



Designation: D2524 – 22

Standard Test Method for Breaking Tenacity of Wool Fibers, Flat Bundle Method— $\frac{1}{8}$ in. (3.2 mm) Gage Length¹

This standard is issued under the fixed designation D2524; 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 breaking tenacity of wool fibers as a flat bundle with a $\frac{1}{8}$ in. (3.2 mm) clamp separation.

1.2 This test method is especially adapted to the fiber bundle clamps and strength testing instruments specified, but may be used on other tensile testing machines when equipped with appropriate adapters to accommodate the prescribed clamps.

1.3 This test method is applicable to wool in any form which can be hand-combed into small bundles of parallelized fibers.

NOTE 1—Other test methods for measuring breaking tenacity of fiber bundles include Test Methods [D1294](#), [D1445](#), and [D540](#).

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D123 Terminology Relating to Textiles](#)

[D540 Methods of Testing Man-Made Staple Fibers; Replaced by D 3660 \(Withdrawn 1973\)](#)³

[D1294 Test Method for Tensile Strength and Breaking Tenacity of Wool Fiber Bundles 1-in. \(25.4 mm\) Gage Length](#)

[D1445 Test Method for Breaking Strength and Elongation of Cotton Fibers \(Flat Bundle Method\)](#)

[D1776 Practice for Conditioning and Testing Textiles](#)

[D4845 Terminology Relating to Wool](#)

[D2525 Practice for Sampling Wool for Moisture \(Withdrawn 2022\)](#)³

3. Terminology

3.1 For all terminology related to [D13.13](#), Wool and Felt, see Terminology [D4845](#).

3.1.1 The following terms are relevant to this standard: breaking tenacity, constant-rate-of-extension (CRE) type tensile testing machine, constant-rate-of-loading (CRL) type tensile testing machine, constant-rate-of-traverse (CRT) type tensile testing machine, gage length, tenacity, wool.

3.2 For definitions of all other textile terms see Terminology [D123](#).

4. Summary of Test Method

4.1 A bundle of fibers is combed until parallel, placed under a uniform tension sufficient to remove as much crimp as possible without stretching the fibers, and secured in special clamps. The fibers are then cut to a known length, broken in the tensile testing machine, removed from the clamps, and weighed. Breaking tenacity is calculated from the ratio of breaking force to bundle linear density. The length measured under the applied tension is the basis for computing linear density from bundle mass.

5. Significance and Uses

5.1 Test Method D2524 for testing wool fibers for tenacity is considered satisfactory for acceptance testing when the participating laboratories, using a reference wool, have shown acceptable between-laboratory precision. It is recommended

¹ This test method is under the jurisdiction of ASTM Committee [D13](#) on Textiles and is the direct responsibility of Subcommittee [D13.13](#) on Wool and Felt.

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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.

³ The last approved version of this historical standard is referenced on www.astm.org.

that any program of acceptance testing be preceded by an interlaboratory check in the laboratory of the purchaser and the laboratory of the seller on replicate specimens of samples of the material to be evaluated. In cases of dispute, the statistical bias, if any, between the laboratory of the purchaser and the seller should be determined with each comparison being based on testing randomized specimens from one sample of material of the type being evaluated.

5.2 Values obtained from flat bundle tenacity show a good correlation with values obtained from single fiber tests and require much less time.

5.3 The basic differences between the procedures described in Test Method D2524 and those described in Test Method D1294 lie in the manner of clamping the bundles and the shorter gage length employed. The special clamps used in this method allow quicker and easier bundle preparation; however, for Test Method D1294 no special clamps are required. Closer agreement with single fiber tenacity is also obtained with Test Method D2524 than when using the procedure in Test Method D1294.

5.4 As the observed tenacity of fibers depends in part on the type of tensile testing machine used and the time required to break the specimen, results obtained with the different types of machines which may be used in this method will not necessarily agree. The machines specifically designed for bundle testing are CRL testers which operate at a loading rate of 1 kgf/s and therefore reach the breaking force at variable times in the order of 5 s. CRE and CRT type machines would be expected to produce somewhat different results not only because of the inherent difference in operation but because CRE and CRT type machines are to be operated at a rate to achieve the breaking load in 20 s.

