



Designation: D 6466 – 99

Standard Test Method for Diameter of Wool and Other Animal Fibers By Sirolan- Laserscan Fiber Diameter Analyser¹

This standard is issued under the fixed designation D 6466; 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 a procedure, using the Sirolan-Laserscan, for the determination of the average fiber diameter and the fiber diameter variation in wool and other animal fibers in their various forms.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *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 584 Test Method for Wool Content of Raw Wool—Laboratory Scale²
- D 1060 Practice for Core Sampling of Raw Wool in Packages for Determination of Percentage of Clean Wool Fiber Present²
- D 1776 Practice for Conditioning Textiles for Testing²
- D 2130 Test Method for Diameter of Wool and Other Animal Fibers by Microprojection²
- D 2252 Specification for Fineness of Types of Alpaca²
- D 2816 Test Method for Cashmere Coarse-Hair Content in Cashmere²
- D 3991 Specifications for Fineness of Wool or Mohair and Assignment of Grade³
- D 3992 Specifications for Fineness of Wool Top or Mohair Top and Assignment of Grade³
- E 126 Test Method for Inspection and Verification of Hydrometers⁴
- E 1750 Guide for Use of Water Triple Point Cells⁴

2.2 Federal Standards:

- Official Standards of the United States for Grades of Wool, Section 31.0⁵
- Measurement Method for Determining Grade of Wool, Section 31.204⁵
- Official Standards of the United States for Grades of Wool Top, Section 31.1⁶
- Measurement Method for Determining Grade of Wool Top, Section 31.301⁶
- IWTO-8 Method of Determining Wool Fiber Diameter by the Projection Microscope⁷
- IWTO-12 Measurement of the Mean and Distribution of Fibre Diameter Using the Sirolan-Laserscan Fibre Diameter Analyser⁷

3. Terminology

3.1 Definitions:

- 3.1.1 *average fiber diameter, n*—the arithmetic width of a group of fibers.
 - 3.1.1.1 *Discussion*—In wool and other animal fibers, all animal fibers, regardless of species, can be measured using the Sirolan-Laserscan to determine average fiber diameter.
- 3.1.2 *grade, n*—in wool and mohair, a numerical designation used in classification of fibers in their raw, semi-processed and processed forms based on average fiber diameter and variation of fiber diameter.
 - 3.1.3 *snippet, n*—a wool or other animal fiber which has been cut to a specified length.
 - 3.1.4 For definitions of other textile terms used in this test method, refer to Terminology D 123.

4. Summary of Test Method

4.1 This test method describes procedures for sampling various forms of wool, the reduction of the sample to small test specimens, and measurement of the diameter of a number of fibers from the test specimens using the Laserscan. Snippets cut from the various forms of wool are cleaned where required, and dispersed in a mixture of isopropanol and water. The suspension of snippets is transported through a measuring cell

¹ This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.13 on Wool and Wool Felt.

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² *Annual Book of ASTM Standards*, Vol 07.01.

³ *Annual Book of ASTM Standards*, Vol 07.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.03.

⁵ *Federal Register*, Vol 30, No. 161, Aug. 20, 1965, pp. 10829–10833.

⁶ *Federal Register*, Vol 33, No. 248, Dec. 21, 1968, pp. 19073–19076.

⁷ International Wool Textile Organization, International Wool Secretariat, Commercial Development Department, Valley Drive, Ilkley, LS298PB, England.

which is positioned in a beam of laser light. The reduction in intensity of the laser beam as the individual snippets pass through the beam of light, approximately 500 μm in diameter, is sensed by a detector and transformed, using a calibration look-up table, into a diameter in micrometres. Each diameter measurement is allocated to a diameter class, and when the specified number of fibers has been measured, the class contents are statistically analysed to produce the mean and standard deviation of fiber diameter for the specimen. Full distribution data are also available in the form of a printed histogram.

5. Significance and Use

5.1 This test method is considered satisfactory for acceptance testing of commercial shipments of wool and other animal fibers in raw and sliver form because current estimates of between-laboratory precision are acceptable. In cases of disagreement arising from differences in values reported by the purchaser and the supplier when using this test method for acceptance testing, Test Method D 2130 shall be used as a referee method.

5.2 This test method may be used for determining compliance with average fiber diameter and diameter variation to assign grades when determining conformance of shipments to material specifications given in Specifications D 2252, D 2816, D 3991, and D 3992.

5.3 The procedures for determining mean fiber diameter and standard deviation of fiber diameter provided in this test method and in IWTO Method 12-93 are in essential agreement.

