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Standard Practice for Qualification of Cotton Classification Instruments for Cotton Marketing[1]

This standard is issued under the fixed designation D7410; 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 two options for the qualification of cotton classification instruments: option 1, *newly installed* cotton classification instrumentation, or option 2, *annual verification* of cotton classification instrumentation using evaluation cottons, trash evaluation images, and color evaluation fiber samples for the fiber measurements of micronaire reading, upper half mean length, uniformity index, breaking tenacity (strength), Rd (color reflectance), +b (color yellowness), percent area (trash), and particle count (trash).

1.2 This practice covers the technical requirements to validate the consistency of data reported by a cotton classification instrument.

1.2.1 The practice can be used when new equipment is installed or it can be used to perform annual verification for consistency of reported data.

1.2.2 The practice can be used to qualify cotton classification instruments using evaluation cottons, trash evaluation images, and color evaluation fiber samples. These data can be used for fiber measurements of micronaire reading, upper half mean length, uniformity index, strength, color reflectance, and trash.

1.3 The values stated in English 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

D1776 Practice for Conditioning and Testing Textiles

D2495 Test Method for Moisture in Cotton by Oven-Drying

D7139 Terminology for Cotton Fibers

2.2 *Other Documents:*

Guidelines for HVI Testing, July 2001, United States Department of Agriculture (USDA), Agricultural Marketing Service (AMS), Cotton Program, 3275 Appling Road, Memphis TN 38133 http://www.ams.usda.gov/cotton/cnpubs.htm

USDA The Classification of Cotton, April 2001, Agricultural Handbook; United States Department of Agriculture, Agricultural Marketing Service, Cotton Program, 3275 Appling Road, Memphis TN 38133 http://www.ams.usda.gov/cotton/cnpubs.htm

3. Terminology

3.1 The following terms are relevant to this standard:

3.1.1 *+b (color yellowness)*

3.1.2 *breaking tenacity (strength)*

3.1.3 *micronaire reading*

3.1.4 *particle count (trash)*

3.1.5 *percent area (trash)*

3.1.6 *rd (color reflectance)*

3.1.7 *uniformity index*

3.1.8 *upper half mean length*

3.2 *Definitions:*

3.2.1 *color evaluation fiber samples, n—as established by United States Department of Agriculture (USDA)*, cotton samples based upon USDA established standard values for Rd (color reflectance) and +b (color yellowness).

3.2.2 *cotton classification instrument, n*—an integrated instrument utilized for the classification of cotton that measures micronaire reading, upper half mean length, uniformity index,

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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.

breaking tenacity (strength), Rd (color reflectance), +b (color yellowness), percent area (trash) and particle count (trash).

3.2.3 *evaluation cottons, n—as established by United States Department of Agriculture (USDA)*, cottons that have established standard values for micronaire reading, upper half mean length, uniformity index and breaking tenacity (strength).

3.2.4 *micronaire-specific evaluation cottons, n—as established by United States Department of Agriculture (USDA)*, cottons that have established standard values for micronaire reading.

3.2.5 *trash evaluation images, n—as established by United States Department of Agriculture (USDA)*, photographic images of reference cottons with established standard values for percent area (trash) and particle count (trash).

3.3 For all terminology related to cotton fibers, see Terminology D7139.

3.4 For all terminology related to textiles, see Terminology D123.

4. Summary of Practice

4.1 The cotton classification instrument shall perform a series of tests on evaluation cottons, trash evaluation images, and color evaluation fiber samples that shall meet established criteria for instrument qualification.

5. Significance and Use

5.1 The purpose of this practice is to provide guiding principles for the use of evaluation cottons and evaluation samples for the qualification of cotton classification instruments.

5.2 The cotton classification instruments qualified under this practice shall be capable of testing the fiber properties of micronaire reading, upper half mean length, uniformity index, breaking tenacity (strength), Rd (color), +b (color), percent area (trash) and particle count (trash).

5.3 This practice provides guidelines for users of cotton classification instruments to perform standardized testing that will ensure that test results are within acceptable tolerances (see tables below) for the marketing of cotton bales.

5.4 A test of the upper half mean length, uniformity index and breaking tenacity (strength) shall consist of an average of two (2) specimens that are prepared by an automatic mechanical sampler.

5.5 A test of the color and trash shall consist of an average of four (4) measurements with a 90 degree rotation of the color evaluation fiber samples between measurements on each sample.

5.6 The micronaire test shall consist of a single measurement.

6. Apparatus and Materials

6.1 *Cotton Classification Instrument:*

6.1.1 The precision of measurement for each property shall be as follows: micronaire to the nearest hundredth, upper half mean length to the nearest thousandth, uniformity index to the nearest tenth, breaking tenacity to the nearest tenth, Rd (color reflectance) to the nearest tenth, +b (color yellowness) to the nearest hundredth, percent area (trash) to the nearest hundredth and particle count (trash) to the nearest whole number.

