



Standard Test Method for Breaking Strength and Elongation of Cotton Fibers (Flat Bundle Method)¹

This standard is issued under the fixed designation D 1445; 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.

INTRODUCTION

The flat bundle test for cotton fiber strength gained immediate acceptance after its introduction in 1953. The first successful instrument was an inclined plane device with the beam calibrated in pounds. The specimen was clamped with no space between the jaws and was called zero-gage strength. Results were expressed in Pressley Index (P.I.) calculated as the force-to-break in pounds divided by the bundle weight in mg. Obviously, P.I. is not a standard engineering unit.

Before the introduction of the flat bundle test, cotton fiber strength had been measured by the Chandler round bundle test (see former Method D 414) and the results expressed in pounds per square inch (psi). The U.S. Department of Agriculture obtained results from both instruments on specimens from the same samples of a large number of cottons. From this study, an empirical equation to express flat bundle test results in psi was

$$\text{Breaking strength, 1000 psi} = (10.81106 \times \text{P.I.}) - 0.12$$

When it was shown that a finite gage length test was more highly correlated with yarn strength than tests made at zero gage length, the clamp design was modified to accommodate a $\frac{1}{8}$ inch (3.2 mm) spacer. Selection of an engineering unit for reporting of results from $\frac{1}{8}$ inch (3.2 mm) gage tests presented a problem. However, the use of the tex for linear density and the introduction of a pendulum type instrument calibrated in kilograms led to the expression of results in grams-force per tex (gf/tex). The clamp width without spacer is 11.81 mm and with spacer is 15.00 mm. The bundle of fibers is mounted across the clamp width and trimmed to the width. The bundle mass is mg/11.81 mm or mg/15.00 mm.

The use of the flat bundle test in domestic and international commerce has had a long and successful history. Correcting this error in the empirical relationship would have serious adverse affects in the textile industry. Therefore, the empirical relationship is retained to calculate zero gage cotton fiber tensile strength designated as the Pressley strength in Eq 3 and 4 of D 1445.

1. Scope

1.1 This test method covers the determination of (1) the tensile strength or breaking tenacity of cotton fibers as a flat bundle using a nominal zero gage length, or (2) the tensile strength or breaking tenacity and the elongation at the breaking load of cotton fibers as a flat bundle with $\frac{1}{8}$ -in. (3.2-mm) clamp spacing. This test method is applicable to loose fibers of untreated cottons whether taken before processing or obtained from a textile product.

1.2 This test method is designed primarily for use with

special fiber bundle clamps and special strength testing instruments but may be used with other tensile strength and elongation testing machines when equipped with appropriate adapters to accommodate the fiber clamps.

NOTE 1—Other methods for measuring the breaking tenacity of fiber bundles include Test Method D 1294, Test for Breaking Strength of Wool Fiber Bundles—1 in gage Length;² Test Methods D 4604, Measurement of Cotton Fibers by High Volume Instruments (HVI) (Motion Control Fiber Information System); Test Methods D 4605, Measurement of Cotton Fibers by High Volume Instruments (HVI) (Spinlab System of Zellweger Uster, Inc.).

1.3 The values stated in either acceptable metric units or in other units shall be regarded separately as standard. The values

¹ This 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 *Annual Book of ASTM Standards*, Vol 07.01.

expressed in each system may not be exact equivalents; therefore, each system must be used independently of each other, without combining values in any way.

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:

D 123 Terminology Relating to Textiles²

D 1294 Test Method for Tensile Strength and Breaking Tenacity of Wool Fiber Bundles 1-in. (25.4-mm) Gage Length²

D 1441 Practice for Sampling Cotton Fibers for Testing²

D 1447 Test Method for Length and Length Uniformity of Cotton Fibers by Fibrograph Measurement²

D 1776 Practice for Conditioning Textiles for Testing²

D 3025 Practice for Standardizing Cotton Fiber Test Results by Use of Calibration Cotton Standards²

D 4604 Test Methods for Measurement of Cotton Fibers by High Volume Instruments (HVI) (Motion Control Fiber Information System)³

D 4605 Test Methods for Measurement of Cotton Fibers by High Volume Instruments (HVI) (Spinlab System of Zellweger Uster, Inc.)³

3. Terminology

3.1 Definitions:

3.1.1 *breaking load, n*—the maximum force applied to a specimen in a tensile test carried to rupture.

