

AATCC 9-Step Chromatic Transference Scale

Developed in 1996 by AATCC Committees RA36/RA38; under jurisdiction of AATCC Committee RA36; reaffirmed and editorially revised 1997, 1998; revised 2002.

1. Scope

1.1 This evaluation procedure describes the use of a 9-step Chromatic Transference Scale for evaluating staining on undyed textiles in colorfastness tests.

2. Principle

2.1 The staining of undyed cloth in colorfastness tests is rated by visually comparing the color of the stained cloth and unstained cloth to the differences in color represented by the Scale (see 7.1).

3. Terminology

3.1 **colorant staining**, *n.*— the unintended pickup of colorant by a substrate due to (1) exposure to a colored or contaminated liquid medium or (2) direct contact with dyed or pigmented material, from which colorant transfers by sublimation or mechanical action (as in crocking).

3.2 **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.

3.3 **grade**, *n.*—in *textile testing*, the symbol for any step of a multistep standard reference scale for a quality characteristic.

NOTE: The grade is assigned to test specimens exhibiting a degree of the quality comparable to that step of the standard. Numerical grades assigned to different specimens from a sample or by different observers are commonly averaged.

3.4 **rating**, *v.*—in *textile testing*, the process for determining or assigning a grade to a material by comparing it to a standard reference scale.

4. Description of Scale

4.1 The Scale makes use of 60 color chips. The five hues (red, yellow, green, blue and purple) were selected from the *Munsell Book of Color*. The neutral chip representing row number 5 as well as the neutral gray chips correspond to the gray chips on the Gray Scale for Staining (see

7.1).

4.2 The chips on the Scale appear on white cardboard in ten rows. The rows are placed and aligned so that every color shows a similar gradation in depth in a vertical line, ranging from the lightest colors on top to the darkest colors on the bottom. For rating purposes, the rows are designated numerically with number 5 being assigned to the top row which depicts no color, number 4.5 to the second row or lightest colors and so on down to number 1 for the bottom row or darkest colors. Nominal $L^*a^*b^*$ values (see 7.2) and Munsell Notations of each chip are given in Table I and are included with the Scale (see 7.3).

4.3 The chips are mounted in rows with sufficient separation between them to show 9.5 mm (3/8 in.) circular holes cut in the card between rows of chips in the ten rows. A white cardboard mask, as shown in Fig. 1, is provided so that when it is held vertically over the scale, it discloses one of the circular openings in the color scale and the two adjacent color chips (see 7.4).

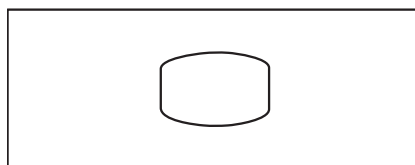


Fig. 1—White cardboard mask.

5. Use of the Scale

5.1 Illuminate the surfaces with a daylight simulator with illumination level at the specimen plane in the range of 1080-1340 lx (100-125 fc) (see 7.5). The light should be incident upon the surfaces at $90 \pm 5^\circ$ and the direction of viewing $45 \pm 5^\circ$ to the plane of the surfaces (see Fig. 2).

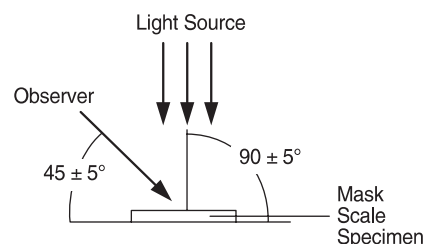


Fig. 2—Illumination and viewing angle for rating specimens.

