Designation: D7642 – 12

Standard Practice for Establishment of Calibration Cottons for Cotton Classification Instruments[1]

This standard is issued under the fixed designation D7642; 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 practice provides instructions for the development of calibration cotton standards by establishing cotton fiber values for micronaire, length, uniformity index, and strength. The purpose of calibration cotton standards is for calibration of cotton classification instruments to the level of the internationally recognized United States Department of Agriculture (USDA) Benchmark Reference Cotton Standards. The USDA has established calibration cotton standards for domestic upland and Extra Long Staple (ELS) cottons and this practice provides an instruction for other geographical regions to establish their own calibration cotton standards for cotton classification instruments.

1.2 This practice shall be used for the establishment of calibration cottons for the testing of Upland and ELS cottons.

1.3 Only saw ginned cottons shall be used in this practice. Roller gin cottons are not valid for use due to higher measurement variability.

1.4 The calibration cotton established by this practice is not valid for use as a micronaire calibration standard. The micronaire standard value is not for the instrument calibration of the micronaire module; it is utilized by the instrument for the correction of the strength measurement during the calibration routine.

1.5 The values stated in inch-pound are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only.

1.6 *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

D7139 Terminology for Cotton Fibers

D7410 Practice for Qualification of Cotton Classification Instruments for Cotton Marketing

3. Terminology

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

3.1.1 The following terms are relevant to this standard: calibration cotton standards, candidate bale, Extra Long Staple Cotton, fanhead, fanheading, length, ringer cotton, roller ginned cotton, saw ginned cotton, strength, Universal micronaire calibration cotton standards, USDA benchmark reference cotton standard, value setting, value setting group, value setting subgroup.

3.2 For definitions of all other textile terms see Terminology D123.

4. Summary of Practice

4.1 In order to establish calibration cotton standards for use in calibration of cotton classification instruments, testing shall be performed on samples from each candidate bale while being tested in conjunction with benchmark cottons and ringer cottons. The samples shall be tested in a minimum of four laboratories and on a minimum of six cotton classification instruments. Established values are calculated based on the level of the benchmark cottons.

5. Significance and Use

5.1 The purpose of this practice is to provide standardization in the value setting of calibration cotton standards to be used for cotton classification instrument calibration.

[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 July 1, 2012. Published September 2012. DOI: 10.1520/D7642–12

[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.

5.2 The practice provides procedures for the value setting for calibration cotton standards. These procedures are for use by cotton fiber testing organizations that establish standard values on candidate bales that will be utilized as calibration cotton standards for cotton classification instruments on the level of the benchmark cottons.

NOTE 1—Benchmark cottons are of high value and of limited supply. Long term accuracy and stability of the internationally recognized USDA cotton standards are dependent on long term maintenance of the benchmark cottons. Therefore, distribution of the benchmark cottons will be tightly controlled by the USDA.

6. Apparatus and Materials

6.1 Cotton classification instruments with a fully automated comb sampling device.

6.1.1 A minimum of six (6) total cotton classification instruments from a minimum of four (4) total laboratories shall be utilized in value setting. One (1) USDA cotton classification instrument from one (1) USDA laboratory shall be included as part of the total instruments and laboratories.

6.1.2 The cotton classification instruments shall adhere to the requirements of Practice D7410 for the qualification of cotton classification instruments. Each instrument to be included in value setting shall successfully complete the qualification process within one month prior to testing. If multiple value settings will be performed, the instrument qualification process shall be successfully completed on a six-month basis during value settings.

6.2 Benchmark cotton (short/weak), with established values for length, uniformity index, strength and micronaire.

6.3 Benchmark cotton (long/strong), with established values for length, uniformity index, strength and micronaire.

6.4 Ringer cotton (short/weak), with established values for length, uniformity index, strength and micronaire.

6.5 Ringer cotton (long/strong), with established values for length, uniformity index, strength and micronaire.

6.6 Candidate bales (up to 18), saw-ginned cotton with targeted measurement ranges for micronaire, length, uniformity index and strength as given in 7.1.2.

7. Sampling

7.1 Value setting begins by obtaining test samples from a maximum of twenty-two (22) bales. Samples from one benchmark cotton (short/weak), one benchmark cotton (long/strong), one ringer cotton (short/weak), one ringer cotton (long/strong) and a maximum of eighteen (18) candidate bales are included in each value setting group.