3.1.2 *breaking tenacity, n*—the maximum resistance per unit size of material to deformation in a tensile test carried to rupture; that is, the breaking load, or force, per unit linear density of the unstrained specimen. (See also breaking strength.)

3.1.3 *cotton, n*—a vegetable seed fiber consisting of unicellular hairs attached to the seed of several species of the genus *Gossypium* of the family Malvaceae. (Also see Table 4 in Annex 2 of D 123.)

3.1.4 *elongation at breaking load, n*—in fiber strength testing of cotton, the elongation corresponding to the maximum load, and expressed as a percentage of the 1/8" (3.2-mm) gage length.

3.1.5 *tenacity, n*—in a tensile test, the force exerted on the specimen based on the linear density of the unstrained material.

3.1.5.1 *Discussion*—In textiles, tenacity is considered a property of fibers and yarns, and tensile strain is the complementary property of fabrics. In direct yarn numbering systems, tenacity is force divided by linear density. In indirect yarn numbering systems, tenacity is force times the reciprocal linear density.

3.1.6 *tensile strength, n*—the maximum resistance of material to deformation in a tensile test carried to rupture; that is, the breaking load, or force per unit cross-sectional area of the unstrained specimen.

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

4. Summary of Test Method

4.1 A bundle of fibers is combed parallel, secured in clamps, cut to a known length, broken in the tensile testing machine, and weighed. Tensile strength or breaking tenacity is calculated from the ratio of breaking load to bundle mass (weight).

4.2 Elongation at the breaking load may be determined on the specimens tested for breaking strength with 1/4-in. (3.2-mm) clamp spacing. The elongation is normally calculated as a percentage of the nominal gage length.

5. Significance and Use

5.1 When the level of results in the laboratory the purchaser and the supplier are both controlled by use of calibration cottons, Test Method D 1445 for the determination of the tensile strength and elongation is considered satisfactory for acceptance testing of commercial shipments of cotton and has been used extensively in trade for acceptance testing.

5.1.1 *Discussion*—Tenacity is commonly expressed as millinewtons per tex (mN/tex), grams-force per denier (gf/den) or pounds-force per denier (lbf/den). Tenacity in millinewtons/tex is numerically equal to tenacity in grams-force/tex times 9.81.

5.1.2 In case of a dispute arising from differences in reported test results when using Test Method D 1445 for acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in the light of the known bias.

5.2 This test method is useful in research studies to determine the influence of variety, environment, and processing on fiber strength and elongation; and in studies of the relationships between these fiber properties, processing performance, and quality of end-product.

5.3 Values obtained for flat bundle tenacity and elongation show a high correlation with values measured on single fibers and require much less time and skill.

5.4 Studies have shown that strength measurements obtained with different types of instruments are highly correlated, but the results are on different levels.⁴

5.5 By use of correction factors calculated from tests made on standard calibration samples of known or established test

³ Annual Book of ASTM Standards, Vol 07.02.

⁴ Burley, Jr., S. T., and Carpenter, F. "Evaluation of Results Obtained on Available Types of Fiber Strength Testers Using Various Gauge Spacings and Their Relation to Yarn Strength," AMS-71, U. S. Dept. of Agriculture (Sept. 1955).

values, the results obtained with different types of instruments at a specified gage length can be adjusted to comparable levels. Due to differences in cottons, strength test results for one gage length cannot be reliably estimated from tests made at a different gage length.

