

Colorfastness to Heat: Hot Pressing

Developed in 1969 by AATCC Committee RR54; revised 1973, supersedes AATCC 5-1962; reaffirmed 1976, 1979, 1984, 1989; editorially revised 1981, 1985, 1986, 1991, 2001, 2002; editorially revised and reaffirmed 1994, 1999, 2004. Technically equivalent to ISO 105-X11.

1. Purpose and Scope

1.1 This test method is intended for determining the resistance of the color of textiles of all kinds and in all forms to color change, and color transfer when subjected to hot pressing. Tests are given for hot pressing when the fabric is dry, damp and wet. The textile end use usually determines which tests should be made.

2. Principle

2.1 Dry Pressing. The dry specimen is pressed with a heating device of a specified temperature, time and weight.

2.2 Damp Pressing. The dry specimen is covered with a wet, undyed cotton cloth and pressed with a heating device of a specified temperature, time and weight.

2.3 Wet Pressing. The wet specimen is covered with a wet, undyed cotton cloth and pressed with a heating device of specified temperature and weight.

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 **hot pressing**, *n.*—a process for smoothing and possibly shaping textile products by applying mechanical pressure with heat, either dry or in the presence of moisture.

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 recommenda-

tions. 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. Apparatus and Materials

5.1 Heating device, providing even heat transfer to the specimen from the top by close contact at a controlled temperature (see 7.1, 12.1, 12.2 and 12.5) and giving a pressure on the specimen of $40 \pm 10 \text{ g/cm}^2$ (see 12.4).

5.2 A smooth heat resistant sheet (see 12.3 and 12.9).

5.3 Wool flannel of approximately 260 g/m² (see 12.4). Two layers of this material are used to make a pad of approximately 3 mm thickness. Similar, smooth wool fabrics or felt to give a pad about 3 mm thick could be used.

5.4 An undyed, bleached and not mercerized cotton cloth, with a smooth surface 100-130 g/m².

5.5 Gray Scale for Color Change (see 12.8).

5.6 Gray Scale for Staining (see 12.8).

5.7 AATCC Chromatic Transference Scale (see 12.8).

6. Test Specimen

6.1 If the textile to be tested is fabric, a piece $12 \times 4 \text{ cm}$ is required.

6.2 If the textile to be tested is yarn or thread, knit it into a fabric and use a piece $13 \times 4 \text{ cm}$ or wind it around a piece of thin inert material $12 \times 4 \text{ cm}$ to obtain the area of the textile for test.

7. Procedure

7.1 The following temperatures are used (see 12.1):

$110 \pm 2^\circ\text{C}$

$150 \pm 2^\circ\text{C}$

$200 \pm 2^\circ\text{C}$

When necessary, other temperatures may be used, provided they are specifically noted in the report (see Table I).

7.2 Specimens of materials that have been subjected to any heat or drying treatment must be allowed to condition (by exposure to air at $65 \pm 2\%$ RH and a temperature of $20 \pm 2^\circ\text{C}$), before they are tested.

7.3 The bottom plate of the heating device is covered with the heat resistant sheeting (see 5.2, 12.3) wool flannel (see 5.3, 12.3) and dry, undyed cotton cloth (see 5.4, 12.3 and 12.4).

7.4 Dry Pressing. Place dry specimen on top of the cotton cloth covering the wool flannel pad (see 7.3, 12.3). Lower top plate of heating device and leave specimen for 15 s at the specified pressing temperature.

7.5 Damp Pressing. Place dry specimen on top of the cotton cloth covering the wool flannel padding (see 7.3, 12.3). Soak a piece of undyed cotton cloth $12 \times 4 \text{ cm}$ in distilled water, and squeeze or extract it to contain its own weight of water. Place the wet cloth on top of the dry specimen. Lower the top plate of the heating device and leave specimen for 15 s at the specified pressing temperature.

7.6 Wet Pressing. Soak the dyed specimen and a piece of undyed cotton cloth $12 \times 4 \text{ cm}$ (see 5.4) in distilled water and squeeze or extract them to contain their own weight of water. Place the wet specimen on top of the dry cotton cloth covering the wool flannel pad (see 7.3, 12.3) and place the wet, undyed cloth on the specimen. Lower the top plate of the heating device and leave specimen for 15 s

Table I—Safe Ironing Temperature Guide

Class 0	Class I	Class II	Class III	Class IV
Below 121°C	121-135°C	149-163°C	177-191°C	204°C and Above
Modacrylic 93-121°C Olefin (Polyethylene) 79-121°C	Acetate Olefin (Polypropylene)	Acrylic Azlon Nylon 6	Nylon 6,6 Polyester	Cotton Fluorocarbon
Rubber 82-93°C	Silk	Spandex Wool		Glass Hemp, Jute, Ramie Linen Rayon, Viscose Triacetate (heat set)
Saran 66-93°C				
Vinyon 54°C				

at the specified pressing temperature.

8. Evaluation Method for Alteration in Color (Shade and Strength)

8.1 Assess the change in color of the specimen with the Gray Scale for Color Change immediately and again after the specimen has been allowed to condition for 4 h in the standard atmosphere ($20 \pm 2^\circ\text{C}$ and $65 \pm 2\%$ RH):

Grade 5—negligible or no change as shown in Gray Scale Step 5.