6. Apparatus and Materials

6.1 *Fiber Diameter Analyser*⁷—Fig. 1, consisting of the following:

6.1.1 A means of transporting fiber snippets in an isopropanol/water mixture through a laser beam.

6.1.2 A means of measuring the reduction of light intensity of the beam due to the passage of a snippet and converting this to digital form.

6.1.3 A system for discrimination against the measurement of fibers that do not properly intersect the beam and contaminants such as fiber fragments, dirt, and vegetable matter particles.

6.1.4 A computing system to transform and collate results.

6.2 *Fiber Sectioning Device*—One or more of the following:

6.2.1 *Guillotine*⁸—Fig. 2, having two parallel cutting edges between 1.8 and 2.0 mm apart.

6.2.2 *Minicore*⁸—Fig. 3, a cylindrical sample holder, designed for large samples, in which a sample is manually packed and a coring head which is driven pneumatically into the sample. The sample is compacted by a spring-loaded platen and 6 minicore tubes with 2-mm diameter tips pass through perforations in the platen when the force supplied by the pneumatic cylinder exceeds the force (300 N) from the preloaded spring. At the end of the stroke, the cutting tips have penetrated to within 0.5 mm of the base of the sample holder. The sample collected by the minicore tubes is automatically expelled into a collection device upon retraction of the coring head.

6.2.3 *Heavy-Duty Sectioning Device*⁹—Fig. 4, comprised of a metal plate with slot and compressing key, and equipped with a propulsion mechanism by which the fiber bundle may be extruded for sectioning. The device is designed to hold a sliver of top or equivalent bulk of fibers.

⁸ Sirolan-Laserscan analyser, minicorer, and guillotine obtainable from Loptex S.r.l., Via L. Leoni 20, 2210 0 COMO (Italia). Tel: 39 31 273502; Fax: 39 1 273255.

⁹ Obtainable from MICO Instruments, 1944 Main St., P.O. Box 451, Marshfield Hills, MA 02051-0451.

