Designation: D3775 – 03a

# Standard Test Method for Warp End Count and Filling Pick Count of Woven Fabric[1]

This standard is issued under the fixed designation D3775; 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 test method covers the measurement of warp end count and filling pick count and is applicable to all types of woven fabrics.

NOTE 1—Historically the term fabric count has been used to describe the warp end count and the filling pick count in woven fabrics. The terms warp end count and filling pick count are replacing the term fabric count to provide clarity and agreement with the text and the intent of Test Method D 3775.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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]

D 123 Terminology Relating to Textiles

D 1776 Practice for Conditioning and Testing Textiles

D 4850 Terminology Relating to Fabric

2.2 *Other Standard:*

ANSI/ASQC Z1.4—Inspection by Attributes[3]

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of textile terms used in this test method; count, end, end count, filling, pick, pick count, and thread count, refer to Terminology D 4850.

3.1.2 For other textile terms used in this test method, refer to Terminology D 123.

## 4. Summary of Test Method

4.1 The number of warp yarns (ends) per unit distance and filling yarns (picks) per unit distance are determined using suitable magnifying and counting devices or by raveling yarns from fabrics.

## 5. Significance and Use

5.1 This test method is considered satisfactory for acceptance testing of commercial shipments because it has been used extensively in the trade for that purpose.

5.1.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative test should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, use the samples for such a comparative test that are as homogeneous as possible, drawn from the same lot of material as the samples that resulted in disparate results during initial testing and randomly assigned in equal numbers to each laboratory. The test results from the laboratories involved should be compared using a statistical test for unpaired data, a probability level chosen prior to the testing series. If bias is found, either its cause must be found and corrected, or future test results for that material must be adjusted in consideration of the known bias.

## 6. Apparatus

6.1 Use any suitable device, such as pick glass, rule and pointer, microfilm reader, or projection equipment.

6.2 Use a scale graduated in mm (1⁄16 in.) to measure the width of the fabric test specimen to be raveled for a count of yarns.

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

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[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D 13.60 on Fabric Test Methods, Specific.

Current edition approved Sept. 10, 2003. Published November 2003. Replaces Sections 28 to 34 of Methods D 1910 – 64 (1975). Originally approved in 1979 as D 3775 – 79. Last previous edition approved in 2003 as D 3775 – 03.

[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 tot he standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

7.2 *Laboratory Sample*—As a laboratory sample, take a full width swatch at least 2 m (2 yd) long from each roll of fabric in the lot sample. Consider each designated place at which warp end counts and filling pick counts are made as a test specimen.

NOTE 2—For specimens not obtained as directed in Section 7, the results should not be used for acceptance testing of a lot.

## 8. Conditioning

8.1 Condition specimens as directed in Practice D 1776.

8.2 Fabrics woven from yarns having a relatively low moisture regain in the standard atmosphere for testing textiles, which is 21° ± 1 C (70° ± 2 F) and 65 % relative humidity, and which are not significantly affected by minor variations in different atmospheric conditions, for example, nylons, acrylics, and polyesters, may be tested without preconditioning. Fabrics woven from yarns composed wholly or in part from wool, rayon, cotton, or acetate are more sensitive to atmospheric changes and must be conditioned prior to testing, except by agreement of all parties interested in the test results.

8.3 When full rolls or bolts of fabric cannot be properly conditioned in a reasonable time with available facilities, perform the test without conditioning and report the actual conditions prevailing at the time of the test. Such results may not correspond with the results obtained after testing in the standard atmosphere for testing textiles.

## 9. Procedure

9.1 *General:*

9.1.1 For fabric widths 1000-mm (40-in.) or more, make no count closer than 150-mm (6-in.) from the selvage edge or within 0.5 m (0.5 yd) from the end of the roll or piece, except for fabric widths less than 1000-mm (40-in.).

9.1.2 For fabric widths less than 1000-mm (40-in.) and greater than 125-mm (5-in.) make no count closer than one tenth of the width of the fabric, or within 0.5-m (0.5-yd) from the end of the roll or piece.

