



Designation: D6544 – 21

Standard Practice for Preparation of Textiles Prior to Ultraviolet (UV) Transmission Testing¹

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 simulate two years of seasonal exposure for apparel textiles labeled as ultraviolet (UV)-protective.

1.2 This practice is used in conjunction with AATCC TM183 and Specification D6603 as they relate to testing and labeling of UV-protective textiles after two years of simulated seasonal use.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

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

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D123 Terminology Relating to Textiles

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

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

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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.

Specified Precision, the Average for a Characteristic of a Lot or Process

2.2 *AATCC Test Methods and Documents:*³

AATCC LP1 Laboratory Procedure for Home Laundering: Machine Washing

AATCC LP2 Laboratory Procedure for Home Laundering: Hand Washing

AATCC M11 Glossary of AATCC Standard Terminology

AATCC TM16.3 Colorfastness to Light: Xenon-Arc

AATCC TM162 Test Method for Colorfastness to Water: Chlorinated Pool

AATCC TM172 Test Method for Colorfastness to Powdered Non-chlorine Bleach in Home Laundering

AATCC TM183 Test Method for Transmittance or Blocking of Erythemally Weighted Ultraviolet Radiation through Fabrics

AATCC TM188 Test Method for Colorfastness to Sodium Hypochlorite Bleach in Home Laundering

3. Terminology

3.1 *Definitions*—For definitions of other textile terms used in this practice, refer to Terminology D123 and AATCC M11.

4. Summary of Practice

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

4.2 This practice guides selection and sequencing of exposure conditions for textiles intended to be labeled as UV-protective.

5. Significance and Use

5.1 The significance of this practice is that a textile intended to be labeled as UV-protective, which will ultimately be submitted for UV transmittance testing, will be in a state that simulates its condition at the end of two years of normal seasonal use. UV resistance of a textile is dynamic and will

³ Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709, <http://www.aatcc.org>.

constantly change. The simulated conditions are to be regarded as only estimates of the changes that will occur to the textile in two years of normal seasonal use.

5.2 To learn the quantitative measure of UV transmission or blocking, reference AATCC TM183.

5.3 To label textiles as UV-protective, reference Specification D6603.

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 cm² (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.

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. See Table 1 for a summary of laundering options.

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.

TABLE 1 Laundering Options

Test Method	Detergent	Detergent Type	Bleach Options
AATCC LP1	AATCC with OBA	Powdered	Do not bleach
AATCC TM172	AATCC without OBA	Powdered	Powdered non-chlorine
AATCC TM188	AATCC without OBA	Powdered	Sodium hypochlorite
AATCC LP2	AATCC with OBA	Powdered	Do not bleach
AATCC LP2, modified	AATCC without OBA	Powdered	Powdered non-chlorine

8.1.1.2 Follow the standard washing and drying procedures in AATCC LP1 or LP2 that matches the care instructions of the fabric or garment.

8.1.1.3 Follow one of the procedures in AATCC TM172 or AATCC TM188 if applying bleach is necessary. Follow quantity advised by manufacturer or as agreed upon.

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 cm² (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 TM16.3. Use Option 3 of AATCC TM16.3 for continuous light and a black panel thermometer.

8.2.2 For directions for preparing the specimens to be exposed to simulated sunlight, refer to the test preparation section of AATCC TM16.3 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. Expose an area at least 50 by 50 mm on each specimen.

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 AATCC TM162. 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 AATCC TM162 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 X1.3** to 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 LP1, AATCC TM172, AATCC TM188 or AATCC LP2 into **Table X1.1**.

9.3.2 Report any deviation from AATCC TM16.3 or the performance of the reference standard used in **Table X1.2**

9.3.3 Report any deviation from AATCC TM162 in **Table X1.3**.

10. Keywords

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

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ANNEX

<https://standards.iteh.ai/catalog/standards/sist/9419e452-2662-41d6-b925-d90880dfd4d6/astm-d6544-21>

(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 D6544 – 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 TM183 – Test Method for Transmittance or Blocking of Erythemally 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 TM183. The value reported is the AATCC TM183 UPF value.

A1.2.2 Refer to ASTM D6544 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 TM16.3

A1.2.2.3 AATCC LP1

- A1.2.2.4 AATCC TM162
- A1.2.2.5 AATCC TM172
- A1.2.2.6 AATCC TM188
- A1.2.2.7 AATCC LP2

A1.2.4 Refer to ASTM **D6603** for additional calculations that need to be performed on the values obtained from AATCC TM183.

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

A1.2.3 After subjecting the specimens to the specified exposure conditions of ASTM D6544, evaluate UV transmission using AATCC TM183. This specimen is referred to as the “prepared-for-testing” specimen, based on the end use of the garment/fabric.

APPENDIX

(Nonmandatory Information)

X1. EXPOSURE REPORT FORMS

X1.1 See [Table X1.1](#), [Table X1.2](#), and [Table X1.3](#).

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