



Standard Test Method for Tensile Properties of Single Textile Fibers¹

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1. Scope

1.1 This test method covers the measurement of tensile properties of natural and man-made single textile fibers of sufficient length to permit mounting test specimens in a tensile testing machine.

1.2 This test method is also applicable to continuous (filament) and discontinuous (staple) fibers or filaments taken from yarns or tow. When the fibers to be tested contain crimp, or if the tow or yarns have been subjected to bulking, crimping, or texturing process, the tensile properties are determined after removal of the crimp.

NOTE 1—Testing of filaments taken from yarns or tow, included in this test method was originally covered in Test Method D 2101, that is discontinued.

1.3 The words “fiber” and “filament” are used interchangeably throughout this test method.

1.4 This test method is also applicable to fibers removed from yarns, or from yarns processed further into fabrics. It should be recognized that yarn and manufacturing processes can influence or modify the tensile properties of fibers. Consequently, tensile properties determined on fibers taken from yarns, or from yarns that have been processed into fabrics, may be different than for the same fibers prior to being subjected to yarn or fabric manufacturing processes.

1.5 This test method provides directions for measuring the breaking force and elongation at break of single textile fibers and for calculating breaking tenacity, initial modulus, chord modulus, tangent modulus, tensile stress at specified elongation, and breaking toughness.

1.6 Procedures for measuring the tensile properties of both conditioned and wet single fibers are included. The test method is applicable to testing under a wide range of conditions.

1.7 As the length of the test specimen decreases, the tensile strength is likely to increase, but the accuracy of the tensile properties determined may decrease, which may require the need to increase the number of test specimens. This is particularly true for those properties dependent on the measurement of elongation, since the shorter lengths increase the

relative effect of slippage and stretching of the test specimens within the jaws of either clamp.

1.8 The values stated in either acceptable metric units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

1.9 *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 76 Specification for Tensile Testing Machine for Textiles²
- D 123 Terminology Relating to Textiles²
- D 578 Specification for Glass Fiber Strands²
- D 629 Test Methods for Quantitative Analysis of Textiles²
- D 1577 Test Methods for Linear Density of Textile Fibers²
- D 1776 Practice for Conditioning and Testing Textiles²
- D 2101 Test Method for Tensile Properties of Single Man-Made Fibers Taken from Yarns and Tow³
- D 2258 Practice for Sampling Yarn for Testing²
- D 3333 Practice for Sampling Manufactured Staple Fibers, Sliver, or Tow for Testing⁴
- D 4848 Terminology of Force, Deformation and Related Properties of Textiles⁴
- E 178 Practice for Dealing with Outlying Observations⁵

3. Terminology

3.1 Definitions:

3.1.1 *breaking force, n*—the maximum force applied to a material carried to rupture.

3.1.1.1 *Discussion*—The observed breaking force for fibers and filaments is generally expressed as millinewton (mN) or gram-force (gf).

3.1.2 *breaking tenacity, n*—the tenacity at the breaking force.

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarn and Fiber Test Methods.

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

³ Discontinued; see 1995 *Annual Book of ASTM Standards*, Vol 07.01.

⁴ *Annual Book of ASTM Standards*, Vol 07.02.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.