



Designation: D8007 – 15

## Standard Test Method for Wale and Course Count of Weft Knitted Fabrics<sup>1</sup>

This standard is issued under the fixed designation D8007; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope

1.1 This test method covers the measurement of wale and course counts of weft knitted fabrics. Weft knit fabrics are made on circular or flat-bed knitting machines and include single- as well as double-knit fabric categories. Typical fabrics in the single-knit category include jersey and single-pique; typical fabrics in the double-knit category are rib, interlock, and swiss pique.

1.2 This test method is not applicable to warp knit fabrics such as tricot or raschel.

1.3 Wale and course counts are to be reported separately.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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:*

[D123 Terminology Relating to Textiles](#)

[D1776 Practice for Conditioning and Testing Textiles](#)

[D3887 Specification for Tolerances for Knitted Fabrics](#)

[D4850 Terminology Relating to Fabrics and Fabric Test Methods](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

### 3. Terminology

3.1 For terminology related to fabrics, see Terminology [D4850](#).

3.2 The following terms are relevant to this test method: count-in knitted fabrics, course-in knitted fabrics, knitted fabric, and wale-in knitted fabrics.

3.3 For definitions of other textile terms used in this test method, refer to Terminology [D123](#).

### 4. Summary of Test Method

4.1 The number of wales and the number of courses per unit distance of a knitted fabric are counted using a suitable ruler, magnifying device, or digital camera system. For an illustration of a simple knitted fabric wale and course orientation, see [Fig. 1](#).

### 5. Significance and Use

5.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is a statistical bias between them using competent statistical assistance. As a minimum, ensure that the test samples to be used are as homogeneous as possible and drawn from the material from which the disparate test results were obtained. The test specimens are to be randomly assigned in equal numbers to each laboratory for testing. The test results from the participating laboratories should be compared using a statistical test for unpaired data to a probability level chosen before initiation of the testing. If a bias is found, either its cause shall be found and corrected, or future test results for that material shall be adjusted in consideration of the known bias.

5.2 The results obtained by this test method may be used to determine if fabrics meet the tolerances for fabric counts given in Specification [D3887](#).

### 6. Apparatus

6.1 Use any suitable device, such as a pick glass, ruler, microscope, or digital camera system that will allow counting by unit distance.

6.2 The use of a stylus, pointer, or pick needle is recommended when using a pick glass, ruler, or if the microscope does not have a micrometer.

### 7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls of fabric as directed in an

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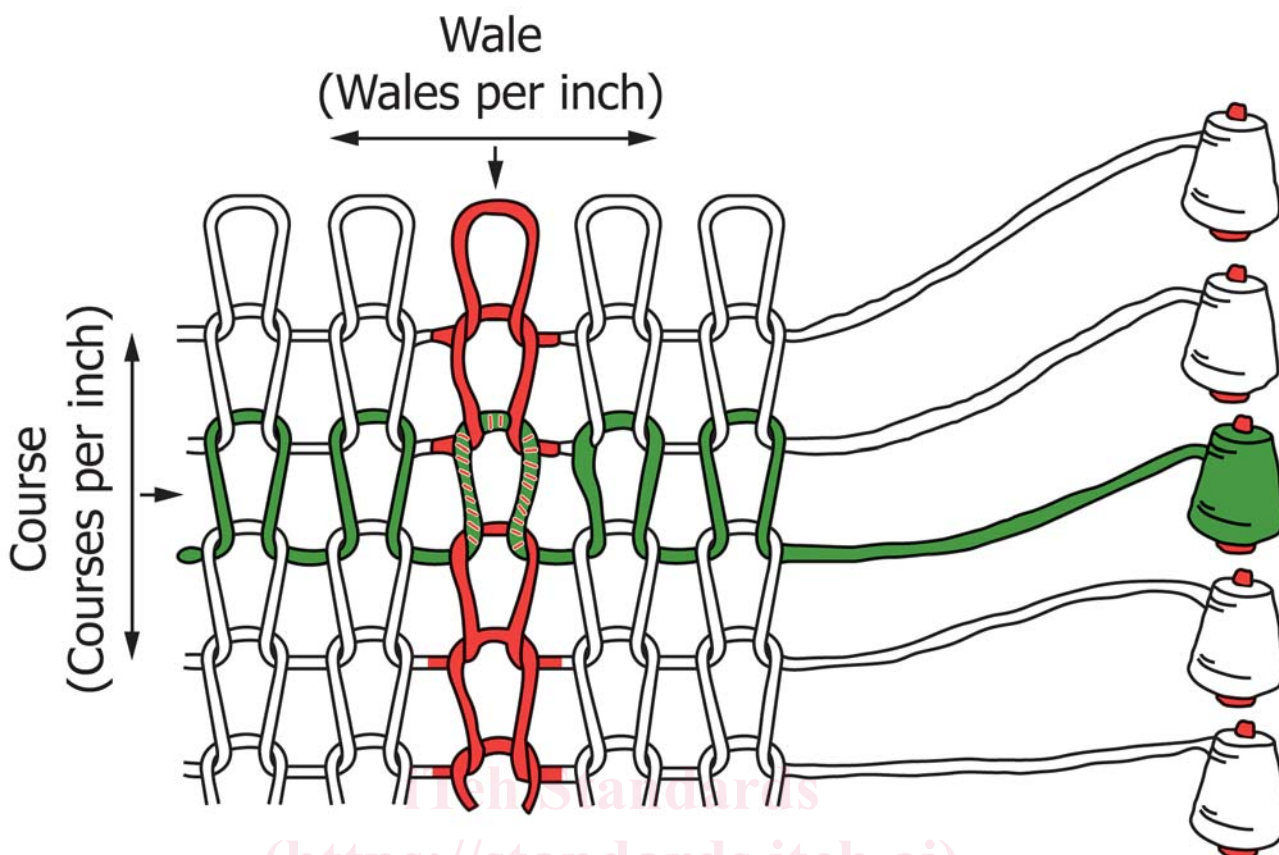