6. Apparatus and Materials

6.1 *Tensile Testing Machine*—Either of two commercially available fiber bundle tensile testing machines, one of the pendulum and one of the inclined-plane type, described in Appendix X1, or other machine from which comparable results can be obtained.

6.2 *Laboratory Balance*:

6.2.1 *Balance*, having a capacity of 3 or 5 mg and a sensitivity of ± 0.01 mg for the zero gage length test.

6.2.2 *Balance*, having a capacity of 5 or 10 mg and a sensitivity of 0.01 mg for $\frac{1}{8}$ -in. (3.2-mm) gage length test.

6.3 Ancillary equipment from the instrument manufacturers.

6.3.1 *Clamp Vise* (Pressley type or Stelometer type), with a device to indicate approximately 8 lbf·in. (9 kgf·cm) torque.

6.3.2 *Fiber Clamps*, having a total thickness of 0.465 ± 0.001 in. (11.81 ± 0.02 mm).

6.3.3 *Spacer*, having a thickness of 0.125 ± 0.001 in. (3.2 ± 0.02 mm).

6.3.4 *Clamp Wrench* or Torque Wrench.

6.3.5 *Coarse Comb*, approximately 8 teeth/in. (3 teeth/cm), or Fibrograph comb.

6.3.6 *Fine Comb*, approximately 52 teeth/in. (20 teeth/cm).

6.3.7 *Black Paper*, to hold bundles.

6.3.8 *Shearing Knife*.

6.3.9 *Tweezers*.

6.3.10 *Standard Calibration Cotton*, having specified fiber strength.⁵

6.3.11 *Fiber Clips or Sample Clips*.

7. Sampling

7.1 Take the lot sample and laboratory sample as directed in Practice D 1441.

8. Preparation, Calibration, and Verification of Apparatus

8.1 *Tensile Testing Instrument*—Before making fiber strength tests, check the instrument and clamp vise for mechanical adjustment as directed for the specific instrument in Appendix X1, or in accordance with the manufacturer's instructions.

8.2 *Laboratory Balance*—Check the zero setting of the laboratory balance and make sure its sensitivity is within the range to be used.

8.3 *Clamp Leathers*—Inspect the leathers in the clamps frequently to ensure that they are in good condition. Keep the

inner edges of the leathers trimmed flush with the metal surface and replace the leathers as soon as grooves become evident.

9. Conditioning

9.1 Bring the laboratory sample from the dry side to moisture equilibrium for testing in the standard atmosphere for testing textiles. See Practice D 1776.

NOTE 2—Cotton is normally received in the laboratory in a relatively “dry” condition, making special preconditioning procedures unnecessary. Samples that are obviously damp should be preconditioned before being brought into the laboratory for conditioning.

9.2 Tufts prepared from the laboratory sample must be conditioned as required for the laboratory sample described in 9.1.

10. Preparation of Specimens

10.1 Make the test specimens (flat bundles) from small subsamples (tufts or Fibrograph beards) which have been prepared from the laboratory sample as directed in 10.1.1 or 10.1.2.

10.1.1 Prepare a tuft of fibers either (1) by taking two small pinches at random from the unblended laboratory sample and placing them one on top of the other near their mid-points, or (2) by taking a section from a blended laboratory sample. Hold the tuft between the thumb and forefinger and comb with the coarse comb to remove foreign matter and short fiber. When one end of the tuft has been combed, reverse the tuft and comb the other end, taking care that the middle portion of the tuft is well combed. Approximately 10 strokes are necessary for combing each end of the tuft. Prepare two to six tufts, each weighing 60 to 80 mg, from each sample to be tested. Before testing, condition the tufts as directed in Section 9.

10.1.2 Prepare a Fibrograph beard as directed in Test Method D 1447. Prepare two to six Fibrograph beards for each sample to be tested.

10.2 Test a specimen from each tuft or Fibrograph beard, depending on the precision desired, and if possible, have two technicians participate with each one testing one half the number of specimens.

