Designation: D6544 – 12

Standard Practice for Preparation of Textiles Prior to Ultraviolet (UV) Transmission Testing[1]

This standard is issued under the fixed designation D6544; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers standardized exposures to laundering, simulated sunlight, and chlorinated pool water to which cloth, labeled as ultraviolet-(UV) protective, must be exposed prior to testing for UV transmission.

1.2 This practice leads to measurement of the residual level of UV-protection in fabrics or garments labeled as sun- or UV-protective, after exposure to conditions that relate to about two years of seasonal use. The UV transmission measurements may be done in accordance with AATCC Test Method 183 using fabrics prepared in accordance with this practice. This measurement may be used in support of a label statement regarding UV protection.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D123 Terminology Relating to Textiles

D2905 Practice for Statements on Number of Specimens for Textiles (Withdrawn 2008)[3]

D3938 Guide for Determining or Confirming Care Instructions for Apparel and Other Textile Products

D6603 Specification for Labeling of UV-Protective Textiles

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

2.2 *AATCC Test Methods and Documents:*[4]

AATCC 16[E] Colorfastness to Light

AATCC 135 Dimensional Changes in Automatic Home Laundering of Woven or Knit Fabric

AATCC 162 Colorfastness to Water: Chlorinated Pool

AATCC 172 Colorfastness to Non-chlorine Bleach in Home Laundering

AATCC 183 Transmittance or Blocking of Erythemally Weighted Ultraviolet Radiation through Fabrics

Glossary of AATCC Standard Terminology

3. Terminology

3.1 *Definitions*—For definitions of other textile terms used in this practice, refer to Terminology D123 and the *Glossary of AATCC Standard Terminology.*

4. Summary of Practice

4.1 This practice directs the exposure of cloth, labeled as UV-protective, to conditions of laundering, simulated sunlight, and chlorinated pool water generally known to affect UV transmittance.

4.2 This practice directs selection and sequencing of exposure conditions for UV-protective fabrics and garments.

5. Significance and Use

5.1 The significance of this practice is that cloth, labeled as UV-protective, which will ultimately be submitted for UV transmittance testing will be in a state that simulates their condition at the end of two years of normal seasonal use. Therefore, the UV-protection level ultimately placed on a label estimates the maximum UV transmittance of the garment fabric during a two-year life cycle.

[1] This practice is under the jurisdiction of ASTM Committee D13 on Textilesand is the direct responsibility of Subcommittee D13.65 on UV Protective Fabrics and Clothing.

Current edition Feb. 1, 2012. Published February 2012. Originally approved in 2000. Last previous edition approved in 2011 as D6544 – 11. DOI: 10.1520/D6544-12.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709, http://www.aatcc.org.

6. Sampling and Test Specimens

6.1 *Primary Sampling Unit*—Consider rolls or bolts of fabric, or cartons of garments to be the primary sampling unit, as applicable.

6.1.1 Take the number of primary sampling units from each lot, shipment, or production run in accordance with Practice E122.

6.2 *Laboratory Sampling Unit:*

6.2.1 Take the number of laboratory sampling units from the primary sampling unit in accordance with Practice E122.

6.2.2 *Rolls or Bolts of Fabric*—Take from each primary sampling unit one full-width piece of fabric that is about 1 m (1 yd) in length along the selvage (machine direction), after removing a first 1-mm length. For narrow fabrics, a longer sample length may be required to meet the test specimen requirements.

6.2.3 *Garments*—Take from each primary sampling unit one entire garment. For small garments, such as children's, where sufficient material is not available to meet the three test specimens requirement, take a pair of garments and treat as one sampling unit.

6.3 *Laundering*—Unless exempt from laundering, launder the laboratory sampling unit or a section of it that is at least 380 by 380 mm (15 by 15 in.) using exposure conditions as described in 8.1. If the laboratory sampling unit does not have the minimum 380-mm dimension, then take a section that is at least 1450 cm^2 (225 $in.^2$). For small samples, it may be necessary to seal the edges to prevent raveling during laundering.

6.4 *Test Specimens*—As test specimens, take from each laboratory sampling unit at least three specimens of each fabric type in accordance with Practice D2905.

