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Designation: D1440 – 07

Standard Test Method for Length and Length Distribution of Cotton Fibers (Array Method)[1]

This standard is issued under the fixed designation D1440; 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 determination of the fiber length and length distribution in loose cotton fibers.

NOTE 1—For another method for measuring fiber length, see Test Method D1447.

1.2 *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
D1441 Practice for Sampling Cotton Fibers for Testing
D1447 Test Method for Length and Length Uniformity of Cotton Fibers by Photoelectric Measurement
D1776 Practice for Conditioning and Testing Textiles
D7139 Terminology for Cotton Fibers

3. Terminology

3.1 For all terminology related to D13.11, Cotton Fibers, see Terminology D7139.

3.1.1 The following terms are relevant to this standard: coefficient of variation, length group, length interval, mean length, pull, upper quartile length.

3.2 For all other terminology related to textiles see Terminology D123.

4. Summary of Test Method

4.1 A sorting apparatus consisting of two banks of parallel combs is used to straighten and align the fibers in a 75-mg test specimen. The fibers are pulled from one bank of combs and transferred to the other in such a manner that one end of each fiber is aligned with the base comb. The transfer is repeated to straighten the other ends of the fibers. As the fibers are withdrawn from the combs for the third time, they are placed in order of length on velvet covered boards. The pulls are measured, and those that fall within each length interval are collected and weighed. From these weight-length data, the upper quartile length, mean length, and coefficient of length variation are calculated.

5. Significance and Use

5.1 The array method provides objective measurements for determining the fiber length and length distribution in a sample of cotton. The results can be plotted to show the length-weight distribution of all the fibers in the sample. Data obtained from array tests are useful in fiber length research studies, for investigation of changes in fiber length distribution in ginning and mill processing, and for other research purposes.

5.2 Upper quartile length is correlated with, but usually longer than, Fibrograph and 2.5 % span length as defined in Test Method D1447. Judgment must be used in making comparisons between length measures from arrays and measures obtained by other methods, which may be basically different.

5.3 The coefficient of length variation is a measure of length distribution, or nonuniformity of length. Because the fiber weight-length distribution is usually highly skewed, statistical judgments based on the assumption of normality are not justified.

[1] This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.11 on Cotton Fibers.

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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.

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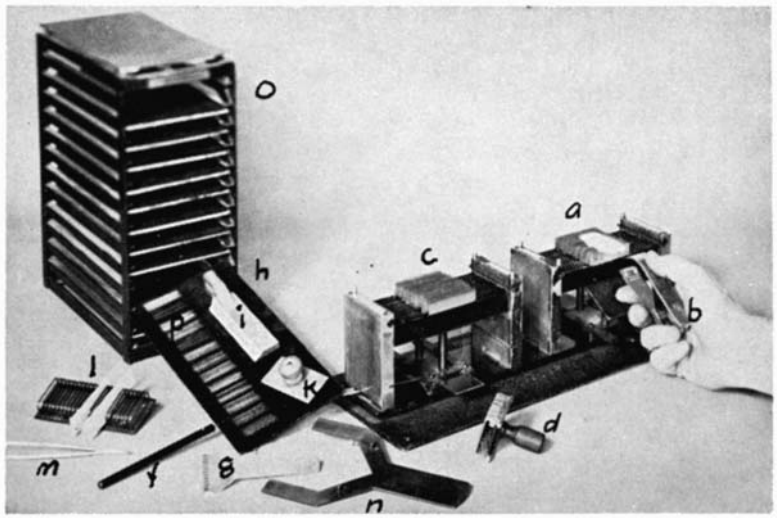

a and *c*—Banks of combs.
b—Forceps, tips padded with hard leather, for transferring fibers from one set of combs to the other.
d—Depressor for placing fibers in combs.
f—Dissecting needle.
g—Fork for scooping up fiber groups off velvet surface.
h—Aluminum plate covered with velvet cloth.
i—Special rule for measuring length of fiber groups.
k—Smooth plate for placing fibers onto velvet surfaces.
l—Wire rack for holding fiber groups wrapped in papers.
m—Smooth pointed tweezers.
n—Lift for raising combs in place.
o—Rack for holding velvet-covered boards.
p—Velvet-covered boards on which several pulls have been arrayed.

NOTE 1—Other accessories required for length arraying, not shown above, consist of the following: small whisk broom for cleaning velvet surfaces, one pair of tweezers with smooth round tips, forceps similar to *b* but having tips padded with rubber for laying groups on velvet surfaces, small papers for wrapping groups of fibers (papers 2½ by 3 in. (62 by 75 mm)) with small envelopes for them (2½ by 4¼ in. (62 by 110 mm)), and balances having ranges from 0 to 25 mg and 0 to 100 mg.

FIG. 1 Combs and Accessories for Arraying Fibers According to Length

5.4 The array method makes a physical separation of fibers of different lengths. It therefore serves as a standard, or benchmark, with which other methods may be compared and by which their precision and accuracy may be judged.

5.5 Test Method D1440 for testing length and length distribution of cotton fibers (array method) is not commonly used for acceptance testing of commercial shipments.

6. Apparatus and Materials

6.1 *Double Bank Sorter*, and equipment as illustrated in Fig. 1. The method outlined here is especially adapted to the Suter-Webb Duplex Cotton Fiber Sorter,[3] but the procedure may be carried out with other similar apparatus with more or less obvious alterations.

6.2 *Balance*, with a capacity of at least 25 mg and a sensitivity of ±0.05 mg.

6.3 *Balance*, with a capacity of at least 100 mg and a sensitivity of ±0.1 mg.

6.4 *Standard Calibration Cotton Samples*, for the calibration of array length measurements.

NOTE 2—Standard calibration cotton samples are available from the Cotton Division, Agricultural Marketing Service, U.S. Department of Agriculture, 3275 Appling Rd., Memphis, TN 38133.

6.5 *Secondary Standard Cotton*—Lots of cotton the length of which has been established by extensive comparisons with USDA standards.

7. Sampling

7.1 Prepare the laboratory sample as directed in Practice D1441. Take either two or three subsamples depending on the precision desired. Take subsamples that weigh approximately 80 mg each for use in preparing the test specimen in one of the following manners:

7.1.1 From a hand sliver, carefully separate a 2-in. (50-mm) length of the sliver for each subsample.

7.1.2 From a mechanically blended 3-g sliver, separate 2-in. (50-mm) subsamples.

7.1.3 From a mechanically blended 10-g sliver, pull out of the middle of the sample a subsample about 2 in. (50 mm) long, extending through its whole thickness, and wide enough to weigh approximately 80 mg. Take subsamples from near the beginning, midway, and near the end of the sliver.

[3] The sole source of supply of the apparatus known to the committee at this time is the Alfred Suter Co., New York, NY. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

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