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Standard Specification for Tolerances for Knitted Fabrics[1]

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers test methods and tolerances applicable to the following properties of knitted fabrics: yield, mass (weight), width, length, fabric count, bursting strength, moisture regain, thickness, extractable matter, and fiber composition.

1.2 These tolerances are applicable to knitted fabrics of all types, such as warp knits, weft knits, flat bed knits, and so forth.

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 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
D629 Test Methods for Quantitative Analysis of Textiles
D2257 Test Method for Extractable Matter in Textiles
D2494 Test Method for Commercial Mass of a Shipment of Yarn or Manufactured Staple Fiber or Tow
D2654 Test Method for Moisture in Textiles (Withdrawn 1998)[3]
D2720 Practice for Calculation of Commercial Weight and Yield of Scoured Wool, Top, and Noil for Various Commercial Compositions
D3773 Test Methods for Length of Woven Fabric
D3774 Test Method for Width of Textile Fabric
D3776 Test Methods for Mass Per Unit Area (Weight) of Fabric
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

2.2 *Other Documents:*

Textile Fiber Products Identification Act[4]
Wool Products Labeling Act of 1939[5]

2.3 *Military Standard:*[6]

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

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

3. Terminology

3.1 *Definitions:*

3.1.1 *bursting strength, n*—the force or pressure required to rupture a fabric by distending it, when applied at right angles to the plane of the fabric, under specified conditions.

3.1.2 *commercial mass, n*—billed weight (mass) as determined by a generally accepted method or as agreed upon between the purchaser and the seller.

3.1.2.1 *Discussion*—The basis for determining the commercial weight (mass) of a shipment of textile product is generally one of the following:

(1) Man-Made Fibers:

(a) CMRU Basis (commercial moisture regain with unscoured material)—the weight (mass) of unscoured, moisture-free textile product plus the weight (mass) corresponding to its commercial moisture regain.

(b) CMRS Basis (commercial moisture regain with scoured material)—the weight (mass) of moisture-free textile product after scouring by definite prescribed methods

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

[4] Act of Congress, "Textile Fiber Products Identification Act," 85th Congress, Second Session, approved Sept. 2, 1958.

[5] Act of Congress, "Wool Products Labelling Act of 1939," 76th Congress, Third Session, approved Oct. 14, 1939.

[6] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

plus the weight corresponding to its commercial moisture regain.

(c) CAS Basis (commercial allowance with scoured material)—the weight (mass) of moisture-free textile product after scouring by definite prescribed methods plus the weight corresponding to its commercial allowance.

(d) UN Basis (unadjusted net)—the weight (mass) of unscoured textile product with no adjustment for the amount of moisture or finish, or both.

(2) *Wool:*

(a) CC Basis (commercial composition)—the weight (mass) of wool base as determined by definite prescribed methods plus the weights (masses) of moisture and other components corresponding to the commercial composition of the commercially designated material (for explanation, see Practice D2720).

(b) UN Basis (unadjusted net)—the weight (mass) of unscoured textile product with no adjustment for the amount of moisture or finish, or other components.

3.1.3 *commercial moisture regain (CMR), n*—a formally adopted, arbitrary value, to be used with the oven-dried mass of textile fibers, when calculating the commercial mass of a shipment or delivery.

3.1.4 *course, n—in knitted fabrics*, a row of successive loops parallel to the width direction of the fabric.

3.1.5 *finished fabric weight, n*—mass per unit area expressed in grams per square metre (ounces per square yard), grams per linear metre (ounces per linear yard), or inversely as metres per kilogram (linear yards per pound), or square metres per kilogram (square yards per pound).

3.1.5.1 *Discussion*—When weight (mass) is based on metres or linear yards, the fabric width must be stated.

3.1.6 *finished yield, n—in knitted fabrics*, the number of finished square metres per kilogram (square yards per pound) of finished fabric.

3.1.7 *greige yield, n— in knitted fabrics*, the number of finished square metres per kilogram (square yards per pound) of greige fabric.