6.2 *Reference Materials:*

6.2.1 The evaluation cottons, micronaire-specific evaluation cottons, trash evaluation images, and color evaluation fiber samples that shall be utilized for this practice can be obtained from the USDA, AMS, Cotton Program's Standardization and Engineering Branch. The contact information is provided below.

USDA, AMS, Cotton Program
Standardization and Engineering Branch
3275 Appling Road, Room #5
Memphis, TN 38133 USA
http://www.ams.usda.gov/cotton/
phone: 901-384-3030 / fax: 901-384-3032

6.2.2 *Evaluation Cottons*—A set of eight (8) evaluation cottons that represents a range in upper half mean length. In addition the evaluation cottons will contain a range for the measurements of micronaire reading, uniformity index, and breaking tenacity.

6.2.3 *Color Evaluation Fiber Samples (Option 1, Newly Installed)*—A set of twelve (12) color evaluation fiber samples that represent a range in Rd and +b.

6.2.4 *Color Evaluation Fiber Samples (Option 2, Annual Verification)*—A set of six (6) color evaluation fiber samples that represent a range in Rd and +b.

6.2.5 *Trash Evaluation Images (Option 1, Newly Installed)*—A set of twelve (12) trash evaluation images that represent a range in percent area and particle count.

6.2.6 *Trash Evaluation Images (Option 2, Annual Verification)*—A set of six (6) trash evaluation image that represent a range in percent area and particle count.

7. Conditioning

7.1 Condition the cotton samples a minimum of 48 hours according to the temperature and relative humidity levels as specified in Practice D1776 (21 ± 1°C (70 ± 2°F) and 65 ± 2 %).

7.2 Moisture content (dry basis) measured by resistance technique referenced to oven method Test Method D2495 shall be within 6.75 to 8.25 %.

NOTE 1—This range covers the equilibrium moisture content range for all cottons.

8. Calibration

8.1 The cotton classification instrument shall be calibrated using USDA calibration materials as specified according to the instrument manufacturer instructions.

OPTION 1—NEW INSTRUMENT EVALUATION

9. Procedure

9.1 The evaluation process for the measurements of micronaire reading, upper half mean length, uniformity index and breaking tenacity shall consist of testing eight evaluation cottons of varying levels. A total of eight test replications shall be performed on each of the eight cottons. A complete

evaluation shall consist of a total of 64 tests for micronaire reading, upper half mean length, uniformity index and breaking tenacity.

9.2 The evaluation process for the individual measurement of micronaire shall consist of testing six micronaire-specific evaluation cottons of varying levels. Eight test replications shall be performed on each of the six cottons for a total of 48 tests.

9.3 The evaluation process for the color measurement shall consist of testing twelve color evaluation fiber samples. Eight test replications shall be performed on twelve various fiber samples for a total of 96 tests for color Rd and color +b.

9.4 The evaluation process for the trash measurement shall consist of testing twelve trash evaluation images. Eight test replications shall be performed on twelve various images for a total of 96 tests for trash percent area and trash particle count.

9.5 The test data shall be evaluated for differences and standard deviation tolerances for micronaire reading, upper half mean length, uniformity index, breaking tenacity, Rd, +b, percent area and particle count.

9.5.1 The data evaluation for the measurements of micronaire reading, upper half mean length, uniformity index, and breaking tenacity will be done as follows:

9.5.1.1 Data from the eight replication tests are used to calculate the individual measurement averages for each of the evaluation cottons. The difference tolerances in Table 1 represent the allowable difference between the average measured value and the standard value for each measurement of the evaluation cottons. The evaluation fails if the difference tolerances are exceeded for more than one evaluation cotton for any measurement.

9.5.1.2 Data from the eight replication tests are used for calculating the individual measurement standard deviations for each of the evaluation cottons. The average standard deviation for each measurement is calculated by using the individual standard deviations from each of the evaluation cottons. The standard deviation tolerances in Table 1 represent the allowable average standard deviations acceptable for each measurement. The evaluation fails if any average standard deviation exceeds the standard deviation tolerances in Table 1.

9.5.2 The data evaluation for the individual measurement of micronaire reading will be done as follows:

9.5.2.1 Data from the eight replication tests are used to calculate the individual measurement averages for each of the micronaire-specific evaluation cottons. A failure of the micronaire evaluation test results if any of the six average micronaire measurements exceeds the difference tolerance in Table 2 or if the average standard deviation exceeds the standard deviation tolerance provided in Table 2.

9.5.3 The data evaluation for the measurements of Rd (color reflectance) and +b (color yellowness):

9.5.3.1 A failure of the color evaluation test results if any of the twelve average color measurements exceeds the difference tolerance in Table 3 or if the average standard deviation exceeds the standard deviation tolerances provided in Table 3.

