

Colorfastness to Non-Chlorine Bleach in Home Laundering

Developed in 1988 by AATCC Committee RA60; reaffirmed 1989, 1995, 2002; revised 1990, 1996, 1997, 2003; editorially revised 1994, 2004, 2005.

1. Purpose and Scope

1.1 This test method is designed to evaluate the colorfastness to non-chlorine bleach in home laundering of textiles which are expected to withstand frequent laundering. The fabric color changes resulting from the non-chlorine bleach, detergent solution and abrasive action of five home laundings are evaluated.

1.2 Results of this test method can be used for establishing care instructions. First establish the level of performance with non-chlorine bleach and if an effect is found, then retest with detergent alone. It may be necessary to use a water only wash to separate the effects of components like hardness, pH or chlorine content.

1.3 Since the non-chlorine bleaches currently available contain ingredients other than the non-chlorine bleach; such as fluorescent whitening agents, bluing, etc., it is the total effect of these chemicals on the color change that is being evaluated.

2. Principle

2.1 Specimens are laundered under appropriate conditions of temperature, detergent solution, non-chlorine bleach solution and abrasive action for five home laundering cycles. The laundered specimens are evaluated for color change.

3. Terminology

3.1 **bleach**, n.—*in home laundering*, a product that will clean, whiten, brighten and aid in the removal of soils and stains from textile materials by oxidation that is inclusive of chlorine and non-chlorine products.

3.2 **care instructions**, n.—*in textiles*, a series of directions describing which care practices should refurbish a product without adverse effects and warning of those care practices expected to have a harmful effect (see 12.1).

3.3 **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, stor-

age or use of the materials.

3.4 **laundering**, n.—*of textile materials*, a process intended to remove soil and/or stains by treatment (washing) with an aqueous detergent solution and normally including subsequent rinsing, extracting and drying.

3.5 **non-chlorine bleach**, n.—a bleach that does not release the hypochlorite ion in solution; i.e., sodium perborate, sodium percarbonate.

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.

4.2 The 1993 AATCC Standard Reference Detergent WOB may cause irritation. Care should be taken to prevent exposure to skin and eyes.

4.3 Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

4.4 All chemicals should be handled with care.

4.5 The procedure for determining the oxidant content outlined in 12.8 should be handled only in an adequately ventilated laboratory hood. In preparing, dispensing and handling the reagents, use chemical goggles or face shield, impervious gloves and an impervious apron.

4.6 An eyewash/safety shower should be located nearby and an organic vapor respirator should be available for emergency use.

4.7 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 amended as of January 1, 1989). 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 lim-

its (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 12.2).

5. Apparatus and Materials

5.1 Automatic washing machine (see 12.3).

5.2 Automatic tumble dryer (see 12.4).

5.3 Conditioning/drying racks with pull-out screens or perforated shelves (see 12.5).

5.4 Ballast of $92 \times 92 \pm 3$ cm ($36 \times 36 \pm 1$ in.) hemmed pieces of bleached cotton sheeting (Wash load ballast type 1) or 50/50 polyester/cotton bleached of plain weave construction (Wash load ballast type 3) (see 12.6).

5.5 1993 AATCC Standard Reference Detergent WOB (see 12.7).

5.6 Facilities for drip and line drying.

5.7 Balance with at least 5 kg (20 lbs) capacity.

5.8 Non-chlorine bleach (see 12.8 and 12.9).

6. Test Specimens

6.1 The weight of the test specimen can influence the results of this test. The amount of fabric dilutes the surface that can be affected. Only one test specimen is to be laundered in a load. For ease in weighing fabrics, the test specimen weight is to be 110.0 ± 10.0 g (0.25 ± 0.02 lb). For garment testing, one garment is to be tested. If the garment weight exceeds the specified load weight of 1.8 kg or 4 lb, the total weight is to be included in the report. See 7.2.2 for exact weight specifications on load.

7. Procedure

7.1 Tables I, II and III summarize washing and drying conditions which can be used to test.

7.2 Washing.

7.2.1 Fill the washer with the specified water volume at the selected water temperature using the normal cycle setting. Measure and record the water hardness in any test.

7.2.2 Add 66 ± 1 g of 1993 AATCC Standard Reference Detergent WOB. Add the amount of the non-chlorine bleach recommended by the manufacturer (see 12.8). Add test specimen and enough ballast to make a 1.8 ± 0.1 kg (4.00 ± 0.25 lb) load. Set the washer on the cycle selected for washing and set the wash timer (see Tables I and II). Start the agitation and independently time the

Table I—Washing and Drying Conditions

Machine Cycle	Washing Temperatures	Drying Procedures
(1) Normal/Cotton Sturdy	(II) $27 \pm 3^{\circ}\text{C}$ ($80 \pm 5^{\circ}\text{F}$)	(A) Tumble:
(2) Delicate	(III) $41 \pm 3^{\circ}\text{C}$ ($105 \pm 5^{\circ}\text{F}$)	i. Cotton Sturdy
(3) Permanent Press	(IV) $49 \pm 3^{\circ}\text{C}$ ($120 \pm 5^{\circ}\text{F}$)	ii. Delicate
	(V) $60 \pm 3^{\circ}\text{C}$ ($140 \pm 5^{\circ}\text{F}$)	iii. Permanent Press
		(B) Line
		(C) Drip
		(D) Screen

