



Standard Test Method for Commercial Mass of a Shipment of Yarn or Man-Made Staple Fiber or Tow¹

This standard is issued under the fixed designation D 2494; 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 provides a measurement of the commercial mass of a shipment of yarn or man-made staple fiber or tow. This test method applies to (1) yarn of all fiber types except silk, glass, asbestos, and bast; (2) tops and slivers of all fiber types except wool, silk, glass, asbestos, and bast; and (3) man-made fibers or tow, except glass and other fibers used for special purposes such as flock (Note 1).

NOTE 1—For other test methods for measuring mass of fibrous materials, refer to Test Method D 1918, Methods D 739, and Practice D 2720.

1.1.1 Sampling in this test method is primarily for use in acceptance testing rather than production control. Man-made fiber producers usually sample for the commercial “mass” of product on an on-going basis rather than each shipment to a customer.

1.2 Commercial mass has been traditionally based on one of three options depending on the state of the material: (1) dried, unscoured yarn, staple fiber, tow, and so forth, using commercial moisture regain in the calculations; (2) dried, scoured yarn, staple fiber, tow, and so forth, using commercial moisture regain values in the calculations; and (3) dried, scoured yarn, staple fiber, tow, and so forth, using a commercial allowance agreed upon between the purchaser and the seller in the calculations.

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 629 Test Methods for Quantitative Analysis of Textiles²

D 739 Methods of Testing and Tolerances for Spun, Twisted, or Braided Products Made from Flax, Hemp,

Ramie or Mixtures Thereof³

D 1909 Table of Commercial Moisture Regains for Textile Fibers⁴

D 1918 Test Method for Asbestos Content of Asbestos Textiles⁵

D 2257 Test Method for Extractable Matter in Textiles⁴

D 2258 Practice for Sampling Yarn for Testing⁴

D 2720 Practice for Calculation of Commercial Weight and Yield of Scoured Wool, Top, and Noil for Various Commercial Compositions⁴

D 3333 Practice for Sampling Man-Made Staple Fibers, Sliver, or Tow for Testing⁶

2.2 AATCC Standard:

150 Dimensional Changes in Automatic Home Laundering of Woven Garments⁷

3. Terminology

3.1 Definitions:

3.1.1 *commercial allowance (CA), n*—an arbitrary value, equal to the commercial moisture regain, plus a specified allowance for finish, used with the mass of scoured, oven-dried yarn, to compute (1) yarn linear density, (2) the commercial or legal mass of a shipment or delivery of any specific textile material (see also *commercial moisture regain*), or (3) the mass of a specific component in the analysis of fiber blends.

3.1.2 *commercial mass, n*—billed mass (weight) as determined by a generally accepted method or as agreed upon between the purchaser and the seller.

3.1.2.1 *Discussion*—The basis for determining the commercial mass of a shipment of yarn or man-made fibers is generally one of the following:

(1) *CAS Basis (commercial allowance with scoured material)*—the mass of oven-dry fiber or yarn after scouring by definite prescribed methods plus the mass corresponding to its *commercial allowance*.

(2) *CMRS Basis (commercial moisture regain with scoured material)*—the mass of oven-dry fiber or yarn after scouring by definite prescribed methods plus the mass corresponding to its

¹ This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarn Test Methods, General.

Current edition approved Oct. 10, 1996. Published February 1997. Originally published as D 2494 – 66 T. Last previous edition D 2494 – 94.

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

³ Discontinued—See *1971 Annual Book of ASTM Standards*, Part 25.

⁴ *Annual Book of ASTM Standards*, Vol 07.01.

⁵ Discontinued; see *1989 Annual Book of ASTM Standards*, Vol 04.06.

⁶ *Annual Book of ASTM Standards*, Vol 07.02.

⁷ Available from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

commercial moisture regain.

(3) *CMRU Basis (commercial moisture regain with unscoured material)*—the mass of unscoured oven-dry fiber or yarn plus the mass corresponding to its *commercial moisture regain*.

(4) *UN Basis (unadjusted net)*—the mass of unscoured fiber or yarn with no adjustment for the amount of moisture or finish, or both.

3.1.3 *commercial moisture regain, (CMR), n*—a formally adopted, arbitrary value, to be used with the oven-dried mass of textile fibers, when calculating the commercial mass of a shipment or delivery.

3.1.4 *laboratory sampling unit, n*—a portion of material taken to represent one of the lot sampling units or the original material and used in the laboratory as a source of test specimens.

3.1.5 *moisture content, n*—the amount of moisture in a material determined under prescribed conditions and expressed as a percentage of the mass of the moist material, that is, the original mass comprising the dry substance plus any moisture present (see also *commercial moisture regain*).