FIG. 1 Wale and Course Orientation in Single Knitted Fabric

Courtesy of Cotton Incorporated, Cary, NC, *Circular Knitting Science Intermediate Workshop Notebook* and *The Art of Knitting: An Interactive Guide to the Basics of Knitting* educational CD, www.cottoninc.com.

applicable material specification or other agreement between the purchaser and the supplier. Consider rolls of fabric to be the primary sampling unit.

7.2 *Laboratory Sample*—As a laboratory sample, take a full width swatch at least 2 yd (2 m) long from each roll of fabric in the lot sample.

7.2.1 It is not necessary to cut out swatches from the laboratory sample for each wale and course count to be taken. Consider each designated place at which wale and course counts are made as a test specimen. It is recommended that a wale and a course count be taken at the same site on the laboratory sample then at different locations along the length and across the width of the laboratory sample.

7.3 When like garments or textile items represent a laboratory sample, wale and course counts should be made at locations on different panels of the garments or products at least 2 in. (5 cm) away from seams, pockets, plackets, or other assembly sites.

## 8. Conditioning

8.1 Condition specimens as directed in Practice D1776. Testing may be performed without conditioning. However, in cases of dispute, specimens shall be conditioned before testing.

8.2 If testing is performed in conditions not specified in Practice D1776, report the prevailing conditions at the time of

testing. Such results may not correspond with the results obtained when testing in the standard atmosphere for testing textiles.

## 9. Procedure

9.1 Wale and course counts should be made no closer to a fabric selvage or tubular edge than one tenth of the width of the fabric or within 0.5 yd (0.5 m) of the end of the roll or piece.

9.1.1 Wale and course counts may be made on either the face or the back side of the fabric sample. Select the fabric side that allows for the best visual observation of the wales and courses.

9.1.2 For garments or textile items, see 7.3.

9.2 For counting wales, position a ruler or counting device along the width direction of the fabric. Using a stylus or the pointer of a counting device, place the starting point between two wales along a single course row. Move the stylus or pointer along the width direction, counting the number of wales until a 1-in. (2.5 cm) distance is reached. Record the count.

9.2.1 Repeat 9.2 in two additional locations.

9.2.2 For counting wales on a rib knitted fabric, only the visible wales are counted and recorded for the side of the fabric chosen for counting.

NOTE 1—A designation of 1 × 1, 2 × 2, or 3 × 3 is used to describe a balanced rib knit fabric, that is, one in which the same number of wales

per unit length are visible on each side of the fabric.

