



Designation: D1447 – 07^{e1}

Standard Test Method for Length and Length Uniformity of Cotton Fibers by Photoelectric Measurement¹

This standard is issued under the fixed designation D1447; 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.

^{e1} NOTE—Updated research report information in Footnote 4 editorially in June 2009.

1. Scope

1.1 This test method covers the measurement of the length and length uniformity of cotton fibers by use of photoelectric measurement. The test method is applicable to fibers taken from raw or partially processed cotton (up to card mat) or some types of cotton waste, but not to fibers from blends of cotton with other fibers or to fibers recovered from cotton yarns, fabrics or to 100 % synthetic fibers.

1.2 This test method is especially adapted for determining the length and length uniformity of cotton fibers by models of the Digital Fibrograph, hereafter referred to as Fibrograph.

NOTE 1—Instructions for the use of Manual and Servo Fibrograph Models were included in the text of Test Method D1447 in 1971 and previous editions.

NOTE 2—For other methods covering the measurement of the length of cotton fibers refer to Test Method D1440.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

D1440 Test Method for Length and Length Distribution of Cotton Fibers (Array Method)

D1441 Practice for Sampling Cotton Fibers for Testing

D1776 Practice for Conditioning and Testing Textiles

D3025 Practice for Standardizing Cotton Fiber Test Results by Use of Calibration Cotton Standards

D7139 Terminology for Cotton Fibers

3. Terminology

3.1 For all terminology related to D13.11, refer to Terminology D7139.

3.1.1 *amount, n*—in cotton length testing with the Fibrograph, a measure of the thickness, or optical density, of the test beard, proportional to the number of fibers present at various distances from the comb(s).

3.1.2 *fibrogram, n*—in cotton length testing with the Fibrograph, the curve representing the second cumulation of the length distribution of the fibers sensed by the length measuring instrument in scanning the fiber board.

3.1.3 *mean length, n*—in testing of cotton fibers, the average length of all the fibers in the test specimen based on mass-length data.

3.1.4 *span length (Fibrograph), n*—the distance spanned by a specified percentage of the fibers in the test beard, taking the amount reading at the starting point of the scanning as 100 %.

3.1.5 *test beard, n*—in length testing of cotton, the portion of the test specimen that has been combed and brushed into a “beard” which protrudes from the outside of the comb(s) or the clamp(s).

3.1.6 *test specimen (Fibrograph), n*—the cotton fibers placed randomly on a Fibrograph comb(s) for fiber length measurements.

3.1.7 *uniformity index, n*—in cotton length testing with the Fibrograph, the ratio between two span lengths expressed as a percentage of the longer length.

3.1.8 *uniformity ratio, n*—in cotton length testing with the Fibrograph, the ratio between two span lengths expressed as a percentage of the longer length.

3.1.8.1 *Discussion*—Various span lengths and measures of length uniformity may be calculated from the results of the measured points, but the 2.5 and 50 % span lengths and the 50/2.5 uniformity ratio are usually used.

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.

Current edition approved Dec. 1, 2007. Published January 2008. Originally approved in 1955. Last previous edition approved in 2000 as D1447 – 00. DOI: 10.1520/D1447-07E01.

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.



FIG. 1 Digital Fibrograph, Model 730

3.1.9 *upper-half-mean length, n* —in fiber length testing of cotton, the mean length by number, of the longer one half of the fibers by weight.

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

4. Summary of Test Method

4.1 Fibers are placed on comb(s) in such a way that they are caught at random points along their lengths to form a beard. The beard is scanned photoelectrically from base to tip, the amount of light passing through the beard being used as a measure of the number of fibers that extend various distances from the comb(s).

4.2 The Fibrograph shows the amount and the length readings from the Fibrogram being sensed on separate dials.

5. Significance and Use

5.1 This test method is considered satisfactory for acceptance testing when the levels of the laboratories are controlled by the use of the same reference standard cotton samples because the current estimates of between-laboratory precision are acceptable under these conditions. 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 the test