10.3 Prepare the specimen as directed in either 10.3.1 or 10.3.2.

10.3.1 Grasp the prepared tuft near the midpoint between the center and the end of the tuft, and pull out a portion of the fibers to form a specimen. Hold the specimen firmly by one end and pull the fibers through the fine comb on the vise two or three times to remove loose fibers, neps, and trash. Comb the other end of the specimen in the same manner, keeping the fiber ends aligned while the middle portion is combed. Maintain the width of the specimen at approximately $\frac{1}{4}$ in. (6 mm). If the specimen is too heavy, remove fibers from either side to obtain the correct weight. The specimen is now ready to be placed in the clamps.

10.3.2 Grasp a group of fibers on the Fibrograph comb, using the fiber clip or similar device to grip the fibers at a point at least $\frac{5}{8}$ in. (15 mm) from the teeth of the comb. Pull these fibers, which constitute the specimen, through the Fibrograph comb teeth three or four times to straighten them and remove loose fibers. Use tweezers to remove any remaining neps or

⁵ International Calibration Cotton Standards with values for the inclined-plane type testing machine for the zero gage tests and USDA Calibration Cotton Standards with values for both the inclined-plane and pendulum-type testing machines for the zero gage and the $\frac{1}{8}$ -in. (3.2-mm) gage tests are available from the Cotton Division, Agricultural Marketing Service, U.S. Department of Agriculture, 4841 Summer Ave., Memphis, TN 35122.

foreign matter. The specimen is now ready to be placed in the clamps.

11. Procedure

11.1 Placing the Specimen in the Clamps—Place the test specimen in the fiber clamps as directed in either 11.1.1 or 11.1.2.

11.1.1 Using a Pressley-type clamp vise, lock the fiber clamps in the vise, and then open the clamps. Hold both ends of the specimen, keeping it approximately ¼ in. (6 mm) wide, and place it in the center of the open clamps. Apply sufficient tension to hold the fibers straight while the jaws of the clamps are lowered and tightened in place by applying an 8-lbf-in. (9-kgt-cm) torque. The torque is controlled by the clamp vise or by a torque wrench. Remove the fiber clamps from the vise. Shear off the protruding ends of the specimen with the shearing knife, shearing downward and away from the leather face of the clamps.

11.1.2 Using the Stelometer-type clamp vise, lock the fiber clamps in the vise, and then open the clamps. Lift the fixed clamp on the vise and insert the loose ends of the flat-bundle specimen held in the fiber clip. Draw the fiber clip forward until it falls into place over the hook of the tension level. Apply sufficient pressure on the fixed clamp to prevent fiber slippage and release the spring lever to apply tension on the specimen. Close and tighten the clamps, applying a torque of 8 lbf-in. (9 kgt-cm). Tighten the clamp farthest from the clip first to ensure correct tension between the clamps. Remove the clamps from the vise and shear off the protruding fibers as in 11.1.1. This method for placement of the flat bundle in the clamps provides a uniform pretension on the specimen, which is necessary to secure reliable measurements of elongation.

11.2 Operation of the Tensile Testing Machine—Insert the prepared clamps in the tensile testing machine and release the locking or trigger mechanism to break the test specimen in accordance with instructions furnished by the manufacturers of the specific instruments (see Appendix X1). After the specimen has been broken, record the breaking load to the nearest scale reading. Remove the clamps from the instrument, check to see that all fibers are broken, and place the clamps in the vise. If the fibers are not all broken, or if the fibers are broken irregularly, or if the breaking load is less than the required minimum for the instrument used, discard the specimen and make a new test. If the break is acceptable, open the clamps, collect the broken fibers with tweezers, and weigh them to the nearest 0.01 mg (Note 4). Collect all the fibers so that the correct weight may be obtained. To avoid a gain in weight from moisture pickup, do not touch the fibers with the fingers while collecting and weighing the specimen.