3.1.8 *knitted fabric, n*—a structure produced by interlooping one or more ends of yarn or comparable material.

3.1.9 *knitted fabric count, n*—the number (counted units) of wale and courses per 25 mm (1 in.).

3.1.10 *length, n—in fabric*, the distance from one end to the other, measured parallel to the selvage or flattened tube edge of fabric that is under zero tension and free of folds and wrinkles.

3.1.11 *tolerances, n—in mathematics*, prescribed limits of variation for specified properties of a particular material based on observed values obtained by specified test methods and on samples that are representative of the material.

3.1.12 *wale, n—in knitted fabrics*, a column of successive loops parallel to the length direction of the fabric.

3.1.13 *width, n—in open-width knit fabric*, the perpendicular distance between the selvages when the fabric is laid flat, under zero tension, and free from folds or wrinkles.

3.1.14 *width, n—in tubular knit fabric*, the perpendicular distance between the edges of a flattened tube of fabric that is under zero tension and free from folds or wrinkles.

3.2 For definitions of other textile terms used in this specification, refer to Terminology D123.

4. Tolerances

4.1 The following are the tolerances for each knitted fabric property:

Characteristic	Requirements	Section
Yield	±5.0 %	8
Weight (mass)	±5.0 %	9
Width	–0 to +25 mm (1 in.)	10
Length	±2.0 %	11
Fabric count	±5.0 %	12
Bursting strength (ball burst)	±10.0 %	13
Extractable matter	1.0 %, max	14
Fiber content	pass[A]	15

[A] Those products to which the Wool Products Labeling Act of 1939[5] apply, shall conform to the requirements of that act. Other fabrics shall conform to the requirements of the Textile Fiber Products Identification Act of 1958.[4]

5. Significance and Use

5.1 Knitted fabrics are known to exhibit inherent variations in properties. This specification lists the tolerances for each property deemed acceptable in the trade.

5.1.1 These tolerances can be used to determine if knitted fabrics meet specifications for properties, and provide a guide in case of dispute.

5.2 Tolerances agreed upon between the purchaser and the seller shall take precedence over those listed in this specification.

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. Conditioning

7.1 For tests made on conditioned material, precondition the specimens by bringing them to approximate moisture equilibrium in the standard atmosphere for preconditioning, then bring the specimens to moisture equilibrium for testing in the standard atmosphere for testing. It shall be considered that moisture equilibrium for testing has been reached when, after free exposure to air in motion, the change in weight (mass) of the specimen at successive intervals of not less than 2 h does not exceed 0.1 % of the specimen weight (mass).

7.2 Properties not significantly affected by minor variations in atmospheric conditions may be tested in prevailing room atmospheres by agreement of all parties concerned.

7.3 If the samples comprise whole rolls or bolts of fabric that cannot be properly conditioned in a reasonable time with

the facilities available, perform the test determinations on the material without conditioning. When tests are carried out under conditions that vary from the standard, report the actual conditions prevailing at the time of test. It must be recognized that such results may not correspond with the results obtained after testing in the standard atmosphere for testing textiles.

8. Test Method—Yield

8.1 Determine the greige yield on unscoured or scoured fabric by dividing the commercial mass (weight) of the greige fabric, obtained as directed in Test Method D2494, into the total finished square metres (square yards), as calculated from the width and lengths on invoices.

8.1.1 The general practice in the trade is to determine greige yield on unscoured fabric. However, in some cases, greige yield is determined on scoured fabric. Hence, the report for the greige yield should specify whether unscoured or scoured basis was used.

8.1.1.1 When it can be shown that tests for extractable matter provide the same results as the scour procedure, the mass obtained on an unscoured basis can be adjusted by the results of tests for extractable matter, and the yield reported on a scoured fabric basis.

8.2 For finished knit fabrics the yield may also be calculated by dividing its commercial mass by the total linear metres (yards), and would be expressed as length per unit mass (yd/lb) based on a given width. For example—60-in. wide open width fabric, 2yd/lb, or 30-in. tubular fabrics, 2yd/lb.

