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Standard Performance Specification for Women's and Girls' Knitted Sportswear Fabrics[1]

This standard is issued under the fixed designation D4156; 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 performance specification covers knitted fabrics comprised of any textile fiber or mixture of fibers, used in women's and girl's sportswear.

1.2 These requirements apply to the length and width directions for those properties where each fabric direction is pertinent.

1.3 *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:*[2]

D123 Terminology Relating to Textiles

D2594 Test Method for Stretch Properties of Knitted Fabrics Having Low Power

D2724 Test Methods for Bonded, Fused, and Laminated Apparel Fabrics

D3786 Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method

D3787 Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test

D7022 Terminology Relating to Apparel

2.2 *AATCC Methods:*[3]

8 Colorfastness to Crocking: Crockmeter Method

15 Colorfastness to Perspiration

16.3 Colorfastness to Light: Xenon-Arc

23 Colorfastness to Burnt Gas Fumes

61 Colorfastness to Laundering: Accelerated

116 Colorfastness to Crocking: Rotary Vertical Crockmeter Method

124 Smoothness Appearance of Fabrics after Repeated Home Laundering

132 Colorfastness to Drycleaning

135 Dimensional Changes of Fabric after Home Laundering

172 Colorfastness to Powdered Non-chlorine Bleach in Home Laundering

188 Colorfastness to Sodium Hypochlorite Bleach in Home Laundering

Evaluation Procedure 1 Gray Scale for Color Change

Evaluation Procedure 2 Gray Scale for Staining

Evaluation Procedure 3 AATCC 9-Step Chromatic Transference Scale

A Glossary of AATCC Standard Terminology

2.3 *Federal Standard:*[4]

16 CFR, Chapter II—Consumer Product Safety Commission Subchapter D—Flammable Fabrics Act Regulations.

2.4 *Military Standard:*[5]

MIL-STD-105D Sampling Procedures and Tables for Inspection by Attributes

NOTE 1—Reference to test methods in this standard give only the permanent part of the designation of ASTM, AATCC, or other test methods. The current editions of each test method cited shall prevail.

3. Terminology

3.1 For all terminology related to Apparel, see Terminology D7022.

3.1.1 The following terms are relevant to this standard: sheer.

3.2 For definitions of all other textile terms see Terminology D123.

3.3 For terms relating to chemical or colorfastness testing, refer to specific AATCC test methods, or the Glossary of AATCC Standard Terminology, or both.

4. Specification Requirements

4.1 The properties of knitted fabrics for women's and girls' sportswear shall conform to the specification requirements in Table 1.

[1] This peformance specification is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.61 on Apparel.

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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.

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

[4] Available from Superintendent of Documents, Government Printing Office, Washington, DC 20402.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

TABLE 1 Specification Requirements

NOTE 1—Grade in colorfastness is based on a numerical scale of 5 for negligible color change or color transfer to 1 for very severe color change or color transfer.

Characteristic	Requirements		Section
	Sheer Fabric	Nonsheer Fabrics	
Bursting strength (ball burst)[A]	133 N (30 lbf), min	222 N (50 lbf), min	7.1
Dimensional change:			
Pressing and finishing	2 % max	2 % max	7.2.1
Laundering (see 7.2.2.2)	3 % max	3 % max	7.2.2
Drycleaning	3 % max	3 % max	7.2.3
Colorfastness:			
Burnt gas fumes, 2 cycles:			7.3.1
Shade change, original	Grade 4[B] min	Grade 4[B] min	
Shade change, after laundering or one drycleaning	Grade 4[B] min	Grade 4[B] min	
Laundering:[E]			7.3.2
Shade change	Grade 4[B] min	Grade 4[B] min	
Staining	Grade 3[C] min	Grade 3[C] min	
Drycleaning:			7.3.3
Shade change	Grade 4[B] min	Grade 4[B] min	
Crocking:[E]			7.3.4
Dry	Grade 4[D] min	Grade 4[D] min	
Wet	Grade 3[D] min	Grade 3[D] min	
Perspiration:[E]			7.3.5
Shade change	Grade 4[B] min	Grade 4[B] min	
Staining	Grade 3[C] min	Grade 3[C] min	
Light (40AATCC FU) (xenon-arc)	Grade 4[B] min	Grade 4[B] min	7.3.6
Sodium Hypochlorite Bleach	Grade 4[B] , min	Grade 4[B] , min	7.3.7
Powdered Non-chlorine Bleach	Grade 4[B] , min	Grade 4[B] , min	7.3.8
Fabric smoothness appearance (see 7.4.1)	SA 3.5 min	SA 3.5 min	7.4
Flammability	pass	pass	7.5