NOTE 3—Correction factors described in Practice D 3025 are required to obtain standard strength results because the results are highly affected by both technician technique and testing machine differences. When adjusting the results to the standard level for the type testing machine being used, the correction factors for individual technicians and different testing machines do not normally exceed the range of 0.90 to 1.10. When adjusting the results to the more commonly used standard level for the inclined-plane type testing machine, however, the correction factor for the pendulum-type testing machine is usually within the range of 1.16 to 1.36. The difference in the size of the correction factors for the different type testing machines is primarily because of a difference in the rate of loading.

The ⅛-in. (3.2-mm) gage test values of the Calibration Cotton Standards for the inclined-plane type testing machine are greater by a factor of 1.26 than those for the pendulum-type testing machine.

NOTE 4—If desired, the broken specimens may be placed temporarily in folded black papers, stored in the standard atmosphere for testing textiles, and weighed later.

11.3 Use of Standard Calibration Cotton Samples—Each day before making other tests, make a check test of at least three specimens per technician on one or more standard calibration samples to check the reproducibility and uniformity of results.⁵ If available, use standard calibration samples with test values within the range of the unknown samples being tested. Make additional check tests in a similar manner at least three more times during a working day to obtain results for the calculation of correction factors. The calculated breaking tenacity or tensile strength values of the samples tested during the same time period can be adjusted to the standard level by applying the correction factor (see Eq 9 and 10) calculated from the check test. This factor is used to adjust the level of observed results for operator, instrument and other uncontrolled sources of difference in testing.

12. Calculation

12.1 Calculate the unadjusted fiber bundle strength for each specimen from the breaking load and the bundle weight by Eq 1-8.

12.1.1 Zero gage strength tests based on a bundle length of 0.465 in. (11.81 mm):

$$B = 5.36 F/m \quad (1)$$

$$B = 11.81 f/m \quad (2)$$

$$T = 10.81 F/m \quad (3)$$

$$T = 23.83 f/m \quad (4)$$

$$B = 0.496 T \quad (5)$$

$$T = 2.016 B \quad (6)$$

where:

- B = breaking tenacity, gf/tex
- T = tensile strength, 1000 psi
- F = breaking force, lbf
- f = breaking force, Kgf, and
- m = bundle mass, mg.

NOTE 5—Because the area of the cotton in the bundle cannot be determined precisely, the test does not provide a measure of tensile strength directly. The breaking tenacity results obtained are converted to the equivalent level of the tensile strength results obtained by the Chandler round bundle test. The conversion formula was established empirically from tests using both the flat bundle and the round bundle methods performed on a large number of cotton samples, which included a wide range of fiber properties. The Chandler round bundle method is described in former Methods D 414. The constant of 10.81 in Eq 3 assumes a density of 1.42 for cotton. The density of cotton has been reported in the range of 1.52 to 1.56. Using a density of 1.52 will result in a constant of about 11.58 in Eq 3 and will yield a result about 7 percent higher.

12.1.2 Tests on ⅛-in. (3.2-mm) gage specimens based on a bundle length of 0.490 in. (15-mm):

$$B = 6.80 F/m \quad (7)$$

$$B = 15.00 f/m \quad (8)$$

where the terms in the equations are defined in 12.1.1.

NOTE 6—The recommended unit for breaking tenacity is millinewton/tex. The value of the breaking tenacity in millinewtons per tex equals the value of the breaking tenacity in grams-force per tex times 9.81. The value of the tensile strength in kilopascals equals the value of the tensile strength in pounds per square inch times 6.89.

12.2 Calculate the average breaking tenacity or tensile strength for each sample from the specimen values calculated in Eq 1-8.

12.3 Calculate the correction factor by Eq 9 as follows:

$$F_c = C_s/C_o \quad (9)$$

where:

- F_c = correction factor,
- C_s = standard value for calibration cottons, and
- C_o = observed value for calibration cottons

Adjust the average breaking tenacity or tensile strength by Eq 10 as follows:

$$A = VF_c \quad (10)$$

where:

- A = adjusted breaking tenacity or tensile strength
- V = observed breaking tenacity or tensile strength, and
- F_c = correction factor

A suggested worksheet is shown in Appendix X2.

