



Designation: D6588/D6588M – 25

Standard Test Method for Fatigue of Tire Cords (Disc Fatigue Test)¹

This standard is issued under the fixed designation D6588/D6588M; 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 fatigue of tire cords in rubber due to compression or extension, or both, using a disc fatigue tester. The fatigue is measured as a loss in strength.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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

1.4 *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

D76 Specification for Tensile Testing Machines for Textiles

D123 Terminology Relating to Textiles

D885 Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers

D1776 Practice for Conditioning and Testing Textiles

D6477 Terminology Relating to Tire Cord, Bead Wire, Hose Reinforcing Wire, and Fabrics

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.19 on Industrial Fibers and Metallic Reinforcements

Current edition approved June 1, 2025. Published August 2025. Originally approved in 2000. Last previous edition approved in 2016 as D6588/D6588M–11(2016) which was withdrawn in March 2025 and reinstated in June 2025. DOI: 10.1520/D6588_D6588M-25.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

D7269 Test Methods for Tensile Testing of Aramid Yarns

2.2 Patent US 2595069³

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms relating to tire cord and fabrics, see Terminology D6477.

3.1.2 For definitions of other terms related to textiles, see Terminology D123.

4. Summary of Test Method

4.1 Disc fatigue is a measure of the strength loss of a tire cord, which is subjected to repeated stresses. The stresses are accomplished by subjecting the tire cords, after being cured in rubber, to repeated cycles of compression and extension.

4.2 The specimen of interest is the cord after it has been stressed and later removed from the rubber in which it was imbedded. Cord specimens are placed between strips of rubber compound and molded into blocks. The specimen block is then mounted between two rotating discs that are positioned in such a way that the specimen will undergo compression or extension, or both, as the discs rotate. After a specified number of cycles, the cords are removed from the blocks and their breaking force measured on a tensile testing machine. The fatigue, based on the unfatigued specimen strength, is expressed as a percent strength loss in fatigued specimens.

5. Significance and Use

5.1 This test method is not recommended for acceptance testing of commercial shipments in the absence of reliable information on between-laboratory precision.

5.1.1 If there are differences of practical significance between the reported test results for two laboratories (or more), a comparative test need to be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, test samples shall be used that are as homogeneous as possible, that are drawn from a material from which the disparate test results were obtained, and that are randomly assigned in equal numbers to each laboratory for testing. Other fabrics with established test values can be used

³ For referenced patent - <https://ppubs.uspto.gov/pubwebapp/static/pages/ppubbasic.html>

for this purpose. The test results from the two laboratories need to 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 must be adjusted in consideration of the known bias.

6. Apparatus, Materials, and Reagents

6.1 *Disc Fatigue Tester* (see schematic drawing in Fig. 1), with capacity for 12 specimens. For actual dimensions, see patent US 2595069.³ Testers with different capacity are acceptable.

6.2 *Displacement Transducer*, with digital readout or dial gage for setting distance between disc fatigue flanges to the nearest 0.01 mm [0.004 in.].

6.3 *Mold*, top and bottom sections with cavities in each for 12 or 24 specimens with the dimensions of 10.8 mm × 12.7 mm × 76.2 mm [$\frac{7}{16}$ in. × $\frac{1}{2}$ in. × 3 in.]. (See schematic drawing in Fig. 2). All dimensions given require an accuracy of 0.1 mm [0.04 in.]. The top of the mold can be coated with TFE-fluorocarbon to release the specimens easily. Molds with other numbers of cavities can be used.

6.4 *Weights*, having a mass of 50 g ± 5 g or 100 g ± 10 g, or both, for tensioning yarns or cords while building specimen blocks.

6.5 *Curing press*, capable of maintaining a minimum pressure of 3.5 MPa [500 psi] over the total area of the mold surface, and capable of a platen temperature control within ±3 °C [±5 °F] of the temperature specified for curing the rubber compound.

6.6 *Guillotine, Hand-operated*, capable of slicing the sample blocks (see 11.2.2).