6.4.1 For simulated sunlight and chlorinated water testing, cut test specimens 125 by 180 mm (5 by 7 in.).

6.4.2 Cut specimens representing a broad distribution diagonally across the width of the laboratory sampling unit. Ensure specimens are free of folds, creases, or wrinkles. Avoid getting oil water, grease, and so forth on the specimens when handling. For printed fabrics, ensure that all colors in the pattern are contained in the test specimen.

6.4.3 For fabric widths 125 mm (5 in.) or more, take no specimen closer than 25 mm (1 in.) from the selvage edge.

6.4.4 For fabric widths less than 125 mm (5 in.) use the entire width for specimens.

6.4.5 When a garment is the laboratory sampling unit, take test specimens from various areas of the garment. Avoid taking specimens along seams.

6.4.6 When the required minimum of three specimens cannot be taken from one garment as might be the case with children's garments, then take two specimens from each of two garments, the pair of garments constituting a laboratory sampling unit.

6.4.7 When a garment is made from different fabrics, at least three test specimens are required of each fabric that covers 10 % or more of the body surface covered by the garment.

7. Procedure

7.1 For garments other than swimwear and fabrics intended to be made into garments other than swimwear, launder 40 times using the exposure conditions described in 8.1 and then take specimens from these fabrics and expose to 100 AATCC Fading Units of simulated sunlight in accordance with the conditions described in 8.2 (see Note 1).

NOTE 1—When this practice was first written 40 launderings was determined to simulate the equivalent to two years worth of wearing. Materials made of different fibers or colors, or both, can act differently to laundering. Some materials may produce higher UPF values, some will not change significantly, while others may produce lower UPF values after laundering. Without prior knowledge of how materials will act to laundering, 40 launderings is necessary to allow for the evaluation of the materials that will show a decrease in UPF values.

7.2 For swimwear and fabric intended for swimwear, launder 40 times in accordance with the exposure conditions described in 8.1. Then take specimens from the laundered fabrics or garments and expose those specimens to 100 AATCC Fading Units of simulated sunlight in accordance with the conditions described in 8.2 and then to chlorinated water in accordance with the conditions described in 8.3.

7.3 Garments and fabrics intended for use in garments other than swimsuits that are sold with the expectation they will not be laundered (such as disposable or limited-use garments for pesticide application) need only be exposed to simulated sunlight.

8. Exposure Conditions

8.1 *Laundering:*

8.1.1 *Conditions of Exposure*—Hand washing or automatic machine washing, wash water temperature, agitation cycle in automatic laundering, drying method and temperature if machine drying, and use of bleach must be those that will be conveyed to the consumer on the care label attached to the fabric/garment. Those conditions should have been determined by following Guide D3938.

8.1.1.1 Care procedures determined in accordance with Guide D3938 may be modified when it is established that those procedures increase the UV-transmittance of the fabric.

8.1.1.2 Follow one of the washing and drying procedures in AATCC 135 or AATCC 172 that matches the care instructions of the fabric or garment.

8.1.2 The specimens to be laundered may be garments, one-yard lengths of fabric, or areas of fabric having minimum dimensions of 380 by 380 mm (15 by 15 in.) or when applicable 1450 cm^2 (225 $in.^2$).

8.2 *Simulated Sunlight:*

8.2.1 A xenon-arc lamp must be used which limits the test conditions to those described in AATCC 16 [E].

8.2.2 For directions for preparing the specimens to be exposed to UV radiation, refer to the test preparation section of Test Method AATCC 16[E] noting that only two specimens are required and that the specimens are to be cut from the laundered specimens and omitting the section which refers to the testing of yarns, not fabrics.

8.3 *Chlorinated Pool Water:*

8.3.1 For preparation of the specimens to be exposed to chlorinated pool water, refer to the procedure section of Test Method AATCC 162. Ignore the reference to colored specimens as white specimens may also be exposed to chlorinated pool water conditions.

8.3.2 The specimens are those previously laundered and exposed to simulated sunlight.

8.3.3 For the exposure procedure, follow the procedure provided in the procedure section of Test Method AATCC 162 with the exception that the chlorine concentration in milligrams per kilogram should be adjusted so it is equal to the unit mass of the fabric specimen.

9. Report

9.1 Report that the specimens were prepared for UV transmission testing as directed in this practice. Describe the material or product samples.