9.5.4 The data evaluation for the measurements of percent area and particle count (trash):

9.5.4.1 A failure of the trash evaluation test results if any of the twelve average percent area measurements exceeds the difference tolerance in Table 4. The difference tolerances in Table 4 represent an allowable percent area difference for each image which is determined by its measurement level.

9.5.4.2 A failure of the trash evaluation test results if any of the twelve average particle count measurements exceeds the difference tolerance in Table 5. The difference tolerances in Table 5 represent an allowable particle count difference for each tile which is determined by its measurement level.

TABLE 1 Difference and Standard Deviation Tolerancesfor Micronaire Reading, Upper Half Mean Length, Uniformity Index and Breaking Tenac

Measurements	Difference Tolerances	Standard Deviation Tolerances
Upper Half Mean Length (in.)	±0.018 in.	0.0124 in.
Uniformity Index (%)	±1.2 %	0.84 %
Breaking strength (g/tex)	±1.5 g per tex	1.04 g per tex
Micronaire reading	±0.15 reading	0.104 reading

TABLE 2 Difference and Standard Deviation Tolerances for Micronaire

Measurements	Difference Tolerances	Standard Deviation Tolerances
Micronaire reading	± 0.10 reading	0.07 reading

TABLE 3 Difference and Standard Deviation Tolerances for Rd and +b Measurements

Measurements	Difference Tolerances	Standard Deviation Tolerances
Rd (color reflectance)	±1.0 %	0.74 %
+b (color yellowness)	±0.5 unit	0.34 unit

TABLE 4 Difference Tolerances for Percent Area (Trash)

Percent Area Image Measurement Levels	Difference Tolerances
0.00 to 0.14	±0.02 %
0.15 to 0.34	±0.03 %
0.35 to 0.54	±0.05 %
0.55 to 0.84	±0.07 %
0.85 to 1.14	±0.09 %
1.15 to 1.74	±0.11 %
1.75 to 2.24	±0.14 %

TABLE 5 Difference Tolerances for Particle Count (Trash)

Particle Count Image Measurement Levels	Difference Tolerances
0 to 5	±1
6 to 15	±2
16 to 20	±3
21 to 30	±4
31 to 40	±5
41 to 50	±6
51 to 65	±7
66 to 90	±10

OPTION 2—ANNUAL VERIFICATION

10. Procedure

10.1 The evaluation process for the measurements of micronaire reading, upper half mean length, uniformity index and breaking tenacity shall consist of testing eight evaluation cottons of varying levels. Each of the eight cottons shall be tested a total of eight times. A complete evaluation shall consist of a total of 64 tests for micronaire reading, upper half mean length, uniformity index and breaking tenacity.

10.2 The evaluation process for the individual measurement of micronaire reading shall consist of testing six varying levels of micronaire-specific evaluation cottons. Each of the six cottons shall be tested eight times for a total of 48 measurements.

10.3 The evaluation process for the rd and +b (color) measurements shall consist of testing six color evaluation fiber samples. The six various fiber samples shall be tested eight times for a total of 48 tests for Rd and +b.

10.4 The evaluation process for the percent area and particle count (trash) measurements shall consist of testing six trash evaluation images. The six various trash evaluation images shall be tested eight times for a total of 48 times for percent area and particle count.

10.5 The test shall analyze the differences and standard deviation tolerances of the cottons.

10.5.1 A failure of the length evaluation process is the result of more than one average exceeding the difference tolerance or if the average standard deviation for any property exceeds the standard deviation tolerance outlined in Table 1.

10.5.2 The data evaluation for the individual measurement of micronaire reading:

10.5.2.1 Data from the eight replication tests are used to calculate the individual measurement averages for each of the micronaire-specific evaluation cottons. A failure of the micronaire reading evaluation test results if any of the six average micronaire reading measurements exceeds the difference tolerance in Table 2 or if the average standard deviation exceeds the standard deviation tolerance provided in Table 2.

10.5.3 The data evaluation for the measurements of Rd and +b (color):

10.5.3.1 A failure of the Rd and +b (color) evaluation test results if any of the six average Rd or +b color measurements exceeds the difference tolerance in Table 3 or if the average standard deviation exceeds the standard deviation tolerances provided in Table 3.

10.5.4 The data evaluation for the measurements of percent area and particle count (trash):

10.5.4.1 A failure of the percent area and particle count (trash) evaluation test results if any of the six average percent area measurements exceeds the difference tolerance in Table 4. The difference tolerances in Table 4 represent an allowable trash percent area difference for each image which is determined by its measurement level.

10.5.4.2 A failure of the particle count (trash) evaluation test results if any of the twelve average particle count measurements exceeds the difference tolerance in Table 5. The difference tolerances in Table 5 represent an allowable particle count difference for each image which is determined by its measurement level.