7.1.1 Candidate bales shall be saw-ginned. Ginning shall take place a minimum of one calendar year prior to being included in a value setting group.

7.1.2 Candidate bales for short/weak and long/strong calibration cottons are selected according to Table 1.

7.1.3 A total of ten (10) samples shall be removed from ten (10) equally spaced positions across the fanheaded candidate bale (see Fig. 1). Ensure each sample is no less than 4 lb (2000 g) or 1 lb (450 g) times the number of laboratories.

7.2 A value setting group also includes a total of ten (10) samples of cotton for each designated benchmark and ringer cotton.

7.2.1 Benchmark and ringer samples shall be obtained from USDA, AMS, Cotton Division.

7.2.2 Ten (10) samples of cotton for each designated benchmark and ringer cotton shall be subdivided into the number of value setting subgroups to be prepared (minimum of 4). Ensure that each subdivided sample is a minimum of 1 lb (450 g).

7.3 Assign the sample identification numbers such that the sample identification is associated with the bale number and the location within the fanheaded bale. See Attachment 1 as an example.

7.3.1 Subdivide the ten samples taken from each bale into the number of value setting subgroups to be prepared (minimum of 4). Ensure that each subdivided sample is a minimum of 1 lb (450 g).

7.4 Distribute the value setting subgroups to the laboratories. An additional 1 lb (450 g) of each benchmark cotton shall be included in each subgroup for calibration of the cotton classification instruments.

8. Conditioning

8.1 Standard atmospheric conditions shall be maintained in each laboratory at 21 ± 1 °C (70 ± 2 °F) and 65 ± 2 % relative humidity.

8.1.1 Condition each value setting subgroup for a minimum of 72 h prior to testing according to 8.1.

9. Procedure

9.1 Arrange the individual samples of the value setting subgroup in numerical order.

9.2 Calibrate each participating cotton classification instrument for length, uniformity index and strength with the benchmark cottons included for instrument calibration purposes.

TABLE 1 Measurement Value Ranges for Calibration Cottons

Bale	Micronaire	Length	Uniformity Index	Strength
Upland Short/Weak	3.5 to 4.5	Below 1.01 in. (25.64 mm)	77 to 82	Lower than 26
Upland Long/Strong	3.5 to 4.5	1.17 to 1.24 in. (29.72 to 31.50 mm)	83 to 87	33 to 38
ELS Long/Strong	3.5 to 4.5	1.35 to 1.50 in. (34.29 to 38.10 mm)	84 to 88	40 to 48

FIG. 1 Fanheaded Bale

9.3 Calibrate each of the cotton classification instruments for micronaire according to instrument manufacturer's recommended methods to achieve a testing level verifiable to ±0.1 with the Au and Gu Universal micronaire calibration cotton standards.

9.4 Perform and record the calibration verification using the benchmark cottons prior to value setting tests. (See Attachment 2: Calibration Verification)

9.4.1 The calibration verification requires the benchmark short and benchmark long cottons used for instrument calibration to be tested ten times each. If the average of the ten (10) readings exceeds ±0.10 for micronaire, ±0.010 in. (0.25 mm) for length, ±1.0 for uniformity index or ±1.0 for strength, the instrument must be re-calibrated. The instrument must pass the calibration verification process before sample testing can begin.

9.5 Test the value setting subgroup across the designated cotton classification instruments without interruption. Recalibration of cotton classification instruments is not permitted during sample testing. Upon completion of sample testing, perform and record the calibration verification again.

9.5.1 For value setting on Upland cottons, set up the instrument to perform a two specimen test for length, uniformity index and strength from each sample of the value setting subgroup.

9.5.2 For value setting on Extra Long Staple cottons, set up the instrument to perform a four specimen test for length, uniformity index and strength from each sample of the value setting subgroup.

9.5.3 The instrument data precision shall be reported for micronaire to the nearest one hundredth of a unit, length to the nearest one hundredth of a millimeter (one thousandth of an inch), uniformity index to the nearest one tenth of a unit, strength to the nearest one tenth of a unit.

9.6 Two separate test replications per instrument shall be performed on the value setting subgroup.

NOTE 2—Completion of steps 9.2 through 9.5 constitutes one test replication.

10. Calculation

10.1 Collect the data from the cotton classification instruments utilized in the value setting.

Measurement Outliers

10.2 Calculate averages for the measurements of micronaire, length, uniformity index, and strength of all data points by measurement for each bale.