6.7 *Tensile Testing Machine*, Continuous-Rate-of-Extension (CRE) type, in accordance with Specification D76.

6.8 *Clamps*, air-actuated, flat, rubber-faced or bollard-type.

6.9 *Rubber Compound*, with a thickness of 6.0 mm ± 0.3 mm [0.24 in. ± 0.01 in.], rolled up in polyethylene liner and free from moisture and contamination.

NOTE 1—The rubber type used, especially rubber modulus, will affect the results.

6.10 *Gloves*, neoprene or other solvent-resistant rubber.

6.11 *Solvent*, 1,1,2,2 tetrachloroethylene, (CHCl₂ CHCl₂), or 1,1,1 trichloroethane (CCl₃CH₃) for removing cords from rubber.

6.12 *Tachometer or Stroboscope*.

6.13 *Screwdriver*, or other tightening device.

6.14 Explosion-proof oven.

7. Hazards

7.1 The manufacturer's material data sheets (MSDSs) shall be used to obtain information on handling, storage, use, and disposal of chemicals used in this test method.

8. Sampling and Test Specimens

8.1 *Primary Sampling Unit*—Consider one roll of dipped tire cord fabric or a cord package as the primary sampling unit.

8.2 *Laboratory Sampling Unit*—As a laboratory sampling unit, from each primary sampling unit prepare tabby samples by taking a sample equal to the length of cord between the regular tabby woven at the end of the roll and a special tabby woven a short distance from the end when the roll of fabric is manufactured. For rolls that do not have a special woven tabby, improvise a tabby by the use of gummed tape or strips of cemented fabric applied across a section of the cord fabric to give a tabby sample length at least 0.5 m [18 in.] long and at least one tenth of the roll width wide.

8.2.1 *Preparation of Tabby Samples*—The handling of the samples must be done with care. The person obtaining the sample shall wear clean gloves. Cut the warp cords of the dipped fabric along the centerline of the special tabby for a

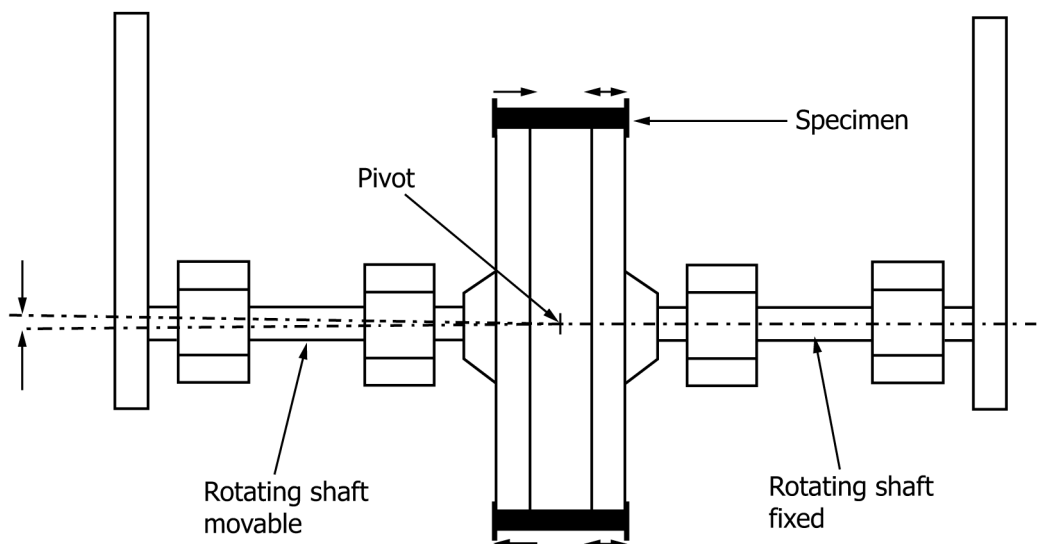


FIG. 1 Schematic Top View of the Disc Fatigue Tester with Two Specimens