Designation: D 1448 – 97

Standard Test Method for Micronaire Reading of Cotton Fibers[1]

This standard is issued under the fixed designation D 1448; 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 micronaire reading of loose cotton fibers by measuring the resistance of a plug of cotton fibers to air flow under prescribed conditions.

NOTE 1—For other methods for determining the fineness of fibers based on the air-flow principle, refer to Test Method D 1449, Test Method for Specific Area and Immaturity Ratio of Cotton Fibers (Arealometer Method),[2] and to Test Method D 1282, Test Method for Resistance to Air Flow as an Indication of Average Fiber Diameter of Wool Top, Card Sliver, and Scoured Wool.[3]

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:*
D 123 Terminology Relating to Textiles[3]
D 1441 Practice for Sampling Cotton Fibers for Testing[3]
D 1776 Practice for Conditioning Textiles for Testing[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *calibration cotton standards, n*—cotton samples taken from blended bulk source on which fiber properties have been determined under the International Calibration Cotton Standards Program.

3.1.1.1 *Discussion*—The International Calibration Cottons are available from the Cotton Division, Agriculture Marketing Service; USDA, 3275 Appling Rd., Memphis, TN 38133. Currently there are ten such cottons, which cover the range of the micronaire scale.

3.1.2 *fineness, n—of fibers,* a relative measure of size, diameter, linear density, or mass per unit length expressed in a variety of units.

3.1.2.1 *Discussion*—For cotton, the weighted mean linear density expressed in micrograms per inch or in millitex.

3.1.3 *micronaire reading, n*—a measure of specific surface area which is influenced by fiber perimeter and fiber wall thickness is determined by the resistance to air flow through a known mass of cotton fiber compressed to a fixed volume.

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

4. Summary of Test Method

4.1 The resistance a plug of cotton fibers offers to the flow of air is measured as an approximate indication of the fineness of fiber. A predetermined mass of loose cotton fibers is placed in the specimen holder and compressed to a fixed volume. The resistance to air flow is measured and expressed as micronaire reading. Instruments available to measure resistance to air flow use compressed air or vacuum and are constructed to measure air flow under constant pressure drop across the plug, to measure pressure drop when a constant flow of air is maintained, or to indicate resistance to air flow from both a balanced and unbalanced wheatstone bridge.

5. Significance and Use

5.1 This test method for determining micronaire reading of cotton fibers is considered satisfactory for acceptance testing of commercial shipments when the levels are controlled by use of a full range of calibration cotton standards.

5.1.1 In case of a dispute arising from differences in reported test results when using this test method 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 The micronaire reading of cotton fibers is a function of

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[2] Discontinued, see *1977 Annual Book of ASTM Standards,* Part 33.
[3] *Annual Book of ASTM Standards,* Vol 07.01.

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both fineness and maturity and is related to mill processing performance and to the quality of the end products. Factors correlated with micronaire reading include cleaning efficiency, neppiness, and the strength and uniformity of the yarn.

NOTE 2—A modification of this test method is used in commercial trading to select bales which will conform to contract guarantees for specified micronaire readings. For this purpose, it is usual practice to test only one specimen per sample.

6. Apparatus and Materials

6.1 *Air-Flow Instrument*, calibrated in micronaire readings or yielding numerical readings from which micronaire readings can be computed.[4]

6.2 *Micronaire Scale*, appropriate for instrument.

NOTE 3—The air instrument scale is calibrated for a specific air regulator and tube. The model number on the scale should corrrespond to the model number of the instrument. If a regulator or tube is replaced, and the same scale is to be used, the new parts must be of the same make and model as those originally furnished with the instrument (**1**).[5]

6.3 *Balance*, having a capacity suitable for mass of the specimen to be used and a sensitivity of at least 0.2 % of the mass.

6.4 *Air Supply*, to furnish the required pressure or vacuum to operate the instrument in accordance with the manufacturer's instructions.

6.5 *Calibration Cotton Standards*, with assigned micronaire readings.

7. Sampling and Selection of Specimens

7.1 Take the test specimen by random sampling from the laboratory sample prepared as directed in 8.3 of Recommended Practice D 1441.

NOTE 4—In commercial testing consider the classer's sample that represents both sides of the bale as the laboratory sample. Take portions for each specimen from the end of the classer's sample, to be representative of all layers, or take two test specimens, one from each side of the bale.

8. Conditioning

8.1 Bring the laboratory sample from the prevailing atmosphere to moisture equilibrium for testing and check the equilibrium as directed in Practice D 1776. Preconditioning is not necessary.

NOTE 5—The effect of conditioning is small for cottons having micronaire readings below 3.5 but is appreciable for readings of 5.0 and above (**2, 3**).