12.4 Calculate the breaking elongation from the measurements of the specimen lengths at zero load and at the breaking load by Eq 11 as follows:

$$E = 80 (L - N)/N \quad (11)$$

where:

- E = elongation, percent.
- L = Length of specimen at break, inch
- N = Nominal gage length, and
- 80 = 0.8 (100).

For a nominal gage length of 1/8 (0.125) in., Eq 11 becomes:

$$E = 640 (L - 0.125) \quad (12)$$

where the terms in the equation are defined above.

NOTE 7—The factor, 0.8, included in the breaking elongation formula compensates for the slippage of fibers in clamps.

12.5 Calculate the average breaking elongation for each sample from the specimen values calculated in Eq 11 or Eq 12.

13. Report

13.1 State that the specimens were tested as directed in Test Method D 1445. Describe the material or product sampled and the method of sampling used.

13.2 Report the following information:

13.2.1 Adjusted average breaking tenacity to 1 decimal (grams-force per tex), or

13.2.2 Adjusted average tensile strength, 1000 psi, to the nearest whole number,

13.2.3 Average breaking elongation in percent, if determined, to the nearest whole number,

13.2.4 Type of testing machine, and

13.2.5 Nominal gage length.

14. Precision and Bias

14.1 *Interlaboratory Test Data*⁶—An interlaboratory test was carried out in 1969 in which two operators in each of two laboratories performed breaking strength and elongation tests on cotton fibers. Each of the two operators tested three specimens from each of five subsamples from each cotton to establish standard values for each of five different cottons. The operators performed strength tests at both zero and 1/8-in. (3-mm) gage length with the Pressley instrument and strength and elongation tests in combination at 1/8-in. gage length with the Stelometer instrument. The operators performing these tests had better than average skill and extensive experience. Each of the subsamples were coded with different numbers and the results were decoded after the tests were completed. The levels of participating laboratories were controlled by the use of the same group of calibration cottons. The components of variance calculated from the results of these tests and expressed as standard deviations are listed in Table 1.

14.2 *Precision*—For the components of variance in Table 1, the averages of observed values for both the six specimen and the two specimen tests should be considered significantly different at the 95 percent probability level if the difference equals or exceeds the critical differences in Table 2.

NOTE 8—The tabulated values for the critical differences listed in Table 2 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 comparison being based on recent data obtained on randomized specimens from one sample of the material to be tested.

14.3 *Bias*—When controlled by the use of calibration cotton standards, the procedures in Test Method D 1445 for breaking strength and elongation have no bias and are accepted as a referee method.

15. Keywords

15.1 breaking strength; cotton; elongation

⁶ ASTM Research Report No. D-13 – 1011. A copy is available on loan from ASTM Headquarters, 100 Barr Harbor Drive, Conshohocken, PA 19428.

TABLE 1 Standard Deviations for Single-Operator, Between Operator-within Laboratory and Between-Laboratory Components of Variance for Results of Cotton Fiber Strength Tests

Test item	Single-Operator	Within-Laboratory
Pressley instrument: Zero-gage strength, 1000 psi	2.488	0.320
1/8-in. gage tenacity, gf/tex	0.9680	0.0211
Stelometer instrument: 1/8-in. gage tenacity, gf/tex	0.6990	0.0464
1/8-in. gage elongation, percentage points	1.6362	0.0371

TABLE 2 Critical Differences Between Two Means in Cotton Fiber Strength Tests for the Conditions Noted^A

