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## Standard Performance Specification for Men's and Boys' Knitted Rainwear and All-Purpose, Water-Repellent Coat Fabrics<sup>1</sup>

This standard is issued under the fixed designation D 3781; 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 men's and boys' knitted rainwear and all-purpose water-repellent coat fabrics composed of any textile fiber or mixture of textile fibers.

1.2 This performance specification is not applicable to knitted fabrics used for interlinings.

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

### 2. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles<sup>2</sup>

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<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.56<sub>1</sub> on Performance Standards for Textile Fabrics—Apparel.

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D 231 Method of Testing and Tolerances for Knit Goods<sup>3</sup>

D 2594 Test Methods for Stretch Properties of Knitted Fabrics Having Low Power<sup>2</sup>

D 2724 Test Methods for Bonded, Fused, and Laminated Apparel Fabrics<sup>2</sup>

D 2905 Practice for Statements on Number of Specimens for Textiles<sup>2</sup>

2.2 *AATCC Methods*:<sup>4</sup>

8-1974 Colorfastness to Crocking: AATCC Crockmeter Method

15-1976 Colorfastness to Perspiration

16-1974 Colorfastness to Light

22-1974 Water Repellency: Spray Test

23-1975 Colorfastness to Burnt Gas Fumes

35-1974 Water Resistance: Rain Test

61-1975 Colorfastness to Washing, Domestic, and Laundering, Commercial: Accelerated

96-1975 Dimensional Changes in Laundering of Woven and Knitted Textiles Except Wool

116-1974 Colorfastness to Crocking: Rotary Vertical Crockmeter Method

124-1975 Appearance of Durable Press Fabrics After Repeated Home Launderings

132-1976 Colorfastness to Drycleaning

135-1973 Dimensional Changes in Automatic Home Laundering of Durable Press Woven or Knit Fabrics

172 Colorfastness to 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 Chromatic Transference Scale

NOTE 1—Reference to test methods in this specification gives only the permanent part of the designation of ASTM, AATCC, or other test methods. The current editions of each test method cited shall prevail. The specific dated editions of the ASTM test methods that prevail in this document are referenced in Section 7.

### 3. Terminology

3.1 *Definition*:

3.1.1 *dimensional change, n*— *in pressing and finishing of textiles*, the change in dimensions of a fabric caused by pressing and finishing during garment manufacture.

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

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *pressing and finishing*—This term takes into account all of the industrial pressing and finishing treatments used in garment production.

NOTE 2—No standard method is available for reproducing on a laboratory level the results of industrial press or finishing treatments, or both, used in the manufacture of woven outerwear garments.<sup>5</sup>

### 4. Specification Requirements

4.1 The properties of fabrics for men's and boys' knitted rainwear and all-purpose, water-repellent coats shall conform to the specification requirements in Table 1.

### 5. Significance and Use

5.1 Knitted fabrics should meet all of the requirements in Table 1 to be suitable for use in the manufacture of rainwear and all-purpose, water-repellent coats for men and boys.

5.2 It is recognized that for purposes of fashion or aesthetics the ultimate consumer of articles made from these fabrics may find acceptable some fabrics that do not conform to all of the requirements in Table 1. For example, the fabric could be dyed in shades that do not meet the requirement in Table 1 for colorfastness to light, yet be acceptable to the ultimate consumer because the shade is fashionable. In such cases, one or more of the requirements may be modified by mutual agreement between the purchaser and the seller.

5.2.1 If any of the requirements in Table 1 are modified by mutual agreement between the purchaser and the seller, any reference to the specification shall specify that "this fabric meets ASTM Specification D 3781 except for the following characteristic(s)."

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

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 07.01.

<sup>3</sup> Discontinued, see *1979 Annual Book of ASTM Standards*, Part 32.

<sup>4</sup> Available from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

<sup>5</sup> The development of a standard method has been referred to Subcommittee D13.59 on Fabric Test Methods, General.

**TABLE 1 Specification Requirements**

NOTE 1—Class in a, b, c and DP is based on a numerical scale of 5 for negligible or no color change, color transfer, or wrinkle to 1 for very severe color change, color transfer, or wrinkle. The numerical rating in Table 1 or a higher numerical rating is acceptable.