9.2 *Specific Conditions of Each Exposure:*

9.2.1 Use Table X1.1 to report all applicable information about laundering conditions.

9.2.2 Use Table X1.2 to report all applicable information about simulated sunlight exposure.

9.2.3 Use Table X1.3to report all applicable chlorinated pool water exposure conditions.

9.3 *Deviations from Specified Conditions:*

9.3.1 Report any deviation from laundering conditions specified in AATCC 135 into Table X1.1.

9.3.2 Report any deviation from AATCC Test Method 16 [E] or the performance of the reference standard used in Table X1.2

9.3.3 Report any deviation from AATCC 162 in Table X1.3.

10. Keywords

10.1 care labeling; chlorinated pool water effects; laundering effects; simulated sunlight exposure effects; sunbathing; swimwear; UV-protective fabrics; UV transmission testing

ANNEX

(Mandatory Information)

A1. UV PROTECTIVE TEST METHODS

INTRODUCTION

Manufacturers and producers of UV protective textile materials or products, or both, must be aware of the proper existing standards and test methods to meet published voluntary standards for labeling UV protective clothing for the United States.

A1.1 There are three published voluntary standards:

A1.1.1 ASTM 6544 – Practice for Preparation of Textiles Prior to Ultraviolet (UV) Transmission Testing

A1.1.2 ASTM D6603 – Specification for Labeling of UV Protective Textiles

A1.1.3 AATCC 183 – Transmittance or Blocking of Erythemcally Weighted Ultraviolet Radiation Through Fabrics

A1.2 To summarize at a high level, these three standards are used in conjunction with one another to develop the proper UPF values to properly label products as “UV Protective.”

A1.2.1 Evaluate UV transmission of original specimen (“unprepared”) or “laundered once” specimen using AATCC 183. The value reported is the AATCC 183 UPF value.

A1.2.2 Refer to ASTM 6544 to determine the exposure conditions depending on the product end use. Section 7 lists three options for exposure conditions. Exposure conditions may reference the following test methods and reflect a combination of multiple exposure conditions following these test methods:

A1.2.2.1 ASTM D3938
A1.2.2.2 AATCC 16
A1.2.2.3 AATCC 135
A1.2.2.4 AATCC 162
A1.2.2.5 AATCC 172

A1.2.3 After subjecting the specimens to the specified exposure conditions of ASTM 6544, evaluate UV transmission using AATCC 183. This specimen is referred to as the “prepared-for-testing” specimen, based on the end use of the garment/fabric.

A1.2.4 Refer to ASTM D6603 for additional calculations that need to be performed on the values obtained from AATCC 183.

A1.2.5 Classification for labeling the UPF value are outlined in ASTM D6603, Section 8.

APPENDIX

(Nonmandatory Information)

X1. EXPOSURE REPORT FORMS

X1.1 See Table X1.1, Table X1.2, and Table X1.3.

TABLE X1.1 Laundering Exposure Report Form

Operator's name_____Date_____

Sample identification_____

Check exposures used:

Machine Cycle:	Washing temperature, °C (°F)[A]	Drying procedure:[B]
Normal /cotton/sturdy	27 ± 3 (80 ± 5)	Tumble cotton study
Delicate	41 ± 3 (105 ± 5)	Tumble, delicate
Permanent press	49 ± 3 (120 ± 5)	Tumble, permanent press
	60 ± 3 (140 ± 5)	Line
		Drip
		Screen

[A]Deviations from washing machine conditions as described in Table II AATCC 135-1995.
[B]Deviations from drying settings in Table III AATCC 135-1995.

TABLE X1.2 Chlorinated Pool Water Exposure Form

Operator's name_____Date_____

Sample Identification_____

Deviations from the procedure in AATCC 162:

TABLE X1.3 Sunlight Exposure Report Form

Operator's name_____Date_____

Sample Identification_____

Material exposed: Face_____Back_____

Reference standard_____

Exposure Controlled by: AATCC Blue Wool Lightfastness Standards_____

Radiant energy_____Other_____

Total radiant energy_____

Type of test apparatus_____Model Number_____

Serial number_____Manufacturer's name_____

Specimen rack: Inclined_____2-Tier_____3-Tier_____Horizontal_____

Type of water supply_____

Option employed_____Elapsed exposure time_____

Mounting procedure: Backed_____Unbacked:_____

Sample rotation schedule_____Percent relative humidity_____

Deviations from the test procedure: