



Standard Test Method for Thermal Shrinkage Force of Yarn and Cord With a Thermal Shrinkage Force Tester¹

This standard is issued under the fixed designation D 5591; 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 preparation and procedures to measure the thermal shrinkage force of yarns and cords in air.

1.2 This test method is applicable to measurement of the thermal shrinkage force of yarns and cords whose shrinkage force at $180 \pm 2^\circ\text{C}$ ($355 \pm 4^\circ\text{F}$) in air does not exceed 20 N (4 lbf). This test method is applicable to nylon, polyester, and aramid yarns and cords within the applicable range of thermal shrinkage force, as well as to comparable yarns and cords from other polymers.

1.2.1 Test specimens may be taken from yarn or cord packages, or retrieved from fabrics.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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. Specific hazards statements are given in Section 8.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D 123 Terminology Relating to Textiles

D 885 Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers

D 2258 Practice for Sampling Yarn for Testing

D 6477 Terminology Relating to Tire Cord and Fabrics

3. Terminology

3.1 Definitions:

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.19 on Tire Cord and Fabrics. Current edition approved Oct. 1, 2004. Published October 2004. Originally published as D 5591 – 95. Last previous edition D 5591 – 02.

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.

3.1.1 For definitions of terms relating to tire cord, bead wire, hose wire, and tire cord fabrics, refer to Terminology D 6477.

3.1.1.1 The following terms are relevant to this standard: adhesive-treated tire cord, cord, greige cord, greige tire cord, pneumatic tire, retraction, in yarns and cords, standard atmosphere for testing textiles, thermal shrinkage force, thermal shrinkage force tester, and tire.

3.2 For definitions of other terms related to textiles, refer to Terminology D 123.

3.2.1 The following terms are relevant to this standard: yarn.

4. Summary of Test Method

4.1 A specified length of yarn or cord is conditioned in a relaxed state, mounted with a pretension of 5 ± 1 mN/tex (0.05 ± 0.01 gf/den), then exposed to dry heat at a temperature of $180 \pm 2^\circ\text{C}$ ($355 \pm 4^\circ\text{F}$) for 120 ± 5 s.

4.2 The shrinkage force induced in the specimen is read from the tester.

5. Significance and Use

5.1 This test method may be used for the acceptance testing of commercial shipments of yarns and cords.

5.1.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, test samples should be used that are as homogeneous as possible, that are drawn from the material from which the disparate test results were obtained, and that are randomly assigned in equal numbers to each laboratory for testing. Other materials with established test values may be used for this purpose. The test results from the two laboratories should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If a bias is found, either its cause must be found and corrected, or future test results for that material must be adjusted in consideration of the known bias.

5.2 Experience shows that yarns or cords on would packages, usually being under tension, exhibit a contraction in length (and a resulting increase in linear density) when removed from the package and allowed to relax over a period

