



Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method¹

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1. Scope

1.1 This test method covers the determination of tensile properties of monofilament, multifilament, and spun yarns, either single, plied, or cabled with the exception of yarns that stretch more than 5.0 % when tension is increased from 0.05 to 1.0 cN/tex (0.5 to 1.0 gf/tex).

1.2 This test method covers the measurement of breaking force and elongation of yarns and includes directions for the calculation of breaking tenacity, initial modulus, chord modulus, and breaking toughness.

1.2.1 Options are included for the testing of specimens in: (A) straight, (B) knotted, and (C) looped form.

1.2.2 Conditions of test are included for the testing of specimens that are: (1) conditioned air, (2) wet, not immersed, (3) wet, immersed, (4) oven-dried, (5) exposed to elevated temperature, or (6) exposed to low temperature.

NOTE 1—Special methods for testing yarns made from specific fibers; namely, asbestos, glass, flax, hemp, ramie, and kraft paper and for specific products; namely, tire cords and rope, have been published: Test Method D 885, Specification D 299, and Specification D 578.

NOTE 2—For directions covering the determination of breaking force of yarn by the skein method refer to Test Method D 1578.

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 76 Specifications for Tensile Testing Machines for Textiles²
- D 123 Terminology Relating to Textiles²
- D 299 Specification for Asbestos Yarns³
- D 578 Specification for Glass Fiber Yarns²
- D 885 Methods of Testing Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Organic-Base Fibers²

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.

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² Annual Book of ASTM Standards, Vol 7.01.

³ Annual Book of ASTM Standards, Vol 04.05.

D 1578 Test Method for Breaking Strength of Yarn in Skein Form²

D 1776 Practice for Conditioning Textiles for Testing²

D 2101 Test Method for Tensile Properties of Single Man-Made Textile Fibers Taken from Yarns and Tows²

D 2258 Practice for Sampling Yarn for Testing²

D 2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data⁴

D 2906 Practice for Statements on Precision and Bias for Textiles⁴

E 178 Practice for Dealing with Outlying Observations⁴

3. Terminology

3.1 Definitions:

3.1.1 *breaking force, n*—the maximum force applied to a material carried to rupture. (Compare **breaking point**, **breaking strength**. Syn., **force at break**).

3.1.2 *breaking strength, n*—strength expressed in terms of the breaking force. (See also **breaking force** and **strength**. Syn., **strength at break**).

3.1.3 *breaking tenacity, n*—the tenacity at the breaking force. See also **breaking force**, **tenacity**.

3.1.3.1 *Discussion*—Breaking tenacity commonly is expressed as centinewton/ptex (cN/tex) or gram-force/p denier (gf/den). The breaking tenacity is either a calculated value using the breaking force and linear density of the unstrained specimen or directly from the tensile machines that can be adjusted suitably to indicate tenacity instead of force for specimens of known linear density.

3.1.4 *breaking toughness, n*—toughness up to the breaking force of a material.

3.1.4.1 *Discussion*—Breaking toughness is proportional to the area under the force-elongation curve from the origin to the breaking force. In textile strands, it is expressed as work (joules)/punit linear density.

3.1.5 *chord modulus, n*—in a stress-strain curve, the ratio of the change in stress to the change in strain between two specified points on the curve.

3.1.5.1 *Discussion*—The chord modulus is expressed in centinewton/p tex (cN/tex) or in gram-force/p denier (gf/den).

3.1.6 *elongation, n*—the ratio of the extension of a material to the length of the material prior to stretching expressed as a percent.

⁴ Annual Book of ASTM Standards, Vol 14.02.