5.2 The material exhibiting the transferred color to be evaluated is placed behind the card on which the chips are mounted, so that a representative part of the colored portion is visible through one of the circular holes in the column closest to it in hue. Before rating a color transferred to a thin material such as white cotton sheeting, the test specimen should be backed with a number of layers of the clean test cloth. This applies also to samples of thin material showing transferred color mounted on test cards. The color of the cardboard will influence the judgment of the examiner, unless the color of the card is eliminated by adding several layers of clean test material behind the specimen showing color transfer. This can be done without removing the sample from the card. With the mask in place, the specimen and the mask are then moved up or down in this column until the specimen most closely approximates the chroma of one of the chips in the column. In order to eliminate or minimize the shadow on the specimen through the holes on the Scale, the Scale should be held so that the specimen and the Scale are perpendicular to the light source.

5.3 Numerical grades are determined by comparison with the numbered rows on the Scale. The rating method given in the Scale is as follows:

Colorant Staining (Transfer)	Grade
No transfer	5
Transfer equal to Row 4.5	4.5
Transfer equal to Row 4	4
Transfer equal to Row 3.5	3.5
Transfer equal to Row 3	3
Transfer equal to Row 2.5	2.5
Transfer equal to Row 2	2
Transfer equal to Row 1.5	1.5
Transfer equal to Row 1	1

6. Evaluation of Results

6.1 Evaluations made with a 9-Step Chromatic Transference Scale should give essentially the same grades as evaluations made with either the Gray Scale for Staining or the 5-Step Chromatic Transference Scale (see 7.1)

6.2 The 9-Step Chromatic Transference Scale is believed to fulfill evaluation requirements when the results are analyzed on a statistical basis. It may facilitate evaluations of staining, especially when used by less experienced raters.

6.3 Reports on grades arrived at by the

Table I

Grade	Munsell Notations and L*a*b* Values					
5	N9.34/ L* = 94.11 a* = -0.01 b* = -0.01	N9.34/ L* = 94.11 a* = -0.01 b* = -0.01	N9.34/ L* = 94.11 a* = -0.01 b* = -0.01	N9.34/ L* = 94.11 a* = -0.01 b* = -0.01	N9.34/ L* = 94.11 a* = -0.01 b* = -0.01	N9.34/ L* = 94.11 a* = -0.01 b* = -0.01
4.5	N9.12/ L* = 91.99 a* = -0.01 b* = -0.01	5R 9.12/1 L* = 91.99 a* = 2.81 b* = 1.61	5Y 9.12/1 L* = 91.99 a* = -1.31 b* = 8.23	10GY 9.12/1 L* = 91.99 a* = -6.29 b* = 5.33	2.5PB 9.12/1 L* = 91.99 a* = -0.77 b* = -2.81	10P 9.12/1 L* = 91.99 a* = 2.35 b* = -1.04
4	N8.91/ L* = 89.98 a* = -0.01 b* = -0.01	5R 8.91/2 L* = 89.98 a* = 5.51 b* = 3.12	5Y 8.91/2 L* = 89.98 a* = -2.40 b* = 16.25	10GY 8.91/2 L* = 89.98 a* = -11.94 b* = 10.38	2.5PB 8.91/2 L* = 89.98 a* = -1.64 b* = -5.64	10P 8.91/2 L* = 89.98 a* = 4.67 b* = -2.10
3.5	N8.73/ L* = 88.25 a* = -0.01 b* = -0.01	5R 8.73/3 L* = 88.25 a* = 10.41 b* = 5.78	5Y 8.73/3 L* = 88.25 a* = -3.05 b* = 23.10	10GY 8.73/3 L* = 88.25 a* = -16.60 b* = 14.69	2.5PB 8.73/3 L* = 88.25 a* = -3.02 b* = -10.26	10P 8.73/3 L* = 88.25 a* = 8.88 b* = -4.10
3	N8.45/ L* = 85.57 a* = -0.01 b* = -0.01	5R 8.45/4 L* = 85.57 a* = 14.98 b* = 8.36	5Y 8.45/4 L* = 85.57 a* = -3.49 b* = 29.70	10GY 8.45/4 L* = 85.57 a* = -20.78 b* = 18.72	2.5PB 8.45/4 L* = 85.57 a* = -4.35 b* = -14.61	10P 8.45/4 L* = 85.57 a* = 12.99 b* = -6.16
2.5	N8.10/ L* = 82.23 a* = -0.01 b* = -0.01	5R 8.10/5 L* = 82.23 a* = 18.95 b* = 10.47	5Y 8.10/5 L* = 82.23 a* = -3.56 b* = 35.96	10GY 8.10/5 L* = 82.23 a* = -25.08 b* = 22.52	2.5PB 8.10/5 L* = 82.23 a* = -5.00 b* = -18.57	10P 8.10/5 L* = 82.23 a* = 16.63 b* = -8.10
2	N7.58/ L* = 77.24 a* = -0.01 b* = -0.01	5R 7.58/6 L* = 77.24 a* = 22.98 b* = 12.54	5Y 7.58/6 L* = 77.24 a* = -3.31 b* = 42.83	10GY 7.58/6 L* = 77.24 a* = -28.86 b* = 25.81	2.5PB 7.58/6 L* = 77.24 a* = -5.46 b* = -22.44	10P 7.58/6 L* = 77.24 a* = 20.70 b* = -10.07
1.5	N6.86/ L* = 70.29 a* = -0.01 b* = -0.01	5R 6.86/7 L* = 70.29 a* = 27.29 b* = 14.51	5Y 6.86/7 L* = 70.29 a* = -2.49 b* = 49.27	10GY 6.86/7 L* = 70.29 a* = -32.65 b* = 28.91	2.5PB 6.86/7 L* = 70.29 a* = -5.33 b* = -26.10	10P 6.86/7 L* = 70.29 a* = 24.79 b* = -12.27
1	N5.84/ L* = 60.25 a* = -0.01 b* = -0.01	5R 5.84/8 L* = 60.25 a* = 31.87 b* = 16.64	5Y 5.84/8 L* = 60.25 a* = -1.16 b* = 56.91	10GY 5.84/8 L* = 60.25 a* = -37.36 b* = 32.66	2.5PB 5.84/8 L* = 60.25 a* = -4.79 b* = -30.73	10P 5.84/8 L* = 60.25 a* = 29.11 b* = -14.88