9. Procedure

9.1 Set up and adjust the instrument as directed in the manufacturer's instructions. Adjust the instrument if necessary to secure values which check the values assigned to the International Calibration Cotton Standards at the beginning of each testing period. Make two tests with each standard cotton. If the average of the two results is not within ±0.1 unit of the established micronaire reading, recheck the instrument and the technique used by the operator. Check the instrument against the standards again at the end of each testing period. If incorrect readings on the standards are obtained at the end of a testing period, discard the results, recheck the instrument, and repeat the tests.

NOTE 6—Built-in calibration devices and calibration plugs alone give only approximate results.

9.2 Test the conditioned specimens in the atmosphere for testing textiles.

9.3 Remove obvious, large pieces of nonfibrous materials. Weigh out a test specimen having the mass specified for the instrument. Place the weighed specimen in the fiber compression cylinder, fluffing it with the fingers as it is packed into the cylinder to eliminate knotty balls, and being careful to place all the fibers inside the cylinder. Insert or activate the fiber compression plunger. Turn on or activate the air, and read the value to the nearest 0.1 unit reading.

9.4 Test two specimens.

10. Calculation

10.1 If the instrument readings are not in micronaire readings, compute micronaire readings from instrument readings in accordance with manufacturer's instructions.

10.2 Calculate the average for the two specimens tested to the nearest 0.1 micronaire reading.

11. Report

11.1 State that the test was carried out as directed in ASTM Test Method D 1448.

11.2 Report the following information:

11.2.1 Type of material used and identification of the samples by shipment, mark, lot numbers or bale numbers, whichever is applicable.

11.2.2 Average readings to the nearest 0.1 micronaire reading.

11.2.3 Make, type, and model of the instrument used.

12. Precision and Bias

12.1 *Interlaboratory Test Data*[6]—An interlaboratory test is carried out semi-annually in connection with the International Calibration Cotton Standards Program (**4**). The data obtained by the five laboratories designated to establish standard values for check test numbers 29, 30, and 31 in 1971 and 1972 were used as the basis for the precision and accuracy statements. One operator at each of the five laboratories tested three specimens from each of six subsamples representing six

[4] Instruments commercially available, with specimen size, include the following:
Micronaire, manufactured by Sheffield Corp., Dayton, OH 45400 (50 grains or 3.2 g);
Fibronaire, manufactured by Motion Control, Inc., Dallas, TX 75229 (3.0 to 3.4 g);
Fibrofine, manufactured by Zellweger Uster, Inc., 456 Troy Circle, P. O. Box 51270, Knoxville, TN 37950-1270 (7.0 to 9.0 g);
IIC/Shirley Fineness Maturity Tester, manufactured by Shirley Developments, Ltd., Manchester M20 8SA, England (4 g); and
WIRA Cotton Fineness Meter, manufactured by Shirley Developments, Ltd., Manchester M20 8SA, England (5 g).

[5] The boldface numbers in parentheses refer to the list of references appended to this test method.

[6] ASTM Research Report No. D-13-1029. A copy is available from ASTM Headquarters.

different cottons. The subsamples for these tests were extracted from cotton which had been hand blended and processed into picker laps to obtain uniform material. The components of variance calculated from the results of these tests and expressed as standard deviations of micronaire reading are 0.0628 for the single-operator component and 0.0230 for the between-laboratory component.

12.2 *Precision*—For the components of variance in 12.1, the averages of observed values should be considered significantly different at the 95 % probability level if the differences exceed the critical differences listed below for various number of specimens in the test:

Critical Differences, Micronaire Readings, for the Conditions Noted[A]

Number of Specimens in Each Average	Single-Operator Precision	Between-Laboratory Precision
1	0.17	0.19
2	0.12	0.14
3	0.10	0.12
4	0.09	0.11
5	0.08	0.10
10	0.05	0.08

[A] The critical differences were calculated using $t = 1.960$ which is based on infinite degrees of freedom.

NOTE 7—The tabulated values of the critical differences 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 being tested.

12.3 *Bias*—This method for the testing of the fiber fineness of cotton is accepted internationally for commercial trading and has no known bias when the results are controlled at the standard level by the use of International Calibration Cotton Standards.

13. Keywords

13.1 cotton; fineness; micronaire reading

REFERENCES

(**1**) "Revised Micronaire Fiber-Fineness Scale for Use in Testing American Upland Cottons," Cotton Branch, PMA, U.S. Dept. of Agriculture, Washington, D. C., October, 1950.

(**2**) Gates, F. R., and Jennings, E. J., "The Effect of Relative Humidity on Micronaire Readings," *Texas Research Journal*, TRJOA, Vol 23, 1953, pp. 942–944.

(**3**) "Effect of Atmospheric Conditions on Testing Certain Cotton Fiber Properties," Cotton Branch, PMA, U. S. Dept. of Agriculture, Washington, D.C., October, 1953.

(**4**) *International Calibration Cotton Standards*, United States Department of Agriculture, Washington, D.C., Revised January 1966.

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