Characteristic	Requirements	Section
Bursting strength (load) (ball burst)	50 lbf (222 N) min	7.1
Dimensional change:		
Pressing and finishing	2 % max, in each direction	7.2.1
After five launderings	3 % max, in each direction	7.2.2
After three dry cleanings	2 % max, in each direction	7.2.3
Growth	3 % max, in each direction	7.2.4
Colorfastness:		
Burnt gas fumes—2 cycles:		7.3.1
Shade change, original fabric	Class 4 <sup>A</sup> min	
Shade change after one laundering or one dry cleaning	Class 4 <sup>A</sup> min	
Sodium Hypochlorite Bleach	Class 4 <sup>A</sup> min	7.3.7
Non-Chlorine Bleach	Class 4 <sup>A</sup> min	7.3.8
Laundering:		7.3.2
Shade change	Class 4 <sup>A</sup> min	
Staining	Class 3 <sup>B</sup> min	
Drycleaning:		7.3.3
Shade change	Class 4 <sup>A</sup> min	
Crocking:		7.3.4
Dry	Class 4 <sup>C</sup> min	
Wet	Class 3 <sup>C</sup> min	
Perspiration (acid phase):		7.3.5
Shade change	Class 4 <sup>A</sup> min	
Staining	Class 3 <sup>B</sup> min	
Light (40 AATCC FU) (xenon-arc)	Step 4 <sup>A</sup> min	7.3.6
Water resistance (categories based on minimum time for 1-g weight increase at following head pressures):		7.4
2 ft (600 mm)	30 s (shower)	
2 ft (600 mm)	2 minutes (rain)	
3 ft (915 mm)	5 minutes (storm)	
Water repellency:		7.5
Smooth-textured fabrics:		
Original	90, min	
After five launderings or three dry cleanings	70, min	
Rough-textured:		
Original	80, min	
After five launderings or three dry cleanings	70, min	
Fabric appearance (see 7.6.1.1)	DP 3.5 <sup>D</sup> , min.	7.6
Flammability	pass	7.7

<sup>A</sup> AATCC Gray Scale for Color Change.

<sup>B</sup> AATCC Gray Scale for Staining.

<sup>C</sup> AATCC Chromatic Transference Scale.

<sup>D</sup> For durable press fabrics only.

## 6. Sampling

6.1 Tests shall be performed on the fabrics as it will reach the consumer. Any “partially cured” or “post cured” fabrics should first be processed in accordance with the fabric manufacturer’s instructions.

6.2 Unless otherwise agreed upon, as when specified in an applicable material specification, take the number of specimens directed in each of the applicable test methods.

6.2.1 If there has been no prior agreement and the test method does not specify the number of specimens, use the procedures in Practice D 2905 to determine the number of specimens, such that the user may expect at the 95 % probability level that the test result is no more than 5 % of the average above or below the lot average (that is, the average that would be obtained by applying this method to the entire lot) when using a reliable estimate of variability of individual observations on similar materials in the user’s laboratory under conditions of single-operator precision.

## 7. Test Method (See Note 1)

7.1 *Bursting Strength*—Determine the bursting strength, in the standard atmosphere for testing textiles, as directed in Method

D 231 using an approved type of constant-rate-of-traverse machine equipped with a bursting attachment or an approved type of diaphragm bursting tester as agreed upon between the purchaser and the seller.

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 case of controversy, the CRT machine equipped with a bursting attachment method shall prevail.

NOTE 4—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 on Fabric Test Methods, General. The test methods are accordingly not recommended for acceptance testing unless preceded by an interlaboratory check test in the laboratory of the purchaser and the laboratory of the seller using randomized replicate specimens of the material to be evaluated.

### 7.2 Dimensional Change:

7.2.1 *Pressing and Finishing During Manufacturing*—Mark Specimen(s) as directed in 4.3.1 of AATCC Method 135-1973. Press and finish specimen(s) as agreed upon between 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 135-1973 (see Note 2).

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 10.1.3.1 through 10.1.3.5 of Test Methods D 2724.