Grade 4.5—change in color equivalent to Gray Scale Step 4-5.

Grade 4—change in color equivalent to Gray Scale Step 4.

Grade 3.5—change in color equivalent to Gray Scale Step 3-4.

Grade 3—change in color equivalent to Gray Scale Step 3.

Grade 2.5—change in color equivalent to Gray Scale Step 2-3.

Grade 2—change in color equivalent to Gray Scale Step 2.

Grade 1.5—change in color equivalent to Gray Scale Step 1-2.

Grade 1—change in color equivalent to Gray Scale Step 1.

9. Evaluation Method for Staining

9.1 Rate staining by the AATCC Chromatic Transference Scale or the Gray Scale for Staining (see 12.10):

Grade 5—negligible or no color transfer.

Grade 4.5—color transfer equivalent to Step 4-5 on the Gray Scale for Staining or Row 4.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 4—color transfer equivalent to Step 4 on the Gray Scale for Staining or Row 4 on the 9-step AATCC Chromatic Transference Scale.

Grade 3.5—color transfer equivalent to Step 3-4 on the Gray Scale for Staining or Row 3.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 3—color transfer equivalent to Step 3 on the Gray Scale for Staining or Row 3 on the 9-step AATCC Chromatic Transference Scale.

Grade 2.5—color transfer equivalent to Step 2-3 on the Gray Scale for Staining or Row 2.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 2—color transfer equivalent to Step 2 on the Gray Scale for Staining or Row 2 on the 9-step AATCC Chromatic Transference Scale.

Grade 1.5—color transfer equivalent to Step 1-2 on the Gray Scale for Staining or Row 1.5 on the 9-step AATCC Chromatic Transference Scale.

Grade 1—color transfer equivalent to Step 1 on the Gray Scale for Staining or Row 1 on the 9-step AATCC Chromatic Transference Scale.

10. Report

10.1 Report the test procedure (dry, damp or wet) and the temperature of the heating device. Report the numerical rating for change in color immediately after testing and after conditioning for 4 h at $65 \pm 2\%$ RH and a temperature of $20 \pm 2^\circ\text{C}$. Report the numerical rating for the staining of the undyed cotton cloth. Report which scale was used for evaluating staining.

11. Precision and Bias

11.1 *Precision.* 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.

11.2 *Bias.* Colorfastness to heat, hot pressing, 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.

12. Notes

12.1 The pressing temperature depends to a large extent on the type of fiber and on the construction of the fabric or garment. In the case of blends, it is further suggested to use the temperature appropriate to the fiber with the lowest heat resistance. The indicated temperatures cover three commonly used pressing conditions.

12.2 A suitable heating device is the current production of the Atlas Scorch Tester. Older Scorch Tester units now in use can be modified to make them suitable by changing of the hinge on the head assembly and by modifica-

tion of the heat controlling unit. Both the Scorch Tester and modification kit for older units are available from SDL Atlas L.L.C., 1813A Associate Lane, Charlotte NC 28217; tel: 704/329-0911; fax: 704/329-0914; e-mail: info@sdlatlas.com.

12.3 The smooth heat resistant sheet (see 12.9) is used for insulation and should be smooth and not warped. It is best to complete specimen assembly on the heat resistant sheet before placing it on the heating device. The sheet should be cooled and the wet wool should be dried between tests. This insulating material must be used, whether the bottom plate is heated or not, to prevent heat to or from the bottom of the test assembly.

12.4 In order to obtain the pressure per unit area $40 \pm 10\text{g/cm}^2$ the total area of the wool flannel padding should bear a suitable relationship to the mass of the plate pressing down on the padding. If the fabric to be tested has an appreciable thickness, it is necessary either to increase the area of the test specimen; or to augment the pressure-bearing surface using a suitable template made from the same material as the test specimen. If the plates of the heating device are smaller than the specimen size, the pressure depends on the design of the apparatus (ratio of mass and area of top plate).

12.5 During the heating-up period of the heating device and between the actual test periods, both plates of the heating device should be in contact to insure a uniform distribution.

12.6 For less critical testing, a household iron may be used; but its temperature should be measured with a surface pyrometer or with temperature sensitive papers. The iron should be weighted so that its area and total weight are in the approximate ratio to exert a pressure of $40 \pm 10\text{ g/cm}^2$. However, due to temperature fluctuation during on-off differences over the iron surface, the accuracy and reproducibility are limited. When a hand iron is used, it must be stated in the report.

12.7 Fabrics for this test method are available from Textile Innovators Corp., div. of SDL Atlas L.L.C., P.O. Box 8, 101 Forest St., Windsor NC; tel: 252/794-9703; fax: 252/794-9704; e-mail: tic@sdlatlas.com.

12.8 Available from AATCC, P.O. Box 12215, Research Triangle Park NC 27709; tel: 919/549-8141; fax: 919/549-8933; e-mail: orders@aatcc.org.

12.9 Available from SDL Atlas L.L.C., 1813A Associate Lane, Charlotte NC 28217; tel: 704/329-0911; fax: 704/329-0914; e-mail: info@sdlatlas.com.

12.10 For very critical evaluations and in the case of arbitration, ratings must be based on the geometric Gray Scale for Staining.