

Test Method for Colorfastness to Powdered Non-Chlorine Bleach in Home Laundering

Developed in 1988 by AATCC Committee RA60; reaffirmed 1989, 1995, 2002; revised 1990, 1996, 1997, 2003, 2007 (with title change), 2010; editorially revised 1994, 2004, 2005, 2008, 2012, 2019; reaffirmed and editorially revised 2016.

1. Purpose and Scope

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

1.2 First establish the level of performance with powdered 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 powdered non-chlorine bleaches currently available contain ingredients other than the powdered 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, powdered 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 **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 materials.

3.3 **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.

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

3.4.1 **liquid non-chlorine bleach**, n.—a product that contains hydrogen peroxide as its active ingredient.

3.4.2 **powdered non-chlorine bleach**, n.—a product that contains either sodium perborate or sodium percarbonate as its active ingredient.

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 and the 2003 AATCC Standard Reference Liquid 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 percent active oxygen content outlined in 13.7 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; 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 Non-chlorine bleaches are available in two different forms—powdered or liquid. This method only evaluates the colorfastness of textiles to powdered non-chlorine bleach in home laundering. Due to differences in active ingredients, the results obtained by this method may not be representative of results obtained by the use of liquid non-chlorine bleach on textiles during laundering.

6. Apparatus and Materials (see 13.2)

6.1 Automatic washing machine (see 13.3).

6.2 Automatic tumble dryer (see 13.4).

6.3 Conditioning/drying racks with pull-out screens or perforated shelves (see 13.5).

6.4 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).

6.5 1993 AATCC Standard Reference Detergent WOB or 2003 AATCC Standard Reference Liquid Detergent WOB (see 13.6).

6.6 Facilities for drip and line drying.

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

6.8 Powdered non-chlorine bleach (see 13.7 and 13.8).

7. Test Specimens

7.1 The weight of the test specimen can influence the results of this test. 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 gar-

Table I—Washing and Drying Conditions (see 13.10)

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

ment weight exceeds the specified load weight of 1.8 kg or 4 lb, the total weight is to be included in the report. See 8.2.2 for exact weight specifications on load.

8. Procedure

8.1 Table I summarizes washing and drying conditions. Information on the machine and laundering conditions may be found in the AATCC LP1 (see 13.10).

8.2 Washing.

8.2.1 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.

8.2.2 Add 66 ± 1 g of 1993 AATCC Standard Reference Detergent WOB or 100 ± 1 g of 2003 AATCC Standard Reference Liquid Detergent WOB. Add the amount of the powdered non-chlorine bleach recommended by the manufacturer. 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 Table I and 8.1). Start the agitation and independently time the 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.

8.2.3 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 Table I and 8.1).

8.2.4 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.

8.3 Drying.

8.3.1 (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 AATCC LP1 (see 8.1). 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.

8.3.2 (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.

8.3.3 (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.

8.3.4 (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.

8.4 Repeat 8.2 and 8.3 for a total of five launderings.

8.5 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 $21 \pm 2^{\circ}\text{C}$ ($70 \pm 4^{\circ}\text{F}$) and $65 \pm 5\%$ RH before evaluating color change.

9. Evaluation

9.1 Evaluate the change in color in the test specimen by comparison with the Gray Scale for Color Change (AATCC EP1), or using AATCC EP7, Instrumental Assessment of the Change in Color of a Test Specimen, and record the numerical rating that corresponds to the appropriate one on the Gray Scale.

10. Interpretation of Results

10.1 This test is a satisfactory end use test for demonstrating the effect of the 1993 AATCC Standard Reference Detergent WOB or the 2003 AATCC Standard Reference Liquid Detergent WOB and powdered non-chlorine bleach on textile materials in home laundering.

10.2 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 TM61, Test Method for Colorfastness to Laundering: Accelerated, without the addition of powdered non-chlorine bleach. This will determine whether the color change is due to dye in-

stability or a bleach effect.

11. Report

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

11.2 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).

11.3 Report the type and amount of detergent used.

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

11.5 Report the percent available oxygen.

11.6 Record the weight of fabric specimen or garment tested.

12. Precision and Bias (see 13.9)

12.1 *Interlaboratory Test Data.* An interlaboratory study was carried out in 1986 to establish the precision of this test method for determining the effect of powdered 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 powdered non-chlorine bleach. After completing the laundering, three raters independently assessed the color change on each specimen of each fabric using the Gray Scale for Color Change. The washing and drying conditions were (1)IVa (see Table I for interpretation of code). Each of the 24×24 in. specimens that were washed separately ranged in weight from 72-97 g (0.16-0.21 lb). The fabrics were 100% cotton and polyester/cotton. Dyes were direct, pigment and disperse. The color change average grades for the three raters at the five laboratories were 3.33-3.93.

12.2 *Precision.* The components of variance as standard deviations of colorfastness grades were calculated to be as follows:

Single-operator component	0.22
Within-laboratory component	0.21
Between-laboratory component	0.00

For the components of variance reported above, the average of two color change grades should be considered significantly different at the 95% probability level if their difference equals or exceeds the critical differences listed in Table II.

12.3 *Bias.* The true value of colorfastness to non-chlorine bleach in home laundering can only be defined in terms of a test method. Within this limitation, this method has no known bias.