7.2.2 *Laundering*—Determine the maximum dimensional change after five launderings as directed in the applicable procedure in AATCC Method 135-1973 (Notes 5 and 6).

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

7.2.3 *Dry cleaning*—Determine the maximum dimensional change after three dry cleanings in accordance with 10.1.1 through 10.1.4 of Test Methods D 2724 (Notes 5 and 6).

7.2.4 *Growth*—Determine the growth of the fabric as directed in Test Methods D 2594.

NOTE 5—Launderable fabrics are expected to be drycleanable except where all or part of the fabric is not dry-cleanable 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. “Dry-cleanable” goods are to be dry-cleaned 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, subtract the pressing and finishing dimensional change from the total dimensional change to obtain that portion due to laundering or dry cleaning. 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 dry cleaning of the fabric as it will reach the consumer (see 6.1).

### 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 dry cleaning as directed in AATCC Method 23-1975.

NOTE 7—Washing conditions shall be the same as those used in 7.2.2.1. Dry-cleaning 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 61-1975. The test conditions shall be as specified by the seller (Note 5).

7.3.3 *Drycleaning*—Determine colorfastness to dry cleaning as directed in AATCC Method 132-1976 (Note 5).

7.3.4 *Crocking*—Determine colorfastness to dry and wet crocking as directed in AATCC Method 8-1974 for solid shades and AATCC Method 116-1974 for prints or as agreed upon between the purchaser and the seller.

7.3.5 *Perspiration*—Determine colorfastness to perspiration as directed in AATCC Method 15-1976.

7.3.6 *Light*—Determine colorfastness to light as directed in AATCC Method 16.

NOTE 8—There are distinct differences in spectral distribution between the various types of machines listed in AATCC Method 16, with no overall correlations between them. Consequently, these machines cannot be used interchangeably. In case of controversy, results obtained with the Water-Cooled Xenon-Arc machine listed in Option E shall prevail.

7.3.7 *Colorfastness to Sodium Hypochlorite Bleach*—Determine colorfastness to sodium hypochlorite bleach as directed in AATCC Method 188 .

7.3.8 *Colorfastness to Non-Chlorine Bleach*—Determine colorfastness to non-chlorine bleach as directed in AATCC Method 172.

7.4 *Water Resistance (Rain Test)*—Determine the water resistance (rain test) on the original fabric and after five launderings as in 7.2.2.1 or three dry cleanings as in 7.2.3 as directed in AATCC Method 35-1974.

7.4.1 Fabrics shall be classified by conformance to the requirements given for the categories in Table 1.

NOTE 9—It is usual practice in manufacturing of rainwear and all-purpose, water-repellent garments to back knitted fabrics with a back coating or a lining. If garments made from knitted rainwear and all-purpose, water-repellent fabrics are to be lined, the test specimen may comprise (a) a single layer of the test fabric, or (b) a combination of the test fabric as the outer fabric and the lining fabric as the inner fabric as agreed upon between the purchaser and the seller.

7.5 *Water Repellency (Spray Test)*— Determine the resistance to wetting (spray test) on the original fabric and after five launderings as in 7.2.2.1 or three dry cleanings as in 7.2.3 as directed in AATCC Method 22-1974.

7.5.1 Determine the resistance to wetting of laundered or dry-cleaned fabrics after pressing as specified by the seller.

7.6 *Fabric Appearance*—Determine the fabric appearance as directed in AATCC Method 124-1975 after laundering using the wash-and-wear cycle or the normal cycle as agreed upon between the purchaser and the seller as specified in 7.2.2.1 for washable fabrics or as specified in 7.2.3 for dry-cleanable fabrics (see Note 5).

7.6.1 For fabrics not intended for use in “durable-press” garments, determine the fabric smoothness after pressing as specified in Section 5.12 of AATCC Method 96-1975.

7.6.1.1 The fabric smoothness durable press (DP) rating of such fabrics, and the DP rating of dry-cleaned fabrics, shall have decreased no more than ½ DP rating from that of the fabric before it is laundered or dry-cleaned.

7.7 *Flammability*—The flammability requirements shall be as agreed upon between the purchaser and the seller, except when regulated by applicable Government mandatory standards.

## **8. Keywords**

8.1 rainwear; water repellant

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