



Standard Performance Specification for Woven and Knitted Sheeting Products for Institutional and Household Use¹

This standard is issued under the fixed designation D 5431; 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 specification covers the evaluation of specific performance characteristics of importance in woven and knit flat, fitted, and waterbed sheet products for use in institutional and household environments.

1.2 This specification may be used by mutual agreement between the purchaser and the supplier to establish purchasing specification requirements.

1.3 The requirements in Table 1 apply to the length and width directions for those properties where fabric direction is pertinent.

1.4 This specification is not applicable to woven and knit products used for sheet blankets or to woven and knitted sheet products used for apparel.

1.5 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 123 Terminology Relating to Textiles²
- D 629 Test Methods for Quantitative Analysis of Textiles²
- D 1230 Test Method for Flammability of Textiles²
- D 1424 Test Method for Tear Resistance of Woven Fabrics by Falling Pendulum (Elmendorf) Apparatus²
- D 1776 Practice for Conditioning Textiles for Testing²
- D 2262 Test Method for Tearing Strength of Woven Fabrics by the Tongue (Single Rip) Method (Constant-Rate-of-Travel Tensile Testing Machine)²
- D 2905 Practice for Statements on Number of Specimens for Textiles²
- D 3136 Terminology for Permanent Care Labels for Consumer Textile and Leather Products Other than Carpets and Upholstery²
- D 3512 Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Random Tumble

Pilling Tester Method³

- D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics—Diaphragm Bursting Strength Tester Method³
- D 3787 Test Method for Bursting Strength of Knitted Goods Constant-Rate-of-Travel (CRT) Ball Burst Test³
- D 3882 Test Method for Bow and Skewness in Woven and Knitted Fabrics³
- D 3938 Guide for Evaluation of Textile Products in Relation to Refurbishing Described on Care Labels³
- D 5034 Test Method for Breaking Force and Elongation of Textile Fabrics (Grab Test)³

2.2 AATCC Methods:⁴

- 8 Colorfastness to Crocking: AATCC Crockmeter Method
- 15 Colorfastness to Perspiration
- 16A Colorfastness to Light: Carbon-Arc Lamp, Continuous Light
- 16E Colorfastness to Light: Water-Cooled Xenon-Arc Lamp, Continuous Light
- 61 Colorfastness to Laundering, Home, and Commercial: Accelerated
- 88B Appearance of Seams in Durable Press Items After Repeated Home Launderings
- 96 Dimensional Changes in Commercial Laundering of Woven and Knitted Fabrics Except Wool
- 116 Colorfastness to Crocking: Rotary Vertical Crockmeter Method
- 124 Appearance of Fabrics After Repeated Home Laundering
- 135 Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics
- 143 Appearance of Apparel and Other Textile End Products After Repeated Home Launderings
- Evaluation Procedure 1 Gray Scale for Color Change
- Evaluation Procedure 2 Gray Scale for Staining
- Evaluation Procedure 3 AATCC Chromatic Transference Scale

NOTE 1—Reference to test methods in this specification give only the pertinent part of the designation of ASTM, AATCC, or other test methods. The current edition of each test method shall prevail.

¹ This specification is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.63 on Home Furnishings.

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² *Annual Book of ASTM Standards*, Vol 07.01.

³ *Annual Book of ASTM Standards*, Vol 07.02.

⁴ Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709.