Number of Specimens in Test and Item ^A	Single- Operator	Within- Laboratory	Between- Laboratory
Six-specimen test:			
Pressley instrument:			
Zero-gage strength, 1000 psi	2.8	3.0	3.0
1/8-in. gage tenacity, gf/tex	1.10	1.10	1.66
Stelometer instrument:			
1/8-in. gage tenacity, gf/tex	.79	.80	.85
1/8-in. gage elongation, percentage points	1.85	1.85	2.24
Two-specimen test:			
Pressley instrument:			
Zero-gage strength, 1000 psi	4.9	5.0	5.0
1/8-in. gage tenacity, gf/tex	1.90	1.90	2.27
Stelometer instrument:			
1/8-in. gage tenacity, gf/tex	1.37	1.38	1.40
1/8-in. gage elongation, percentage points	3.21	3.21	3.45

^A The values for the critical differences listed in Table 2, were calculated using $t = 1.960$ which is based on an infinite number of degrees of freedom. These values are applicable only when the tests are performed by skilled operators in laboratories which control the level of results by use of standard calibration cottons.

APPENDIXES

(Nonmandatory Information)

X1. DESCRIPTION AND ADJUSTMENT OF COTTON FIBER STRENGTH INSTRUMENTS

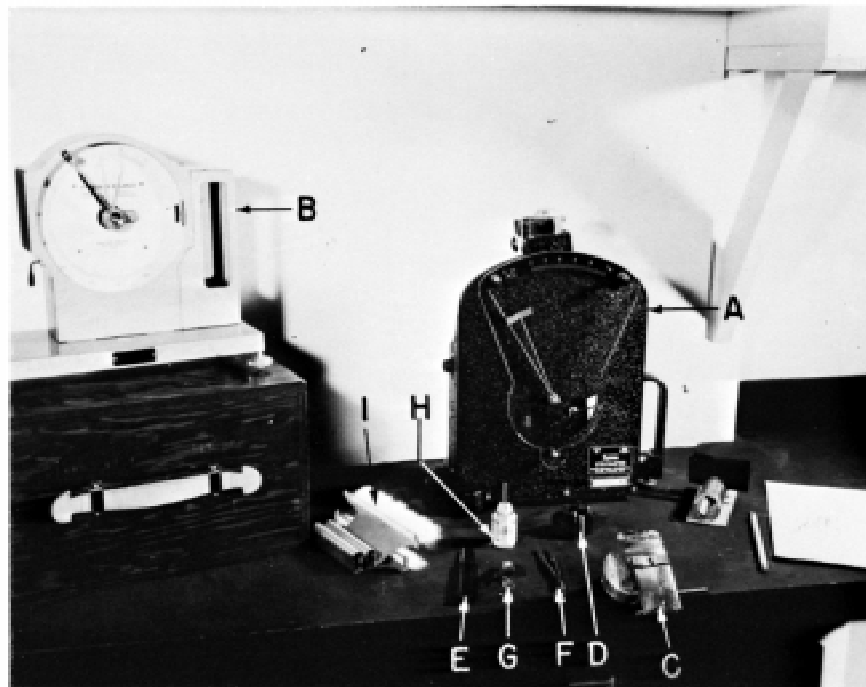
X1.1 Pressley Apparatus

X1.1.1 The testing machine, which is an inclined-plane



- | | |
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| <p>A—Pressley test instrument.
 B—Laboratory balance.
 C—Vise.
 D—Fiber clamps.
 E—Cutting tool.
 F—Tweezer.</p> | <p>G—Coarse comb.
 H—Wrench.
 I—Fine comb.
 K—Black paper to hold specimens.
 L—Rack for holding papers and specimens.</p> |
|--|--|

FIG. X1.1 Pressley Cotton Fiber Strength Instrument and Accessories



A—Stelometer.
 B—Torsion balance.
 C—Vise with tension device.
 D—Clamps and spacer.
 E—Cutting tool.
 F—Tweezers.
 G—Sample clip.
 H—Wrench.
 I—Fibrograph combs.

FIG. X1.2 Stelometer Cotton Fiber Strength Tester and Accessories

type, and the accessory equipment⁷ are shown in Fig. X1.1.