8.3 It is recognized that values for fabric widths and lengths stated on invoices may not match those obtained by actual measurement. However, in the case of large shipments, it is impractical to measure the width and length of every roll. Hence, values obtained by actual measurement may also be used to determine yields.

8.4 If required, determine moisture regain by taking three specimens weighing 5 g or more and representative of the lot when the weight (mass) of the lot is determined, place promptly in separate airtight containers, and weigh to the nearest 1 mg. Determine the regain of these specimens as directed in Test Methods D2654.

8.4.1 The percentage moisture regain of the fabric shall be the arithmetic mean of the results of the three determinations.

NOTE 2—Yield is useful to the fabric manufacturer for cost purposes. This property is unknown to the purchaser of the dyed and finished fabric unless the information on yield is supplied by the seller.

9. Test Method—Weight (Mass)

9.1 Determine the fabric weight (mass) as directed in Test Method D3776 as agreed to between the purchaser and seller (see Note 3).

NOTE 3—Test Method D3776 for determining weight (mass), Test Method D3774 for determining width and Test Methods D3773 for determining length are intended to be used with woven fabrics. The precision of these test methods when used to determine these properties for knitted fabrics is being determined.

9.1.1 The test results from Sections 7 or 8 of Test Method D3776 will include selvages, except in the case of circular knit fabrics.

9.1.2 The test results obtained from Section 7 of Test Method D3776 are not on a conditioned basis since there is no practical means to determine the actual moisture content of a full roll or piece.

9.1.3 In case of controversy, the procedure in Section 8 of Test Method D3776 shall prevail.

10. Test Method—Width

10.1 Determine the maximum usable width, exclusive of gummed or taped selvages and of minor irregularities in width, as directed in Section 9 of Test Method D3774 as agreed to between the purchaser or the seller.

10.1.1 The test results obtained from Section 6 of Test Method D3776 are not on a conditioned basis since there is no practical means to determine the actual moisture content of a full roll or piece.

10.1.2 In case of controversy, the procedure in Section 7 of Test Method D3774 shall prevail.

11. Test Method—Length

11.1 Determine the fabric length as directed in Section 6, 7, 8, or 9 of Test Methods D3773 as agreed to between the purchaser or the seller (see Note 3).

11.1.1 The test results obtained from Section 7, 8, or 9 of Test Methods D3773 are not on a conditioned basis since there is no practical means to determine the actual moisture content of a full roll or piece.

11.1.2 In case of controversy, the procedure in Section 6 of Test Methods D3773 shall prevail.

12. Test Method—Fabric Count

12.1 *Scope*—This test method is applicable to knitted fabrics of all types, such as warp knits, weft knits, flat bed knits, and so forth.

12.2 *Summary of Test Method*—The number of wales and courses per unit distance are determined using suitable magnifying and counting devices.

12.3 *Significance and Use*—This test method is considered satisfactory for acceptance testing of commercial shipments because of prior extensive use. In case of disagreement arising from differences in values reported by the purchaser and the seller when using this test method for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the seller should be determined with each comparison being based on testing specimens randomly drawn from one sampling unit of material of the type being evaluated.

12.4 *Apparatus*—Use any suitable magnifying and counting device (such as pick glass, rule and pointer, microfilm reader, or projection equipment).

12.5 *Sampling:*

12.5.1 Take a lot sample as directed in Section 6 or as agreed upon between the purchaser and the seller.

12.5.2 From the lot sample of rolls or pieces, cut one laboratory sample from each roll or piece the full width of tubular or open-width knit fabric, and at least 2 m (2 yd) in length.

12.6 *Conditioning*—Condition specimens as directed in Section 7.

12.7 *Procedure:*

12.7.1 Unless otherwise specified in a prior agreement between the purchaser and the seller, make no count closer to a selvage than one-tenth of the width of the fabric, or within 0.5 m (0.5 yd) of the end of the roll or piece.