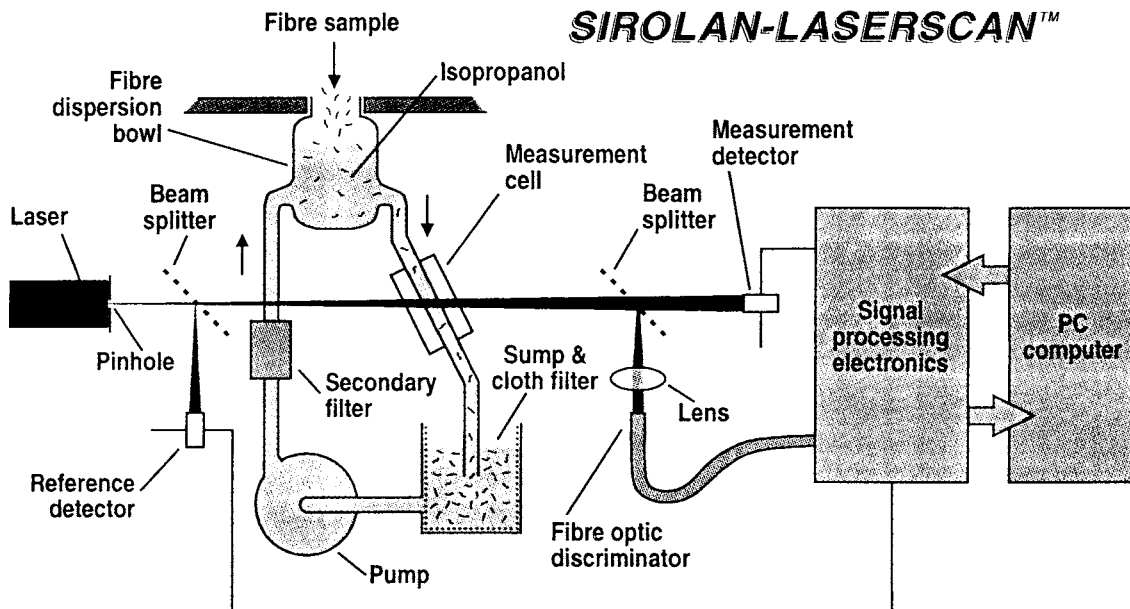


FIG. 1 Block Diagram of Laserscan System

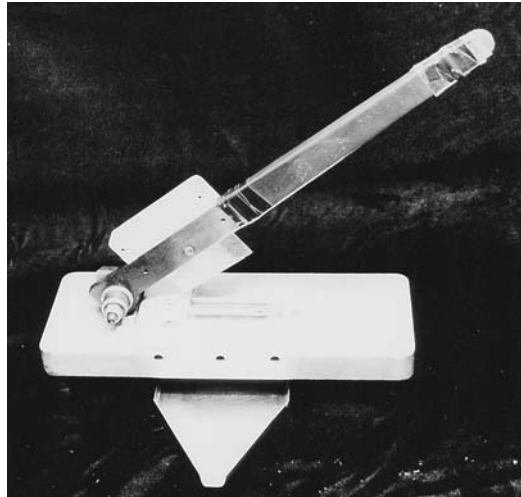


FIG. 2 Guillotine

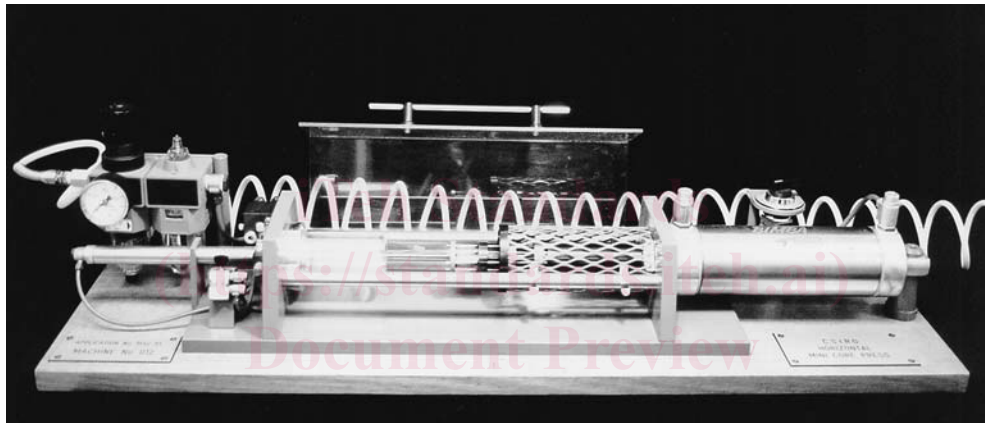


FIG. 3 Minicorer 99

<https://standards.itech.ai/catalog/standards/sist/2c36ef72-bda0-44c5-84b0-a02541932a80/astm-d6466-99>

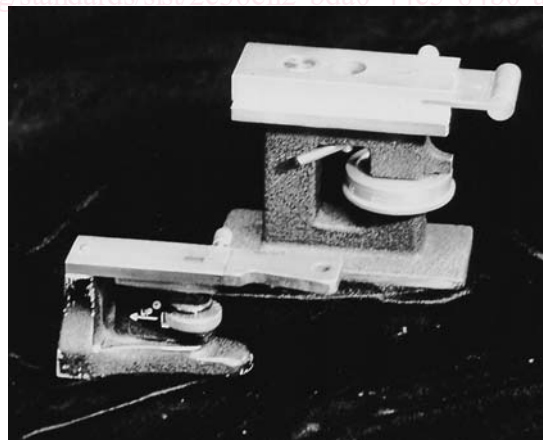


FIG. 4 Heavy Duty Sectioning Device

6.3 *Box for Compressing Loose Fibers*—A box, 300 by 150 by 375 mm deep in inside dimensions, equipped with floating top which has 16 randomly spaced holes 20 mm in diameter over its area. The sample may be firmly compressed by

applying pressure on the top. The top is held in place by two rods extending through holes in the side of the box and over the top. The coring tube is thrust through the holes in the top to obtain a sample.

6.4 *Pressure Coring Tube*¹⁰—A 13-mm inside-diameter metal tube, approximately 760 mm long, reamed and tapped on one end to hold a sharp 10 or 13-mm diameter cutting tip. The tube is fitted with a “T” cross bar about 500 mm long.

6.5 *Core Extruder*—A 6-mm wood dowel or aluminum rod slightly longer than the coring tube to push the sample from the tube.

6.6 Apparatus for Measuring the Water Content of Isopropanol.

6.6.1 *Hydrometer*, for the range density from 0.800 to 0.900 Mg/m³ and calibrated in accordance with Test Method E 126.

6.6.2 *Thermometer*, for the range from 0 to 50°C and calibrated in accordance with Guide E 1750.

6.7 *Calibration Standards*, for instrument calibration.

6.7.1 *Current Interwoollabs III Standard Tops*, for wood.¹¹

6.7.2 *Current International Mohair Association Standard Tops*, for mohair.¹²

7. Reagents

7.1 The following reagents are used:

7.1.1 *Water*, distilled, or equivalent.

7.1.2 *Alcohol*, isopropyl (CH₃CH₂CH₂OH).

7.1.3 *Petroleum Spirit*, boiling range from 40 to 70°C, for cleaning sliver subsamples.

7.1.4 *1,1,1 Trichlorethane* (CH₃CCl₃), for cleaning sliver subsamples.