[A] There is more than one standard method that can be used to measure bursting strength, and lightfastness. These methods cannot be used interchangeably since there may be no overall correlation between them (see Note 2 and Note 3).
[B] AATCC Gray Scale for Color Change.
[C] AATCC Gray Scale for Staining.
[D] AATCC 9-Step Chromatic Transference Scale.
[E] See Note 8.

5. Significance and Use

5.1 Upon mutual agreement between the purchaser and the seller, fabrics intended for this end use should meet all of the requirements listed in Table 1 of this performance specification.

5.2 It is recognized that for purposes of fashion or aesthetics the ultimate consumer of articles made from these fabrics may find acceptable fabrics 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 seller.

5.2.1 In such cases, any references to the specification shall specify that: "This fabric meets ASTM Specification D4156 except for the following characteristic(s)."

5.3 Where no prepurchase agreement has been reached between the purchaser and the seller, and in case of controversy, the requirements listed in Table 1 are intended to be used as a guide only. As noted in 5.2, ultimate consumer demands dictate varying performance parameters for any particular style of fabric.

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

6. Sampling

6.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls as directed in an applicable specification or other agreement between the purchaser and the supplier, such as an agreement to use MIL-STD-105D.

6.2 *Laboratory Sample*—From each roll or piece in the lot sample, cut two laboratory samples the full width of the fabric and at least 375 mm (15 in.) along the selvage,

7. Test Methods (See Note 1)

7.1 *Bursting Strength*—Determine the bursting strength as directed in Test Methods D3786 or D3787 as agreed between the purchaser and the seller.

NOTE 2—Care should be taken to subtract the tare diaphragm pressure from the gross pressure to obtain actual bursting strength of fabric when using the diaphragm bursting tester. Calibrate the equipment according to the manufacturer's instruction before use. Since there is no overall correlation between the results obtained with the CRT machine equipped with a bursting attachment and the diaphragm bursting tester, these two bursting testers cannot be used interchangeably. In case of controversy, Test Method D3786 shall prevail.

NOTE 3—The precision of the ball burst method using the CRT machine equipped with a bursting attachment and the precision of the diaphragm bursting tester method are being established by Subcommittee D13.59. The methods are accordingly not recommended for acceptance testing unless preceded by an interlaboratory test in the laboratory of the purchaser and the laboratory of the seller using randomized replicate specimens of the type of material to be evaluated.

7.2 *Dimensional Change:*

7.2.1 *Pressing and Finishing During Garment Manufacturing*—Mark specimen(s) as directed in Section 4.5 of AATCC Method 135. Press and finish specimen(s) as agreed

upon by the purchaser and the seller with respect to time cycles, temperature, steam, vacuum, and mechanical pressure of the press head. Measure the specimen(s) and calculate the dimensional change as directed in Sections 6 and 7 of AATCC Method 135 (see Note 4).

7.2.1.1 If no agreement has been made between the purchaser and the seller, press the specimen(s) using a flat-bed steam press according to the cycle in 10.1.4 through 10.1.4.5 of Test Methods D2724.

NOTE 4—No standard method is available for reproducing on a laboratory level the results of industrial pressing or finishing treatments used in the manufacture of sportswear from knitted fabrics.[6]

7.2.2 *Laundering*—Determine the maximum dimensional change after five launderings or as agreed between the purchaser and the seller as directed in the applicable procedure in AATCC Method 135 (see Note 5 and Note 6).