12.7.2 Unless otherwise specified, count the wales and courses on the face side of the fabric.

12.7.3 For fabrics containing 10 loops per linear cm (25 loops per linear in.) or more, determine the number of wale loops and course loops per 2.5 cm (1 in.) by counting the number in a space not less than 5 cm (2 in.) at five different places in the piece, equally spaced both across the width and throughout the length to the nearest whole number of loops.

12.7.4 For fabrics containing less than 10 loops per 1 cm (25 loops per 1 in.), make the count over a 10-cm (4-in.) width and repeat in at least five randomly designated places across the width and throughout the length to the nearest whole number of loops.

12.7.5 In fancy knits where one or more yarns do not appear at regular, short intervals, make count measurements over at least one full pattern repeat of each design component to the nearest whole number of loops.

12.8 *Calculation*—Calculate the average number of wales and courses per 2.5 cm (1 in.) to the nearest 0.1 wale or course.

12.9 *Report:*

12.9.1 State that the specimens were tested as directed in Specification D3887. Describe the material or product sampled and the method of sampling used.

12.9.2 Report the following information:

12.9.2.1 Average number of wales and courses per 2.5 cm (or per 1 in.) stating the wale count first.

12.9.2.2 Size of the pattern repeat, size of each design component in the pattern, and the total yarns in each measured component for fabrics having fancy knits.

12.9.2.3 Temperature and relative humidity conditions during testing. For example, standard atmosphere for testing textiles, ambient conditions, and the like.

12.10 *Precision and Bias:*

12.10.1 *Precision*—The precision of this test method for counting wales and courses in knitted fabrics is being established.

12.10.2 *Bias*—This test method for counting wales and courses in knitted fabrics has no known bias and is used as a referee method.

13. Test Method—Bursting Strength

13.1 Determine the bursting strength of at least five specimens as directed in Test Method D3786 using the diaphragm bursting strength tester or Test Method D3787 using the CRT ball burst tester as agreed upon between all interested parties. In the case of controversy, the CRT ball burst tester method in Test Method D3787 shall prevail.

13.1.1 The specimens may be tested under prevailing atmospheric conditions, except in the settlement of a dispute. In the latter case, tests shall be made on specimens conditioned as described in Section 7.

13.1.2 Calculate the average of the results of five bursting strength tests for each laboratory sample. Calculate the average for all laboratory samples as the bursting-strength for the lot.

NOTE 4—There is no overall correlation between the results obtained with the CRT machine equipped with a bursting strength attachment and the diaphragm bursting tester. Consequently, these two bursting testers cannot be used interchangeably.

14. Test Method—Extractable Matter

14.1 Determine the extractable matter of the fabric as directed in Test Method D2257.

NOTE 5—The bursting strength test specimens may be used for this test.

15. Test Method—Fiber Content

15.1 Determine the fiber content of the fabric as directed in the methods for the quantitative analysis of textiles described in Test Methods D629.

16. Conformance

16.1 The purchaser and the seller may agree on a procedure to establish conformance, including control charts furnished by the seller, a sequential-sampling plan, or the double-sampling plan outlined as follows.

16.2 In the absence of a control-chart or sequential-sampling plan, proceed as directed in 16.3-16.5.

16.3 If the test results for the lot meet the specification requirements by application of the tolerances listed in 4.1, consider the lot a valid delivery.

16.4 If the test results for one or more characteristics do not meet the specification requirements, after application of the tolerances take a new laboratory sample from either the original lot sample or a new lot sample. Test the new sample for the characteristic(s) that did not conform to the requirements in the first test, and average the results of the first and second samples as if all results were from one test of double the original number of specimens. If the new average(s) conform(s) to the specified requirements, consider the lot a valid delivery.

16.5 If the test results obtained as directed in 16.4 do not conform to the specified requirements, consider the lot a nonvalid delivery.

17. Keywords

17.1 bursting strength; construction; extractable matter; fiber composition; knitted fabric yield; length; mass; width