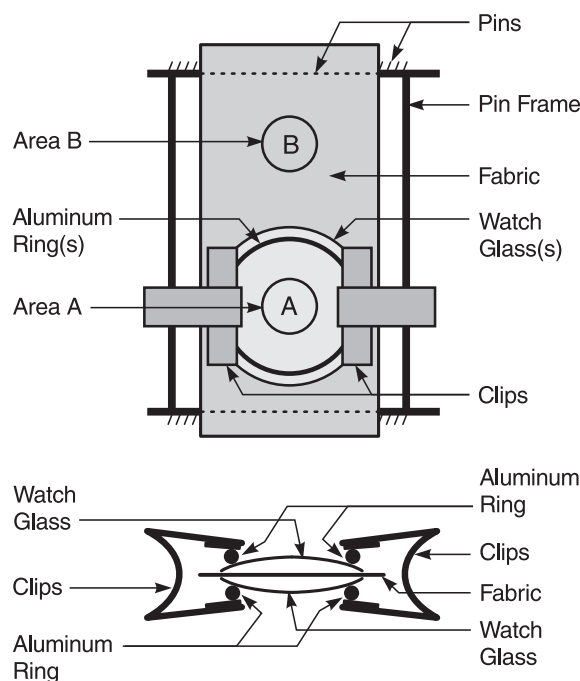


Fig. 2—Layout of apparatus for inducing colorant migration using procedure B.

12. References

- 12.1 Etters, J. N., *Textile Chemist and Colorist*, Vol. 4, No. 6, 1972, p160.
- 12.2 Etters, J. N., *Modern Knitting Management*, Vol. 51, No. 2, 1973, p24.
- 12.3 Gerber, H., *Melliand Textilberichte*, Vol. 53, No. 3, 1972, p335.
- 12.4 Lehmann, H., and Somm, F., *Textile Praxis International*, Vol. 28, No. 1, 1973, p52.
- 12.5 Northern Piedmont Section, AATCC, *Textile Chemist and Colorist*, Vol. 7, No. 11, 1975, p192.
- 12.6 Urbanik, A., and Etters, J. N., *Textile Research Journal*, Vol. 43, 1973, p657.

13. Notes

- 13.1 Available from Publications Office, ACGIH, Kemper Woods Center, 1330 Kemper Meadow Dr., Cincinnati OH 45240; tel: +1. 513.742.2020; web site: www.acgih.org.

13.2 Available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: +1.919.549.8141; fax: +1.919.549.8933; e-mail: ordering@aatcc.org; web site: www.aatcc.org.

13.3 For disperse dyes, vat dyes and pigments, generally the preferred fabric is a 65/35 polyester/cotton gabardine or heavy twill, heat-set, bleached and mercerized. For soluble dyes with affinity to cellulose (e.g., reactive dyes) a bleached and mercerized 100% cotton gabardine or heavy twill should be used. However, any other fabric intended for use on a continuous dye range may be chosen.

13.4 The desired wet pickup is obtained by adjusting the pressure at the nip of the pad rolls. Wet pickup is the weight gained by the substrate at ambient conditions after padding:

$$\% \text{ wet pickup} = 100 \times (A/B - 1)$$

where:

A = weight after padding

B = weight before padding