X1.1.2 Preparation of Apparatus—Place a thin metal strip in the clamps to prevent movement or separation and insert the clamps in position in the instrument. Level the instrument with the bubble level on the carriage track by turning the adjustment screw on the base plate of the instrument (the track angle should be approximately 1.5 deg). Properly adjusted, the carriage should travel from the 5-lb reading to the 20-lb reading in approximately 1 s.

X1.1.3 Operation—The carriage is released by gently raising the locking lever. The scales are calibrated in pounds and the breaking load can be read on the beam scale to the nearest 0.1 lb (50 g). If the observed breaking load is less than 10 lb (45 kg), discard the specimen and make a new test.

NOTE X1.1—Although this instrument is capable of making fiber strength tests at 1/8-in. (3.2-mm) gage clamp spacing, it is not equipped to measure fiber elongation.

X1.2 Stelometer Apparatus

X1.2.1 The testing machine, which is a pendulum type, and the accessory equipment⁸ are shown in Fig. X1.2.

X1.2.2 Preparation of Apparatus—Level the instrument with the bubble level by turning the screw directly under the

right handle. Placing a thin metal strip in the clamps to prevent movement or separation, insert the clamps in the instrument in the same orientation as that used during testing. Release the pendulum by depressing the release trigger. Check the time required for the load indicator to advance to 7 kg. Adjust the small valve attached to the control cylinder as required to obtain a rate of loading of 1 kg/s. Hold the pendulum where the first indicator reads 2 kg by grasping the instrument head, and check the position of the elongation indicator, which should be on the first red line to the left of zero. If a change in the elongation indicator is needed, loosen the setscrew on the instrument head, turn the adjustment screw until the correct setting is obtained, and retighten the setscrew. This adjustment usually has to be changed whenever different clamps or clamp spacers are used.

X1.2.3 Operation—The Stelometer has a trigger release which starts both the force and elongation indicators moving across the scales. The force scale is calibrated in kilograms and the elongation scale is calibrated in percent. The indicators can be read to the nearest 0.01 kg and 0.1 percent for force and elongation respectively (Note X1.2). If the observed breaking load is less than 3 kg, discard the specimen and make a new test.

NOTE X1.2—The elongation indicator on the Stelometer is graduated to provide a direct reading of percentage elongation for 1/8-in. (3.2-mm) nominal gage length. The observed reading should be multiplied by a factor of 0.8 to compensate for the slippage of fibers in the clamps.

⁷ The Pressley Cotton Fiber Strength Test Instrument is manufactured by Joseph M. Doeblich and Sons, Inc., Tucson, AZ.

⁸ The Stelometer is manufactured by the Special Instruments Laboratory, Inc., Knoxville, TN.

X2. SUGGESTED WORKSHEET FOR USING STANDARD CALIBRATION STANDARDS

See Table X2.1

TABLE X2.1 Suggested Work Sheet for Using Standard Calibration Samples
 (Work sheets may be prepared based upon metric units).

FLAT BUNDLE COTTON FIBER STRENGTH DATA SHEET							Laboratory Test No.	Date Tested		
SAMPLE IDENTIFICATION	ITEM	TECHNICIAN AND BREAK NUMBER						AVERAGE		Grams/ Tex ^b
		First (initials)			Second (initials)			Ratio or 1000 psi ^a		
		1	2	3	1	2	3	Observed	Corrected	
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
CHECK SAMPLE	Beam								Correction Factor ^c	
Identification Std. avg.	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
	Beam									
	Mass (Weight)									
	Ratio or 1000 psi									
^a Use ratio for 1/8-in. gage or 1000 psi for 0-gage (cross out one) (If working in metric units, make appropriate change in form.)								Calc. by		Date
^b Grams/tex = ratio × 6.80 for 1/8-in. gage or 1000 psi × 0.495 for 0-gage.								Ck. by		Date
^c Factor = Std. Avg. – Observed Avg. (Corrected Avg. of other samples factor × Observed Avg.)										

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