TABLE 1 Specification Requirements

Characteristics	Requirements				Section
	Non-flannel		Woven	Knitted	
	Polyester/Cotton	100 % Cotton	Flannel	Flannel/Non-flannel	
Breaking Force					7.1
CRT Method Each Direction ^A	222 N (50 lbf) min	178 N (40 lbf) min	156 N (35 lbf) min		
Bursting Force ^A				222 N (50 lbf) min	7.1.2
Tear Resistance, Elmendorf ^A					7.1.3
Each Direction	7 N (1.5 lbf) min	7 N (1.5 lbf) min	7 N (1.5 lbf) min		
Pilling	4.0	NA	NA	4.0	7.1.4
Dimensional Change:					7.1.5
Durable Press (In Each Direction)	2 % max	3 % max	3.5 % max	4 % max	
Nondurable Press (Nonpreshrunk)					
Length	8 % max	8 % max	8 % max		
Width	6 % max	6 % max	6 % max		
Preshrunk (In Each Direction)	2 % max	3 % max	3.5 % max		
Laundered Appearance	Acceptable	Acceptable	Acceptable	Acceptable	7.2.1
Fabric Appearance	SA 3.0 min	SA 2.2 min ^B	NA	SA 3.0 min	7.1.6
Bow and Skewness	3 % max	3 % max	3 % max	3 % max	7.1.7
Colorfastness To: ^C					
Laundering:					7.1.8.1
Alteration in Shade	Class 4 min ^D	Class 4 min ^D	Class 4 min ^D	Class 4 min ^D	
Staining	Class 3 min ^E	Class 3 min ^E	Class 3 min ^E	Class 3 min ^E	
Crocking:					7.1.8.2
Dry	Class 4 min ^F	Class 4 min ^F	Class 4 min ^F	Class 4 min ^F	
Wet	Class 3 min ^F	Class 3 min ^F	Class 3 min ^F	Class 3 min ^F	
Light (20 AATCC FU), Xenon-Arc ^E	Step 4 min ^D	Step 4 min ^D	Step 4 min ^D	Step 4 min ^D	7.1.8.3
Perspiration					7.1.8.4
Alteration in Shade	Class 4 min ^D	Class 4 min ^D	Class 4 min ^D	Class 4 min ^D	
Staining	Class 3 min ^E	Class 3 min ^E	Class 3 min ^E	Class 3 min ^E	
Flammability	Class I	Class I	Class I	Class I	7.1.9

^AThere is more than one standard method that can be used to measure breaking force, bursting force, tear resistance, and lightfastness. These methods cannot be used interchangeably since there may be no overall correlation between them. See Notes 2-5 and Note 8.

^BRecommended requirement for Easy Care Products which must be ironed.

^CClass in colorfastness and 5A rating is based on a numerical scale of 5.0 for negligible color change, color transfer, or wrinkling to 1.0 for very severe color change, color transfer or wrinkling. The numerical rating in Table 1 or higher is acceptable.

^DAATCC Gray Scale for Color Change.

^EAATCC Gray Scale for Staining.

^FAATCC Chromatic Transference Scale.

3. Terminology

3.1 Definitions:

3.1.1 *fitted sheet, n—in textiles*, a product usually made with boxed corners, sometimes elasticized with shape and size to conform to the contours of the mattress and used for covering the mattress on a bed.

3.1.2 *flannel, n—as applied to bed sheeting*, a napped fabric used in the fabrication of sheeting products.

3.1.3 *flat sheet, n—in textiles*, a flat, hemmed product, usually rectangular, used for covering the mattress on a bed and used for sleeping on or under.

3.1.4 *muslin, n—as applied to bed sheeting*, a plain weave fabric with not fewer than 128 yarns/in.² (645 mm²).

3.1.5 *percale, n—as applied to bed sheeting*, a plain weave fabric with not fewer than 180 yarns/in.² (645 mm²).

3.1.6 *sheet, n—in textiles*, a large rectangular usually plain woven fabricated product which is used over a mattress on a bed. The product may be carded or combed yarn in a wide range of constructions.

3.1.7 For definitions of other textile terms used in this specification, refer to the individual ASTM and AATCC test methods, Terminology D 123 and Terminology D 3136, or your dictionary.

4. Significance and Use

4.1 Upon mutual agreement between the purchaser and the

supplier, woven and knitted products intended for this end use should meet all of the requirements listed in Table 1 of this specification.

4.2 It is recognized that for purposes of fashion or aesthetics, the ultimate consumer of articles made from these fabrics may find acceptable products that do not conform to all of the requirements in Table 1. Therefore, one or more of the requirements listed in Table 1 may be modified by mutual agreement between the purchaser and the supplier.