3.1.5.1 *Discussion*—Moisture content is also referred to as moisture on the *asis, as received, or wet* basis. Use the following equation to convert from moisture content to moisture regain, or vice-versa:

$$R = [M/(100 - M)] \times 100 \quad (1)$$

$$M = [R/(100 + R)] \times 100 \quad (2)$$

where:

R = moisture regain, %, and

M = moisture content, %.

3.1.6 *oven-dry, adj*—the condition of a material that has been heated under prescribed conditions of temperature and humidity until there is no further significant change in its mass.

3.1.7 *shipment, n*—goods or commodities which are transported together as a unit; a quantity of product for which a bill of lading has been signed by the carrier.

3.1.8 *tare, n*—the mass of all external and internal packing materials (including bobbins, tubes, and so forth), of a case, bale, or other type of container.

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

4. Summary of Test Method

4.1 Representative specimens from a shipment are dried, weighed, and, in some cases, scoured and weighed again. From the net mass of the shipment and the masses of the specimens before and after treatment, commercial mass of the shipment is calculated using one of the following options:

4.1.1 *Option I*—CMRU basis treatment consists of drying only. Commercial mass includes finishes and a correction for commercial moisture regain.

4.1.2 *Option II*—CMRS basis treatment consists of scouring and drying. Commercial mass excludes scourables but includes a correction for commercial moisture regain.

4.1.3 *Option III*—CAS basis treatment consists of scouring and drying. Commercial mass includes a correction for commercial allowance.

4.1.4 *Option IV*—UN basis requires no samples and no

treatment. Commercial mass equals the net mass of the shipment without adjustment for scourables or moisture.

5. Significance and Use

5.1 This test method is considered satisfactory as a referee method for acceptance testing of commercial shipments of yarn or man-made staple fibers.

5.1.1 In cases of disagreement arising from differences in values reported by the purchaser and the supplier when using this test method for acceptance testing, the statistical bias, if any, between the laboratory of the purchaser and the laboratory of the supplier should be determined with each comparison being on the testing of specimens taken from a lot sample of material of the type being evaluated so as to be as nearly homogeneous as possible and then randomly assigned in equal numbers to each of the laboratories.

5.2 Option I is generally used to calculate the commercial mass of spun yarns, textured yarns, tops, and slivers. When materials are sold on a CMRU basis, the purchaser pays for the fiber lubricant or other removable processing aids.

5.3 Option II is generally used to calculate the commercial mass of as-produced man-made filament yarns (except some producer-textured yarns), man-made staple fibers, and tows. This option is intended to reflect the mass of fiber remaining after fiber lubricants and processing aids are removed.

5.4 Option III is in common use in other countries, particularly in Europe.

5.5 Option IV is in common use with yarns made of wool or wool blends and some aramids.

5.6 When it can be shown that solvent extraction or another method of testing gives the same results, or results that have a constant ratio to those obtained by the scour procedure, that method may be used for routine testing of known production but should not be substituted for a scour on new or unknown material. For the determination of extractable matter, refer to Test Method D 2257.

5.6.1 When the finish is not removable by a water scour, a solvent extraction may be substituted on agreement between the purchaser and the supplier.

5.7 Under certain circumstances, samples taken from yarns and man-made staple fibers and tows can change moisture content rapidly. For this reason, very careful planning and handling of samples are required to prevent major biases in commercial mass results.

6. Apparatus and Reagents

6.1 *Washing Machine*,⁷ automatic home-type, of the make and model specified by the AATCC each year, or equivalent washing machine.

6.2 *Soft Water* (10 ppm or less calcium carbonate hardness) for hot setting of washer controlled for 60 to 65°C.

6.3 *Bags*,⁸ made from polyester yarn, of a stable construction, such as a leno weave, which have been previously scoured

⁷ The sole source of supply of the apparatus known to the committee at this time is Mar Mac Manufacturing Co., P.O. Box 278, McBee, SC 29101. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

and which have a known oven-dry mass. Each bag shall be large enough to permit the test specimen to be sufficiently porous to permit free access of the scouring solution to the specimen. The bag should have an adequate closure to prevent fiber loss.

6.4 *Automatic Dryer*,⁷ automatic home-type, of the make and model specified by the AATCC each year, or equivalent, (optional).

6.5 *Drying Oven*, ventilated and capable of controlling the temperature in the range of $105 \pm 3^\circ\text{C}$. The oven shall be supplied with a current of air sufficient to change the air once every 4 min. The specimens shall be protected from direct radiation of the heating units. Air supplied to the oven shall be at standard atmospheric conditions for testing textiles. The oven may be provided with facilities for cutting off the air current and weighing the specimens without removing them from the oven.