Table II—Typical Washing Machine Operating Parameters¹

	Normal	Delicate	Permanent Press
(A) Water Level	$68.1 \pm 3.8 \text{ L}$ ($18 \pm 1.0 \text{ gal}$)	$68.1 \pm 3.8 \text{ L}$ ($18 \pm 1.0 \text{ gal}$)	$68.1 \pm 3.8 \text{ L}$ ($18 \pm 1.0 \text{ gal}$)
(B) Agitator Rate	$179 \pm 2 \text{ spm}^2$	$119 \pm 2 \text{ spm}$	$179 \pm 2 \text{ spm}$
(C) Washing Time	12 min	8 min	10 min
(D) Spin Speed	$645 \pm 15 \text{ rpm}^3$	$430 \pm 15 \text{ rpm}$	$430 \pm 15 \text{ rpm}$
(E) Final Spin Cycle	6 min	4 min	4 min

¹ Per machine specifications.

² spm = strokes per minute.

³ rpm = revolutions per minute.

Table III—Dryer Conditions

	Normal or Cotton/Sturdy	Delicate	Permanent Press
Exhaust Temperature	High $66 \pm 5^{\circ}\text{C}$ ($150 \pm 10^{\circ}\text{F}$)	Low $< 60^{\circ}\text{C}$ (140°F)	High $66 \pm 5^{\circ}\text{C}$ ($150 \pm 10^{\circ}\text{F}$)
Cool Down Time	10 min	10 min	10 min

wash for reproducible results. Advance the dial to the end of the wash cycle and rinse at a temperature below 29°C (85°F). If this rinse temperature is not attainable, record the actual temperature of the rinse water used.

7.2.3 For specimens to be dried by procedures A, B or D, allow washing to proceed automatically through the final spin cycle. Remove test specimens immediately after the final spin cycle, separate any tangled pieces—taking care to minimize distortion—and dry by procedures A, B or D (see Tables I and III).

7.2.4 For specimens to be dried by procedure C, Drip Dry, stop the washer at the end of the final rinse cycle just before the water begins to drain. Remove the specimens soaking wet.

7.3 Drying.

7.3.1 (A) Tumble Dry. Place the washed load (test specimens and ballast) in the tumble dryer, set on the cycle which generates the correct exhaust temperatures as specified in Table III. For fibers that are heat sensitive, lower temperatures consistent with producer's recommendations are required and must be reported. Operate the dryer until the total load is dry. Remove the load immediately after machine stops.

7.3.2 (B) Line Dry. Hang each specimen by two corners with the fabric length

in the vertical direction. Allow the test specimens to hang in still air at room temperature until dry.

7.3.3 (C) Drip Dry. Hang each dripping wet specimen by two corners, with the fabric length in the vertical direction. Allow specimens to hang in still air at room temperature until dry.

7.3.4 (D) Screen Dry. Spread each specimen on a horizontal screen or perforated surface, removing wrinkles but not distorting or stretching, and allow to dry in still air at room temperature.

7.4 Repeat 7.2 and 7.3 for a total of five launderings.

7.5 After drying, condition the specimens for at least 4 h by laying each specimen separately on the screen or perforated shelf of a conditioning rack in an atmosphere of $21 \pm 1^{\circ}\text{C}$ ($70 \pm 2^{\circ}\text{F}$) and $65 \pm 2\%$ RH before evaluating color change.

8. Evaluation

8.1 Visual evaluation.

8.1.1 Rate the color change of the test specimens using the Gray Scale for Color Change. (Usage of the scale is discussed in Evaluation Procedure 1.)

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. Interpretation of Results

9.1 This test is a satisfactory end use test for demonstrating the effect of the 1993 AATCC Standard Reference Detergent WOB and non-chlorine bleach on textile materials in home laundering. The color change results will establish a level of performance that can be used to prepare care instructions to meet the requirements of the Federal Trade Commission (see 12.1).

9.2 If a significant color change is observed, an untreated duplicate sample could be retested using either this method with detergent only, or the 2A Test in AATCC Method 61, Colorfastness to Laundering, Home and Commercial: Accelerated, without the addition of non-chlorine bleach. This will determine whether the color change is due to dye instability or a bleach effect.

10. Report

10.1 Report the numerical average color change grade for each specimen tested.

10.2 Report washing procedure (Arabic and Roman Numerals) and drying procedure (capital letter from Table I; [i.e., (1) IIIA (iii)] means NORMAL cycle, wash water temperature of $41 \pm 3^{\circ}\text{C}$ ($105 \pm 5^{\circ}\text{F}$), tumble dry (permanent press).

10.3 Record the brand and quantity of the non-chlorine bleach used.

10.4 Report the oxidant content of the dosage.

10.5 Record the weight of fabric specimen or garment tested.

11. Precision and Bias

11.1 *Interlaboratory Test Data.* An interlaboratory study was carried out in 1986 to establish the precision of this method for determining the effect of non-chlorine bleach in home laundering on the colorfastness of textile materials.

Four materials were tested separately for five cycles of home laundering in duplicate at each of the five laboratories using one brand of non-chlorine bleach. After completing the laundering, three