9.3 For counting courses, place a ruler or counting device in the length fabric direction along a wale column. Position a stylus or the pointer of a counting device between two courses as the starting point. Move the stylus or pointer along the wale direction, counting the number of courses until a 1-in. (2.5 cm) distance has been reached.

9.3.1 Repeat 9.3 in two additional locations.

9.4 If using a digital counting microscope, follow the manufacturer's instructions for counting wales and courses to the selected distance of measurement.

9.5 If counting wales and courses on garments or products, select locations in three different panels of the garment or product.

9.6 For any measurement device used (ruler, fabric counter, or microscope), if there is a difference of two or more wales or courses between the three locations, count and record wales or courses in three locations at 3- or 5-in. (7.5 or 25.4 cm) or greater distances. Counting distances greater than 1 in. (2.5 cm) will produce more precise wale and course counts.

9.7 For fancy knitted fabrics in which one or more yarns do not appear at regular, short intervals, perform counts over at least one full pattern repeat of each design component rounding to the nearest whole number wale or course. Record the counts and the distances measured.

## 10. Calculation

10.1 Calculate the average number of wales and courses per 1 in. (2.5 cm) separately to the nearest whole number.

10.2 In instances in which 3-in. (7.5 cm) or greater distances are counted, divide the average counts by three, or the distance measured, to report a count per 1 in. (2.5 cm).

10.3 In the case of counting fancy knitted fabrics in which pattern repeats or areas of different components in the design are used, divide the number of wales (or courses) by the distance counted to achieve a count per 1 in. (2.5 cm) and average the respective counts to the nearest whole number.

## 11. Report

11.1 Samples were tested as directed in Test Method D8007.

11.2 Report the following information:

11.2.1 Each sample's identification, lot number, and so forth;

11.2.2 Standard conditions or the conditions under which the testing was performed;

11.2.3 The actual distance across which the wales and courses were counted if greater than 1 in. (2.5 cm); and

11.2.4 Average number of wales and courses per 1 in. (2.5 cm) stating the wale count first. See Eq 1.

$$\text{Knitted fabric count} = 36 \times 48 \quad (1)$$

where:

36 = Average wale count per inch, wpi, and

48 = Average course count, cpi.

NOTE 2—Knitted fabric manufacturers may use the reverse order, that is, courses by wales, when denoting knitted fabric counts.

## 12. Precision and Bias

12.1 *Precision*—The precision of this test method is based on an intralaboratory study of D8007, new Test Method for Wale and Course Count of Weft Knit Fabric, conducted in 2010. Three operators in a single laboratory tested four samples: jersey, 2 × 2 rib, single-pique, and interlock knitted fabrics. Wale and course counts were performed on each sample. Every “test result” represents the average of three individual determinations, and all participants were asked to report two replicate test results for each fabric analyzed. For the pique and interlock samples, some wale counts were performed at 3-in. (7.6 cm) intervals that indicate greater variability is likely to occur when counting these fabric constructions. Insufficient data were available for a full statistical analysis on these fabrics. A later study will be performed to provide additional information. Except for testing in only a single laboratory, Practice E691 was followed for the study design and analysis of the data; the details are given in ASTM Research Report No. D13-1139.<sup>2</sup>

12.1.1 *Repeatability Limit (r)*—Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the *r* value for that material; *r* is the interval representing the critical difference between two test results for the same material obtained by the same operator using the same equipment on the same day in the same laboratory.

12.1.1.1 Repeatability limits are listed in Tables 1 and 2.

12.1.2 *Reproducibility Limit (R)*—Two test results shall be judged not equivalent if they differ by more than the *R* value for that material; *R* is the interval representing the critical

<sup>2</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D13-1139. Contact ASTM Customer Service at service@astm.org.

**TABLE 1 Wale Counts**

Material	Average <sup>A</sup>	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Modified Reproducibility Limit <sup>B</sup>
	$\bar{x}$	$S_r$	$S_R$	<i>r</i>	<i>R</i>
Jersey—100 % cotton, 5.6 oz /yd <sup>2</sup>	41.0	0.0	0.0	0.0	0.0
2 x 2 rib—100 % cotton, 5.8 oz /yd <sup>2</sup>	26.7	0.6	0.9	1.6	2.4

<sup>A</sup> The average of the operators' calculated averages.

<sup>B</sup> Based on the variability of three different operators in a single laboratory.