9.1.3 For fabrics less than 125 mm (5 in.) wide: count all the warp yarns (ends) in the width, including the selvage, and divide by the actual width at that point. For filling yarns (picks), count randomly space along the length as practical.

9.1.4 Count the number of warp yarns (ends) and filling yarns (picks) in five randomly spaced places diagonally across the width of the laboratory sampling unit. Count individual warp yarns (ends) and filling yarns (picks) as single units regardless of whether they are comprised of single or plied components.

9.1.4.1 When two yarns are laid-in together and parallel, then each yarn is counted separately as single units regardless of whether they are comprised of single or plied components.

9.1.5 In fancy weaves 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.

9.1.6 When coefficient of variation for five counts is more than 5 % make five additional counts.

9.2 *For Fabrics Containing Less Than 1 Yarn Per mm (25 yarns per in.):*

9.2.1 Count the number of warp yarns (ends) over a 75-mm (3 in.) width in five randomly designated places across the width of the laboratory sampling unit. Successively count the number of filling yarns (picks) over a 75-mm (3 in.) length in five different random places along the length of the laboratory sampling unit.

9.2.1.1 When the coefficient of variation for ten counts on a 75 mm (3 in.) width is more than 5 %, take five counts using a count width of 125 mm (5 in.) subject to 9.1.6.

9.3 *For Fabrics Containing 1 Yarn Per mm (25 yarns per in.) or more.*

9.3.1 Count the number of warp yarns (ends) over 25 mm (1 in.) of fabric width in five randomly designated places across the width of the laboratory sampling unit. Successively count the number of filling yarns (picks) over a 25 mm (1 in.) length in five different random places along the length of the laboratory sampling unit (see 9.1.1 and 9.1.2).

9.4 *Count by Raveling Options*—For fabrics in which individual yarns cannot be readily distinguished for counting in fabric, there are two options as described in 9.4.1.

9.4.1 Take warp counts in five different random places across the width of the laboratory sampling unit. Take successive filling yarn (pick) counts in five different random points along the length of the laboratory sample.

9.4.1.1 One option is to ravel a piece of fabric parallel to the direction to be counted to get a straight edge, then ravel and count the yarns in a 25-mm (1 in.) strip. For example, cut a strip of fabric from each designated place approximately 35 mm (1.5 in.) wide and of practical length parallel to the yarns to be counted. Then, ravel each strip to give a testing width of 35 mm (1 in.) by removing an approximately equal number of yarns from each side prior to counting.

9.4.1.2 A second option is to make a straight cut through the fabric across the yarns to be counted. Place a ruler along the cut edge and mark off a 25-mm (1 in.) length and then count the number of protruding yarns between the two marks. When possible, ravel a yarn or two to emphasize the protruding yarns.

## 10. Calculation

10.1 Calculate the average of all warp end counts made for the warp direction to the nearest individual yarn for each roll and for the lot.

10.2 Calculate the average of all filling pick counts made for the filling direction to the nearest individual yarn for each roll and for the lot.

10.3 When requested, calculate the thread count of the fabric as the sum of the warp end and filling pick counts to the nearest whole number for each roll and for the lot.

## 11. Report

11.1 State that the specimens were tested as directed in Test Method D 3775. Describe the material or product sampled and the method of sampling used.

11.2 Report the following information:

11.2.1 Average number of warp yarns (ends) and filling yarns (picks) per 25 mm (1 in.) calculated to the nearest individual yarn; when stating the count for the fabric, show the warp yarn (end) count first followed by the filling yarn (pick) count for each roll and for the lot. For example:

Count = 100 × 40 *or* 100 *by* 40

NOTE 3—The result is to be read as "one hundred by forty" not as 4000.

11.2.2 Thread count for each roll and for the lot, when requested,

11.2.3 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 weaves,

11.2.4 Atmospheric conditions under which the tests were conducted and whether the specimens were conditioned as directed in Practice D 1776.