4.2.1 In such cases, any references to the specification shall specify that: “This product meets ASTM Specification ____ except for the following characteristic(s).”

4.3 Where no prepurchase agreement has been reached between the purchaser and the supplier, and in case of controversy, the requirements listed in Table 1 are intended to be used as a guide only. As noted in 4.2, ultimate consumer demands dictate varying performance parameters for any particular product.

4.4 The uses and significance of particular properties and test methods are discussed in the appropriate sections of the specified test methods.

5. Sampling

5.1 *Acceptance Testing Lot*—Unless there is prior agreement, consider as a lot for acceptance testing all material of a single item as a single shipment.

5.2 *Lot Samples and Laboratory Samples*—For acceptance testing, take lot samples and laboratory samples as directed in each of the applicable test methods.

5.3 *Specimens*—Take the number of specimens directed in each of the applicable test methods. Perform the tests on the products as it reaches the customer. Any “partially finished” or “post-finish” fabrics should be processed in accordance with the fabric manufacturer’s instructions.

5.4 If the applicable test method does not specify the number of specimens, use the procedures in Practice D 2905 to determine the number of specimens per laboratory sample unit.

5.4.1 Use a reliable estimate of the variability of individual observations on similar materials in the user’s laboratory,

5.4.2 A 95 % probability level, and

5.4.3 An allowable difference of 5 % of the average between the test results on laboratory sampling units and the average for the laboratory sampling unit.

5.4.4 The average for a laboratory sampling unit is the average that would be obtained by applying the test method to all of the potential specimens from that laboratory sampling unit.

6. Specification Requirements

6.1 The properties of institutional and household sheet products shall conform to the specification requirements in Table 1 or by mutual agreement between the purchaser and the supplier.

7. Testing For Household and Institutional Use

7.1 *Test Methods—Fabric*—The physical and colorfastness properties of the fabrics in the sheet products shall be evaluated as directed as follows:

7.1.1 *Breaking Force*—Determine the breaking force as directed in the grab test procedure of Test Method D 5034, using a constant-rate-of-traverse (CRT) tensile testing machine with the speed of the pulling jaw at 300 ± 10 mm/min (12 ± 0.5 in./min).

NOTE 2—If preferred, a constant-rate-of-extension (CRE) tensile testing machine may be used. The crosshead speed should be as agreed upon between the purchaser and the supplier. There may be no overall correlation between the results obtained with the CRT machine and with the CRE machine. Consequently, these two breaking load testers cannot be used interchangeably. In case of controversy, the CRT method shall prevail.

7.1.2 *Bursting Force (Knit Fabrics Only)*—Determine the bursting force of knit fabrics in the standard atmosphere for testing textiles, as directed in Test Method D 3786 or Test Method D 3787 as agreed upon between the purchaser and the supplier.

NOTE 3—There is no overall correlation between the results obtained with the CRT machine equipped with a bursting attachment and the diaphragm bursting tester. Consequently, these two bursting testers cannot be used interchangeably. In the case of controversy, the motor-driven diaphragm tester method (Test Method D 3786) shall prevail.

NOTE 4—The precision of the bursting strength testers has not been established. The methods are accordingly not recommended for acceptance testing unless preceded by an interlaboratory check in the laboratories of the purchaser and the supplier, using randomized replicate specimens of the material to be evaluated.

7.1.3 *Tear Resistance*—Determine the tear resistance of

woven fabrics as directed in Test Method D 1424.

NOTE 5—If preferred, the use of Test Methods D 2261 or D 2262 is permitted, with existing requirements as given in this specification. There may be no overall correlation between the results obtained with the tongue tear testers and the Elmendorf Tester. Consequently, these three testers cannot be used interchangeably. In case of controversy, Test Method D 1424 shall prevail.

7.1.4 *Pilling*—Determine pilling as directed in Test Method D 3512 with a test time (run time) of 30 min.