8. Hazards

8.1 Refer to the manufacturer’s material safety data sheet (MSDS) for information on handling, storage, use, and disposal of chemicals used in this test method.

9. Sampling

9.1 *Loose Fibers*—The test method for obtaining a representative sample of wool differs according to circumstances. The sampling procedures and major circumstances encountered are as follows:

9.1.1 *Lots of Packaged, Grease, Pulled, or Scoured Wool*—Take core samples in accordance with Practice D 1060. Clean or scour the raw wool sample in accordance with Test Method D 584. If a representative portion of the scoured wool core sample resulting from the test for clean wool fiber present is available, it may be used for fiber diameter determination. If core sampling is not feasible, take at random, by hand, at least 50 handfuls of wool from not less than 10 % of the packages. The aggregate mass of the sample shall be at least 1.5 kg.

9.1.2 *Major Sort*—Packaged grease wool in fleece from which a diameter test is needed, hand sample by drawing one or more handfuls of wool from the major sort portion of at least 50 fleeces taken at random from the lot. The aggregate mass of the sample shall be at least 1.5 kg.

9.1.3 *Piles of Graded or Sorted Wool*—Sample piles of graded or sorted wool by taking from random locations in the pile at least 50 handfuls of wool, the aggregate mass of which shall be at least 1.5 kg. If the wool is in fleece form and a test is needed for only the major sort, take the sample in accordance with 9.1.2.

9.1.4 *Card Sliver*—Sample the wool card sliver by drawing ten 600-mm lengths at random from the lot, preferably during the carding operation.

9.1.5 *Top*—Sample the top by drawing from each 9000 kg or fraction thereof, four sections of sliver, each of which shall be at least 1 m in length and taken from different balls of top selected at random. Take only one ball from any one bale or carton. For broken top, take an equivalent aggregate length of sliver at random.

10. Test Samples and Test Specimens, Number and Preparation

10.1 *Test Samples* (one from each laboratory sampling unit):

10.1.1 *Grease Wool, Pulled Wool, and Scoured Wool*:

10.1.1.1 *Sub-Coring*—Randomly pack the core or hand sample (see 9.1.1, 9.1.2, and 9.1.3), into a suitable container (see 6.3) and compress to approximately 14 kPa by loading a weight of 667 N on the floating top. By means of a pressure coring tube (6.4) extract at least five cores to provide a test specimen of at least 20 g of scoured wool. Scour or otherwise clean the test specimen in accordance with Test Method D 584 if it is grease wool or pulled wool.

10.1.1.2 *Gridding, Core Test Residue*—If the sample comprises an adequate amount of scoured wool resulting from core testing a lot for clean wool fiber present (see 9.1.1), divide the sample into 40 portions of approximately equal size. From each portion, draw at random at least 0.5 g. Mix or blend these 40 portions to form the test specimen.

10.1.1.3 *Gridding and Machine Blending*—For samples other than those specified in 10.1.1 and 10.1.2, divide the sample into 40 portions of approximately equal size. From each portion draw at random a sufficient quantity of fiber to provide a clean test specimen of 20 g. Scour or otherwise clean the specimen of grease or pulled wool.

10.1.2 *Card Sliver*—Strip off portions of each of the ten 600-mm lengths of sliver (see 9.1.4). Combine these portions to form a composite sliver about 600 mm in length. This constitutes the test specimen.

10.1.3 *Top*—Each of the four sections of sliver comprising the sample (see 9.1.5) constitutes a test specimen.

10.2 *Test Specimens*:

10.2.1 Test one test specimen from each bulk subsample and two specimens from each sliver and top subsample. Prepare approximately 0.3 g test specimens by cutting enough fiber snippets to measure the diameters of 2000 fiber segments for each test specimen measured. Obtain snippets using a minicore (10.2.1.1) or guillotine (10.2.1.2). Where required to achieve the necessary quantity of snippets, combine snippets from one sliver subsample or bulk subsample to form the test specimen.

10.2.1.1 *Minicore (Applicable to Raw Wool, Card Sliver, or Top)*—Minicore each sliver subsample or each bulk subsample, as appropriate, using cutting tips between 1.8 and 2.0 mm in

¹⁰ Obtainable from Yocom-McColl Testing Laboratories, Inc., 540 West Elk Place, Denver, CO 80216 and Acro Associates, Inc., 163 Merrimac St., Woburn, MA 01801.

¹¹ Available from Interwoollabs Secretariat, Boit 14, Rue du Luxembourg 19/21, 1040 Brussels, Belgium.

¹² Available from International Mohair Association, Mohair House, 68 The Grove, Ilkley, West Yorkshire, LS29 9PA, England, U.K.