## 12. Precision and Bias

12.1 *Summary*—In comparing two averages of five observations when measuring the warp end or filling pick count of a woven fabric, the difference should not exceed about 0.42 ends or picks/in. in 95 out of 100 cases when all the observations were taken by the same well-trained operator using the same piece of equipment and specimens randomly drawn from the same sample of material. Larger differences are likely under all other circumstances.

12.2 *Interlaboratory Test Data*[4]—An interlaboratory test was run in 1981 in which randomly drawn specimens of four materials were tested in each of four laboratories. Two operators in each laboratory each tested two specimens of each material for both warp end count and filling pick count. The first fabric was a 65 % polyester and 35 % cotton seersucker type basket weave. The second fabric was a 65 % polyester and 35 % cotton gingham check. The third fabric was an 88 % cotton and 12 % polyester corduroy. The fourth fabric was a 100 % cotton denim. Warp end counts ranged from about 50 to 130 ends/in., and filling pick counts ranged from about 50 to 125 picks/in. The components of variance for warp end count and for filling pick count expressed as standard deviations were calculated to be as follows:

| Counts | Single-Operator Component | Within-Laboratory Component | Between-Laboratory Component |
|---|---|---|---|
| *Single Material Comparisons:* | | | |
| Warp End or Filling Pick Counts | 0.337 | 0.000 | 0.458 |
| *Multi-material Comparisons*[5]*:* | | | |
| Warp End Counts | 0.551 | 0.000 | 0.383 |
| Filling Pick Counts | 0.000 | 0.000 | 0.736 |

[4] Supporting data are available from ASTM Headquarters. Request RR: D-13-1067.

NOTE 4—The square roots of the components are being reported to express the variability in the appropriate unit of measure rather than as the square of those units of measure.

12.3 *Precision*—For the components of variance reported in 12.2, two averages of observed values should be considered significantly different at the 95 % probability level if the difference equals or exceeds the critical differences in Table 1.

NOTE 5—The tabulated values of the critical differences should be considered to be a general statement, particularly with respect to between-laboratory precision. Before a meaningful statement can be made about two specific laboratories, the amount of statistical bias, if any, between them must be established with each such comparison being based on recent data obtained on specimens taken from a lot of material of the type being evaluated so as to be as nearly homogeneous as possible and then randomly assigned in equal numbers to each of the laboratories.

12.4 *Bias*—Test Method D 3775 for counting warp ends and filling picks in woven fabrics has no known bias and is used as a referee method.

## 13. Keywords

13.1 construction; fabric; filling pick count; warp end count; woven

[5] The single-operator components for multi-material comparisons are in addition to the single-operator components for single-material comparisons and are not reduced by replication.

**TABLE 1 Critical Differences for the Conditions Noted, 95 % Probability Level, Ends or Picks/in.**[A]

| Number of Observations in Each Average | Single-Operator Precision | Within-Laboratory Precision | Between Laboratory Precision |
|---|---|---|---|
| Single-material Comparison (warp end or filling count) | | | |
| 1 | 0.93 | 0.93 | 1.58 |
| 5 | 0.42 | 0.42 | 1.34 |
| 10 | 0.30 | 0.30 | 1.30 |
| 20 | 0.21 | 0.21 | 1.29 |
| Multi-material Comparison (warp end count only) | | | |
| 1 | 1.79 | 1.79 | 2.08 |
| 5 | 1.58 | 1.58 | 1.91 |
| 10 | 1.56 | 1.56 | 1.88 |
| 20 | 1.54 | 1.54 | 1.87 |
| Multi-material Comparison (filling pick count only) | | | |
| 1 | 0.93 | 0.93 | 2.24 |
| 5 | 0.42 | 0.42 | 2.08 |
| 10 | 0.30 | 0.30 | 2.06 |
| 20 | 0.21 | 0.21 | 2.05 |

[A] The critical differences were calculated using t = 1.960 which is based on infinite degrees of freedom.