10.3 Subtract each individual data point from the averages calculated in 10.2.

10.4 Compare the differences from 10.3 to the tolerances in Table 2. Remove all measurement data by test replication, by instrument for any sample where a single measurement falls outside of the tolerances.

10.4.1 No more than ten (10) data points shall be removed for any one measurement for any instrument for any replication based on comparison to the average.

10.4.2 If the number of data points removed in 10.4.1 is exceeded, the value setting shall be repeated for the instrument(s) in question until the requirements of 10.4.1 are met.

Benchmark Outliers

10.5 Calculate the average of the benchmark short and benchmark long cottons for each instrument for each test replication.

10.6 Compare the observed averages of the benchmark short and benchmark long cottons from each instrument on each test replication to the standard values for the benchmark cottons.

10.6.1 The difference between the observed benchmark averages for any instrument by test replication and the standard values cannot exceed the tolerances as shown in Table 3.

10.6.2 If the tolerance for any instrument by test replication on any one measurement is exceeded, the value setting shall be repeated for the instrument(s) in question until the requirements are met.

NOTE 3—Benchmark cottons are not the reference basis for the micronaire measurement.

Standard Deviation Outliers

10.7 Identify outliers based on standard deviations for each bale in the value setting.

10.7.1 For each bale, calculate the standard deviations of *all* data points for the measurements of micronaire, length, uniformity index and strength.

10.7.2 For each bale, calculate the standard deviations by test replication by instrument for the measurements of micronaire, length, uniformity index and strength.

10.7.3 Calculate the difference between 10.7.1 and 10.7.2. If the differences exceed the values listed in Table 4, identify as standard deviation outliers any measurement data by test replication, by instrument for any bale.

10.7.4 No more than eight standard deviation outliers for any measurement for any instrument can be included in the value setting.

TABLE 2 Single Measurement Removal Tolerances

Micronaire	Length	Uniformity Index	Strength
± 0.35	± 0.05 in. (1.27 mm)	± 4.0	± 4.0

TABLE 3 Benchmark Outlier Tolerances

Length	Uniformity Index	Strength
± 0.020 in. (0.51 mm)	± 1.5	± 1.5

TABLE 4 Standard Deviation Outlier Tolerances

Micronaire	Length	Uniformity Index	Strength
± 0.03	± 0.003 in. (0.076 mm)	± 0.15	± 0.2

TABLE 5 Maximum Allowable Standard Deviations for Calibration Cotton Standards

	Micronaire	Length	Uniformity Index	Strength
Upland	0.1	0.013 in. (0.33 mm)	1.0	1.0
ELS	0.1	0.013 in. (0.33 mm)	1.0	1.25

10.7.5 If the number of standard deviation outliers in 10.7.4 is exceeded, the value setting shall be repeated for the instrument(s) in question until the requirements of 10.7.4 are met.

Correction of Data

10.8 Calculate the slopes and offsets by instrument and test replication based upon the standard values of the benchmark cottons for the measurements of length, uniformity index and strength.

10.8.1 Calculate the slope using the following formula:

Slope = (Standard Value of Benchmark Long
– Standard Value of Benchmark Short)
/ (Observed Average of Benchmark Long
– Observed Average of Benchmark Short)

10.8.2 Calculate the appropriate offset using the following formula:

Offset = Standard Value of Benchmark Long
– (Slope * Observed Value of Benchmark Long)
or
Offset = Standard Value of Benchmark Short
– (Slope * Observed Value of Benchmark Short)

10.9 Calculate the corrected values for each data point for length, uniformity index and strength.

10.9.1 Multiply each single test data point by the appropriate slope and add the appropriate offset calculated for each instrument for each test replication.

NOTE 4—As a result of benchmark cottons not being the reference basis for the micronaire measurement, a correction is not applied to the micronaire data.

11. Bale Value Establishment

11.1 Using the corrected data calculate an average value and a standard deviation for each bale for the measurements of length, uniformity index and strength.

11.2 Using the uncorrected micronaire data calculate an average value and a standard deviation for each bale.

11.3 Verify that the average values from 11.1 and 11.2 meet the guidelines as given in Table 1.

11.4 Verify that the standard deviations from 11.1 and 11.2 meet the guidelines as given in Table 5.

11.5 If the criterion of 11.3 and 11.4 are met, then the candidate bales are assigned the average values from 11.1 and 11.2.