6.6 *Scale*, with a capacity and sensitivity sufficient to weigh beams, bales, cases, or other shipping units within 0.1 % of their gross mass and maintained according to National Institute of Standards and Technology (NIST) criteria.⁹

6.7 *Balance*, having a sensitivity of 0.1 % of the mass of the specimens being tested and maintained according to NIST criteria.⁹ These requirements apply both to balances built into ovens and to free-standing devices.

6.8 *Weighing Cans*, with tight-fitting lids of sufficient size to hold the bag and specimen (required only if weighings are made outside the oven).

6.9 *Desiccator(s)*, of sufficient size to hold the weighing cans (required only if weighings are made outside the oven).

6.10 *Desiccant*, silica gel or equivalent, if desiccators are used.

6.11 *High Cloud Point Nonionic Detergent*,¹⁰ as agreed upon between the purchaser and the seller.

7. Procedure

7.1 *Shipment Mass*—Weigh, intact, each shipping unit (bale or case) in the shipment to the nearest 0.1 % of its mass.

NOTE 2—The gross mass and the tare mass should be obtained on materials at equilibrium with the same ambient conditions, which are often not the standard atmosphere for testing textiles. Also, for this procedure, the tare should be determined from actual weighings and not from values supplied by the supplier.

7.2 *Lot Sample*—Take a lot sample as directed in the applicable material specifications, or as agreed upon between the purchaser and the supplier, or in their absence as directed in Practice D 2258 for yarn or Practice D 3333 for staple fiber. Treat sliver (or top) and tow as staple for lot sampling. The same units selected for product samples will also be used for tare samples. The lot sample must be representative of the shipment and must be taken at random from the various shipping units.

⁹ "Specifications, Tolerances and Other Technical Requirements for Commercial Weighing Devices," *NBS Handbook No. 44*, 1977, may be obtained from the National Institute of Standards and Technology, Washington, DC 20234.

¹⁰ Detergents Tergitol 15-S-12, available from Union Carbide, Old Ridgebury Road, SCTNC-2, Danbury, CT 06817, and Merpol HCS, available from Dupont Chemicals and Pigments, 1007 Market St., Wilmington, DE 19898, or their equivalent, have been found satisfactory.

NOTE 3—An adequate specification or other agreement between the purchaser and the supplier requires taking into account variability between shipping units, between packages or ends within a shipping unit, and between specimens from a single package so as to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

7.3 *Laboratory Samples*—Take laboratory samples representative of the shipment as directed as follows. Save all loose packaging materials (wrappings, strappings, and separators) from each lot sample unit for tare weighing. Sample the lot as quickly as possible to reflect accurately the moisture level in the lot. Place samples in airtight containers for subsequent weighing.

7.3.1 *Yarn*—Take at least 20 unit packages from random places within the different shipping units forming the lot sample as directed in Practice D 2258. Use a prearranged plan for random sampling to save time in taking the packages from the shipping units. Enclose each unit package in a separate airtight container until the specimens are removed.

7.3.1.1 Sampling beams of yarn for verification of commercial mass presents unique problems which are left to the agreement of the purchaser and the seller.

7.3.2 *Staple, Sliver or Top, and Tow*—Take laboratory samples from each laboratory sampling unit as directed in Practice D 3333.

7.4 *External Tare*—Collect, without delay, all packaging materials which were part of the lot sample and which were associated with the shipping units. Supports for individual packages will be dealt with in 7.6. Weigh the external tare material for each lot sample unit to 0.1 % of its mass. (See Note 3).

7.5 *Specimens*—Without delay, prepare specimens as directed in 7.5.1 or 7.5.2. Save all yarn supports which were part of the laboratory sample.

7.5.1 *Yarn*—Take two 5-g bits of yarn from each of at least 20 packages that form the laboratory sample. Immediately put each bit into one of two airtight containers and close the container after obtaining each bit. (Each container will contain bits from 20 packages.) With the exception of lots shipped on beams, take the yarn from random locations within the packages. Prepare representative specimens each weighing approximately 100 g. Do not wind or reel yarn being taken for specimens. Keep the hands dry and handle the yarn (both packages and specimens) as little as possible. Select one of the specimens for testing; set the other aside for any confirmatory tests which may be required.

7.5.1.1 Preparation of specimens from beams is left to the agreement of the purchaser and the supplier.

7.5.2 *Staple, Sliver, Top, Tow*—Treat each of the laboratory samples as a specimen. Select one of each pair of specimens for testing and set the other aside for confirmatory testing, if required.

7.6 *Internal Tare*—Collect, without delay, all yarn supports which were part of the laboratory sample and weigh each to 0.1 % of its mass.

7.7 *Specimen Mass, M*—Without delay, weigh each specimen to the nearest 0.1 % of its mass, after removing from the container.