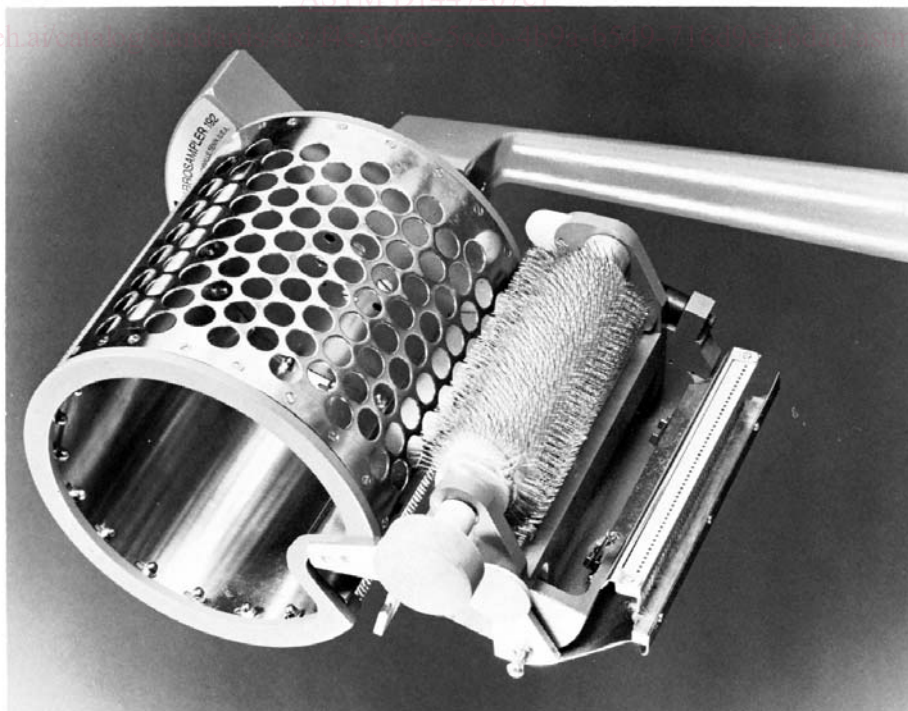


FIG. 2 Fibrosampler

samples to be used are as homogeneous as possible, are drawn from the material from which the disparate test results were obtained, and are randomly assigned in equal numbers to each laboratory for testing. The test from the two laboratories should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If a 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.

5.2 Fibrograph measurements provide a relatively fast method for determining the length and length uniformity of the fibers in a sample of cotton in a reproducible manner.

5.3 Results of the Fibrograph length tests do not necessarily agree with those obtained by other methods for measuring lengths of cotton fibers because of the effect of fiber crimp and other factors.

5.4 Fibrograph tests are more objective than commercial staple length classifications and also provide additional information on fiber length uniformity of cotton fibers. The cotton quality information provided by these results is used in research studies and quality surveys, in checking commercial staple length classifications, in assembling bales of cotton into uniform lots, and for other purposes.

5.5 Fibrograph measurements are based on the assumptions that a fiber is caught randomly along its length.

6. Apparatus

6.1 *Fibrograph*,³ digital model, with accessory equipment as shown in Fig. 1.

6.2 *Fibrosampler*, for the preparation of test specimens (required) as shown in Fig. 2.

7. Sampling

7.1 *Division into Lots*—For acceptance testing purposes, the purchaser and the supplier shall agree on what material constitutes a lot.

7.2 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of shipping containers directed in an applicable material specification or other agreement between the purchaser and the supplier, such as an agreement to use Practice D1441.

7.3 *Laboratory Sample*—As a laboratory sample for acceptance testing, select and prepare a 30 to 50 g (1 to 2 oz) subsample from each of the shipping containers in the lot sample, proceeding as directed in Practice D1441 using either the blended sample procedure or the subsample procedure as agreed between the purchaser and the supplier.

7.4 *Test Specimens*—As directed in Section 10, prepare either two or four specimens from each subsample in the laboratory sample. For acceptance testing, test either two or four specimens from each subsample in the laboratory sample as agreed between the purchaser and the supplier.

8. Preparation and Adjustment of Apparatus

8.1 Set up the Fibrograph and adjust it as directed in the manufacturer's instructions for the model being used.

8.2 Set up and adjust the Fibrosampler as directed in the manufacturer's instructions.

8.3 Before making Fibrograph length tests, allow the instrument to warm up until it is electronically stable (5 minutes), then carefully check it both electronically and mechanically by using the methods listed in 8.3.1-8.3.4 for specific items.

8.3.1 When the Fibrograph is first powered on, the LEDs on the front of the instrument will display the unit's system information. After the system information is displayed, the comb transport moves from the start to the stop position to zero the optics. Once the comb transport has returned to the start position, lift the door and adjust the optics by following the manufacturer's instruction.

8.3.2 The Fibrograph calibration should be checked once a week. During calibration check the calibration values are not changed. When a calibration is performed, the calibration values will be changed. A metal length standard with a known length value is supplied with the Fibrograph for calibration purposes. Follow the calibration procedures as directed in the manufacturer's instructions.

8.3.3 Measure specimens of cotton fibers from a laboratory control sample with established length values (Note 3). Each technician must measure separate specimens prepared from a laboratory control sample and obtain acceptable length results before performing similar measurements on specimens from unknown samples. When unacceptable results are obtained from the laboratory control sample, recheck the instrument adjustments and the testing techniques until acceptable results are obtained (Note 4).

NOTE 3—Standard calibration cotton samples for Fibrograph length tests are available from the Cotton Division, Agricultural Marketing Service, U.S. Department of Agriculture, 3275 Appling Road, Memphis, TN 38133, or other cottons may be used for routine calibration after extensive tests in comparison with USDA calibration samples have established the test values and the uniformity of the material. See Practice D3025.

NOTE 4—The Fibrograph length results obtained are affected by the amount of combing performed on the specimens. Operators quickly learn through practice the sampling process and the amount of brushing required to obtain acceptable results for the tests on the laboratory control samples for the instrument being used.

8.3.4 Make additional length measurements of specimens taken from the laboratory control sample at least every 2 h during the day to maintain a continuing check on the level of results.

9. Conditioning

9.1 Before preparing the specimens, bring the laboratory sample from the prevailing atmosphere to moisture equilibrium for testing in the standard atmosphere for testing textiles according to Practice D1776. Preconditioning is not necessary.

10. Preparation of Specimens

10.1 *Fibrosampler Method* (Fig. 2):

10.1.1 From a sample of fibers, select a subsample of approximately 25 grams or more (two handfuls). Place it in the

³ Instruments and accessories meeting these requirements may be obtained from Uster Technologies, Inc., 456 Troy Circle, P. O. Box 51270, Knoxville, TN 37919-1270.