6. Apparatus and Materials

6.1 *Tensile Testing Machine*, having a capacity of at least 7 kgf (70 N), equipped to accommodate the specified flat bundle clamps. For CRL testing machines,⁴ the rate of loading is specified as 1 kgf/s (10 N/s). For CRE and CRT machines, select a rate of operation which will reach the breaking force in an average time of 20 ± 3 s.

6.1.1 In case the CRE or CRT testing machine is not capable of operating as specified in 6.1, select a rate so as to reach the breaking force in an average time as close to 20 s as possible and report the average time to break.

NOTE 2—There may be no overall correlation between the results obtained with the CRE, CRT or CRL type testing machines. Consequently, these three machines cannot be used interchangeably.

6.2 *Balance*, suitable for weighing 2 mg to 6 mg with a sensitivity of 0.02 mg.

6.3 *Flat Bundle Clamps and Accessories*, including the following components:

⁴ The sole source of supply for the Stelometer known to the committee at this time is Special Instruments Laboratory, Inc., 312 W. Vine St., Knoxville, TN 37901. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend. The Clemson Tester (no longer available) have been found satisfactory for this purpose.

NOTE 3—Pressley clamps and accessories have been found satisfactory for this purpose.⁵ Adapters to fit the clamps to various tensile testing instruments are also available or can be fabricated.

6.3.1 *Clamps*, having a total thickness of 0.465 in. $\pm$ 0.001 in. (11.8 mm $\pm$ 0.03 mm) and a 0.125 in. $\pm$ 0.001 in. (3.2 mm $\pm$ 0.03 mm) spacer.

6.3.2 *Clamp Vise*, with a device to indicate approximately 8 lbf-in. (0.9 N·m) torque.

6.3.3 *Clamp Wrench*.

6.4 *Coarse Comb*, approximately 8 teeth per in. (3 per 10 mm).

6.5 *Fine Comb*, approximately 50 teeth per in. (20 per 10 mm).

6.6 *Black Paper*, to hold bundles.

6.7 *Shearing Knife or Razor Blade*.

6.8 *Tweezers*.

6.9 *Torque Wrench or Friction Disk Wrench*, to indicate approximately 8 lbf-in. (0.9 N·m) torque (optional).

6.10 *Standard Wool Top Sample*⁶, having an assigned breaking tenacity of 11.4 gf/tex (112 mN/tex).

NOTE 4—The standard wool top sample, USDA Lot 58-27, has a breaking tenacity (based on single fiber tests) of 11.4 gf/tex $\pm$ 0.6 gf/tex, at the 95 % probability level.

7. Sampling

7.1 *Division into Lots*—Treat a single shipment of a single fiber type as a lot.

7.2 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of shipment containers directed in an applicable material specification or other agreement between the purchaser and the supplier, such as an agreement to use Practice D2525. Consider shipping containers to be the primary sampling units.

7.3 *Laboratory Sample*—For acceptance testing, take a laboratory sample from each shipping container in the lot sample as follows:

7.3.1 For loose fiber, grease, and scoured wool, reduce the mass of clean fiber submitted for testing to approximately 15 g by randomly selecting pieces throughout the mass. Form into a loose sliver by hand.

7.3.2 For card sliver and top, cut a length of sliver about 20 in. (500 mm) long from each ball submitted for testing.

7.3.3 For roving, cut a length about 20 in. (500 mm) long from each spool submitted for testing and include all ends.

⁵ The sole source of supply of the apparatus known to the committee at this time is J. M. Doebrich and Co., P. O. Box 2789, Tucson, AZ 85702. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

⁶ The sole source of supply of the apparatus known to the committee at this time is the Wool and Mohair Laboratory, Livestock and Seed Division, AMS, U.S. Department of Agriculture, 711 "O" Street, Greeley, CO 80631. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.