7.2.2.1 The wash conditions and drying procedure shall be as specified by the seller.

7.2.2.2 When the dimensional change after five launderings exceeds 3 %, determine the stretch of the fabric after five launderings as directed in Test Methods D2594 using 2.2-N (0.5-lbf) load. If the difference between the percent stretch of the laundered fabric and the percent shrinkage due to laundering does not exceed 3 % shrinkage then the fabric meets the specification requirement in Table 1.

7.2.3 *Drycleaning*—Determine the maximum dimensional change after three drycleanings or as agreed between the purchaser and the seller in accordance with Sections 10.1.1 through 10.1.5 of Test Methods D2724 (Notes 5 and 6).

NOTE 5—Launderable fabrics are expected to be drycleanable except where all or part of the fabric is not drycleanable and is so labeled. For example, the fabric could contain a functional finish soluble in the solvent, or the fiber could be degraded by the solvent, which would be the case with poly(vinyl chloride) fiber. "Drycleanable" goods are to be drycleaned only.

NOTE 6—Specimens prepared for 7.2.1 may be used for 7.2.2 and 7.2.3 as desired. When this is done the dimensional change due to laundering or drycleaning is calculated using Eq 1. The dimensional change to pressing and finishing is determined on the fabric as it will reach the user. It is not additive to the dimensional change to laundering or drycleaning of the fabric as it will reach the consumer (see 6.1).

$$\text{Percent Dimensional Change} = 100\,(D_1 - D_2)/D_2 \qquad (1)$$

where:

D_1 = measurement after laundering or drycleaning, and
D_2 = measurement after pressing and finishing.

7.3 *Colorfastness:*

7.3.1 *Burnt Gas Fumes*—Determine the colorfastness to burnt gas fumes on the original fabric and after one laundering or one drycleaning as directed in AATCC Method 23 after 2 cycles.

NOTE 7—Washing conditions shall be the same as those used in 7.2.2.1. Drycleaning conditions shall be the same as those used in 7.2.3.

7.3.2 *Laundering*—Determine the colorfastness to laundering as directed in the applicable procedure of AATCC Method 61. The test conditions shall be as specified by the seller (see Note 6).

NOTE 8—It has been reported that the results for staining, obtained by standard AATCC Test Methods, on fabrics dyed to dark shades that contain a combination of polyester and spandex, or their blends, may not show the full staining propensity of such fabrics in consumer use. It is, therefore, recommended that the staining results obtained by these tests not be used for acceptance testing of such fabrics.

7.3.3 *Drycleaning*—Determine colorfastness to drycleaning as directed in AATCC Method 132 (see Note 6).

7.3.4 *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 between the purchaser and the seller (see Note 8).

7.3.5 *Perspiration*—Determine colorfastness to perspiration as directed in AATCC Method 15 (see Note 8).

7.3.6 *Light*—Determine colorfastness to light as directed in AATCC Method 16.3 – Option 3.

7.3.7 *Colorfastness to Sodium Hypochlorite Bleach*—Determine colorfastness to light as directed in AATCC Method 16. The test conditions shall be as specified by the seller.

7.3.8 *Colorfastness to Powdered Non-chlorine Bleach*—Determine colorfastness to light as directed in AATCC Method 16. The test conditions shall be as specified by the seller.

7.4 *Fabric Smoothness Appearance*—Determine the fabric appearance as directed in AATCC Method 124 after laundering using the wash-and-wear cycle or the normal cycle as agreed between the purchaser and the seller as specified in 7.2.1.1 for washable fabrics, or after drycleaning as specified in 7.2.2 for drycleanable fabrics (see Note 4).

7.4.1 The fabric smoothness (SA) rating of such fabrics, and the SA rating of drycleaning fabrics shall have decreased no more than 0.5 SA rating from that of the fabric before it is laundered or drycleaned.

7.5 *Flammability*—The flammability requirements shall be as agreed between the purchaser and the seller, provided they meet or exceed those of Part 1610 of the Flammable Fabrics Act Regulations.

8. Keywords

8.1 sportswear

[6] The development of a standard method has been referred to Subcommittee D13.59 on Fabric Test Methods, General.