



Designation: D2969 – 25

# Standard Test Methods for Steel Tire Cords<sup>1</sup>

This standard is issued under the fixed designation D2969; 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 These test methods cover the testing of cords made from steel that are specifically designed for use in the reinforcement of pneumatic tires. By agreement, these test methods can be used to test similar cords or filaments used for reinforcing other rubber products. The steel cords shall be wound on spools or beams. The steel cords can also be woven into fabric, in which case they must be removed from the fabric prior to testing.

NOTE 1—For other methods of testing tire cords and tire cord fabrics, refer to Methods [D885](#), Test Methods [D1871](#), Specifications [D122](#), and Test Methods [D2692](#) and [D2970/D2970M](#). For tolerances on tire cords and tire cord fabrics, refer to Specifications [D122](#) and Methods [D885](#).

1.2 These test methods include test procedures only; they do not establish specifications or tolerances.

1.3 This test method includes the following sections:

| Subject                                             | Section     |
|-----------------------------------------------------|-------------|
| Adhesion of Steel Cords and Filaments to Elastomers | 16          |
| Brass Coating Composition and Mass                  | 14, 15      |
| Breaking Force (Strength)                           | 10          |
| Construction                                        | 12          |
| Data Form for Reporting Test Results                | Appendix X1 |
| Elongation at Break                                 | 10          |
| Elongation Between Defined Forces (EDF)             | 11          |
| Flare                                               | 8           |
| Lay                                                 | 12          |
| Linear Density                                      | 9           |
| Visual Appearance                                   | 8           |
| Nomenclature System                                 | Annex A1    |
| Residual Torsions                                   | 8           |
| Straightness                                        | 8           |
| Thickness and Out-of-Roundness                      | 13          |

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. See [14.3](#) and [Note 11](#).*

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee [D13](#) on Textiles and are the direct responsibility of Subcommittee [D13.19](#) on Industrial Fibers and Metallic Reinforcements.

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1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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:<sup>2</sup>

- [D76 Specification for Tensile Testing Machines for Textiles](#)
- [D122 Tolerances for Tire Fabrics Other Than Tire Cord Fabrics \(Withdrawn 1993\)](#)<sup>3</sup>
- [D123 Terminology Relating to Textiles](#)
- [D885 Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers](#)
- [D1871 Test Method for Adhesion Between Tire Bead Wire and Rubber \(Withdrawn 2023\)](#)<sup>3</sup>
- [D2229 Test Method for Adhesion Between Steel Tire Cords and Rubber](#)
- [D2692 Test Method for Air Permeability of Tire Fabrics, Tire Cord Fabrics, Tire Cord, and Yarns](#)
- [D2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data \(Withdrawn 2008\)](#)<sup>3</sup>
- [D2970/D2970M Test Methods for Testing Tire Cords, Tire Cord Fabrics, and Industrial Yarns Made From Glass Filaments \(Withdrawn 2023\)](#)<sup>3</sup>
- [D4393 Test Method for Strap Peel Adhesion of Reinforcing Cords or Fabrics to Rubber Compounds](#)
- [D6477 Terminology Relating to Tire Cord, Bead Wire, Hose Reinforcing Wire, and Fabrics](#)

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [www.astm.org/contact](http://www.astm.org/contact). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

**E663 Practice for Flame Atomic Absorption Analysis** (Withdrawn 1997)<sup>3</sup>

2.2 *International Bureau for the Standardization of Man-Made Fibers (BISFA)*:

**Internationally Agreed Methods for Testing Steel Tire Cords**<sup>4</sup>

2.3 *ISO Standards*:<sup>5</sup>

**ISO 23475-1 For the XRF method for Brass Coating Analysis**

### 3. Terminology

#### 3.1 Definitions:

3.1.1 For definitions of terms relating to tire cord, bead wire, hose wire, and tire cord fabrics, refer to Terminology **D6477**.

3.1.1.1 The following terms are relevant to this standard: core, direction of lay, flare, high elongation, length of lay, residual torsion, steel cord, steel cord wrap, steel filaments, steelstrand, straightness, in steel cord, breaking force (strength) and linear density.

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

### 4. Summary of Test Method

4.1 A summary of the test methods prescribed for the determination of specific properties is stated in each of the sections pertaining to the respective properties.

### 5. Significance and Use

5.1 The procedures in Test Methods D2969 for the determination of the properties of steel tire cord and related materials are considered satisfactory for acceptance testing of commercial shipments of such products because the procedures are the best available and have been used extensively in the trade. When a purchaser frequently uses a specific supplier, it is recommended that the two parties investigate the methods to determine if there is any bias between their two laboratories as directed in **5.1.1**.

5.1.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and the supplier shall conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties shall take a group of test specimens that are as homogeneous as possible and that are from a lot of material of the type in question. Test specimens shall then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories shall be compared using the appropriate statistical analysis and an acceptable probability level chosen by the two parties before testing is begun. If bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results with consideration to the known bias.

5.2 The significance and use of particular properties are discussed in the appropriate sections.

### 6. Sampling

6.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of primary sampling units as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider cartons of cords or rolls of fabric as primary sampling units.

NOTE 2—A realistic specification or other agreement between the purchaser and the supplier requires taking into account the variability between cartons of cords and between spools or other packages within a carton, or the variability between and within rolls of fabric so as to provide a sampling plan with meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

6.2 *Laboratory Sample*—As a laboratory sample for acceptance testing, proceed as follows:

6.2.1 For cords, take at random the number of spools or other packages per carton as directed in the applicable material specification or other agreement between the purchaser and the supplier.

6.2.2 For fabric, take a full-width swatch 1 m long from the end of each roll in the lot sample, after first discarding a minimum of 1 m of fabric from the outside layer of the roll (see **6.2.3**).

6.2.3 Place each laboratory sampling unit in a moisture-proof container to protect it from atmospheric corrosion and contamination.

6.3 *Test Specimens*—Take the number of specimens from each laboratory sampling unit as directed in each specific test method.

6.4 *Specimen Preparation*—For cords, when practical, perform tests on specimens taken directly from the spools or other packages in the laboratory sample.

### 7. Conditioning

7.1 Conditioning of materials covered by these test methods has not been found necessary, except to maintain cleanliness.

### 8. Visual Appearance, Residual Torsion, Straightness, Flare

8.1 *Scope*—This test method covers the visual examination of steel cord for appearance and test procedures for residual torsion, straightness, and flare.

8.2 *Significance and Use*—Physical properties of steel tire cord are affected by the methods of manufacturing and handling procedures. Cleanliness has a direct effect on the adhesion of steel tire cord to elastomers.

8.3 One specimen is taken from each laboratory sampling unit for residual torsion, flare, and straightness. Specimens for other tests shall be used for visual appearance.

#### 8.4 Procedures:

8.4.1 *Residual Torsion*—Determine residual torsion by removing at least 3 m of cord from the package, cutting it off, and discarding it. Make a right angle bend about 25 mm from the cord end on the package. Hold this bent end tightly so that it cannot turn while pulling out a specimen having a length of 6

<sup>4</sup> Available from BISFA, 40, rue Belliard B – 1040 Brussels, Belgium.

<sup>5</sup> Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.