use of the 9-Step Chromatic Transference Scale must clearly state that this scale was used and not the Gray Scale for Staining or the 5-Step Chromatic Transference Scale.

7. Notes

7.1 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.

7.2 Sphere geometry spectrophotometric measurements of the chips shall be taken with the specular component included. A 0°/45° (45°/0°) geometry is an acceptable alternate. The colorimetric data shall be calculated using the CIE 1964 10° observer data for

Illuminant D₆₅.

7.3 Provision for a grade lower than 1 is provided for in *Nomenclature for Subjective Rating Processes* elsewhere in this MANUAL. Any test specimen which has a change in contrast decidedly greater than a grade of 1 may be rated a 0.

7.4 The cleanliness and physical condition of the Scale is extremely important in obtaining consistent results. Inspect the Scale frequently for fingerprints and any other marks. If the marks are considered to interfere with the ratings, then the Scale should be replaced. The Scale can also be physically damaged through handling. Again, if the physical damage to the chips; e.g., chipped edges, loose or buckled chips; interferes with the rating process, replace the

Scale. At least annually, the Scale should be measured on a spectrophotometer or colorimeter to ensure that the total color differences are within specification. Measure the colors on the Scale upon receipt and, using the initial color readings, total color difference for each chip should not exceed a ΔE_{CMC} value of 0.3. A CMC ratio of 2:1 should be used (ΔE_{CMC} computed from the nominal values listed in Table I will likely differ from the actual ΔE_{CMC} obtained from measurement of original and stained test crock squares). Keep the Scale in its case when it is not in use.

7.5 See AATCC Evaluation Procedure 9, Visual Assessment of Color Difference of Textiles, for notes on choice of daylight simulator and illumination level.