7.1.5 *Dimensional Change*—Determine the maximum dimensional change after five launderings following permanently attached care label instructions and as directed in AATCC Method 135 for household use or AATCC Method 96 for institutional use as agreed upon between the purchaser and the supplier.

7.1.5.1 The wash conditions and drying procedure shall be as specified by the seller when using AATCC Method 135 for household products or AATCC Method 96 for institutional products.

7.1.5.2 When chlorine bleach is to be used, introduce one cup of any liquid chlorine household bleach containing 5.25 % sodium-hypochlorite (5.0 % available chlorine) into the washer in the manner directed on the bleach container. When non-chlorine bleach is to be used, introduce it into the washer in the amount and manner directed on the bleach container.

NOTE 6—Nondurable press items can be flat bed pressed after tumble drying to eliminate wrinkles before measuring.

7.1.6 *Fabric Appearance*—Determine the smoothness appearance of non-flannel fabric products after five launderings as directed in Test V-A of AATCC Method 124 unless otherwise agreed upon between the purchaser and the supplier.

7.1.7 *Bow and Skewness*—Before and after laundering, determine the bias of the sheeting fabrics as directed in Method D 3882 or by mutual agreement between the purchaser and the supplier.

7.1.8 *Colorfastness:*

7.1.8.1 *Laundering*—Determine the colorfastness to laundering as directed in Test 4-A of AATCC Method 61 unless otherwise agreed upon between the purchaser and the supplier. Use Multifiber Test Fabric No. 10⁵, to determine the staining characteristics.

NOTE 7—For all unbleachable items, Test 3-A will be used.

7.1.8.2 *Crocking*—Determine colorfastness to dry and wet crocking as directed in AATCC Method 8 for solid shades and AATCC Method 116 for prints or as agreed upon between the purchaser and the supplier.

7.1.8.3 *Light*—Determine colorfastness to light as directed in AATCC Method 16A or AATCC Method 16E.

NOTE 8—There is a distinct difference in spectral distribution between the xenon fading lamp apparatus and the enclosed carbon-arc (not sunshine-carbon arc). Consequently, these two fading apparatus cannot be used interchangeably since there is no known overall correlation between them. In case of controversy, AATCC Method 16E shall prevail.

7.1.8.4 *Perspiration*—Determine colorfastness to perspiration as directed in AATCC Method 15.

⁵ Multifiber Test Fabric, No. 10 is available from Test Fabrics, Inc., P.O. Box 420, Middlesex, NJ 08841.

7.1.9 *Flammability*—The flammability requirements shall be as agreed upon between the purchaser and the supplier, except when regulated by applicable government mandatory standards. If flammability is to be tested, Method D 1230 can be used as the method of evaluation. Test only as received. Do not launder or dryclean.

7.2 *Product*:

7.2.1 *Appearance*—Evaluate before and after laundering for appearance of fabric and all component parts such as seams and trim. Mount and evaluate as directed in Section 7 of AATCC Method 143 using appropriate standards as described in AATCC Methods 88B and 124. Acceptable performance requirements shall be as agreed upon between the purchaser and the supplier.

8. Report

8.1 State that the specimen(s) were tested as directed in Performance Specification D 5431. Describe the fiber content, the type of fabric, the type(s) of sheeting product tested, and identify the components.

8.2 The report shall include the following additional information:

- 8.2.1 Objective of the test,
- 8.2.2 Description and identification of sheeting product(s),
- 8.2.3 Description of the method of sampling used,
- 8.2.4 List of performance characteristics evaluated, the test method used for each and the results of each,
- 8.2.5 Number of laundering cycles and the wash conditions used, and
- 8.2.6 Conclusion, if appropriate.

9. Conformance

9.1 When the purchaser and the supplier have agreed upon specific requirements for the characteristics that are to be considered, sheeting products that fail to meet these requirements may be rejected. Rejection should be reported to the supplier in writing. In case of disagreement with the results of the test, the supplier may make claim for a retest.

10. Keywords

- 10.1 household; institutional; sheeting products

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