



Designation: D 4777 - 88

Standard Test Method for Adhesion of Tire Cords and Other Reinforcing Cords to Rubber Compounds by Hot U-Test Procedure¹

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1. Scope

1.1 This test method covers the determination of adhesion, at a controlled elevated temperature, of reinforcing cords that are bonded to rubber compounds. This test method is applicable to cord structures made from both natural and manmade fibers, other than steel. For adhesion testing of steel tire cords refer to Test Method D 2229.

1.2 This test method is primarily used to evaluate tire cords, using a specific tire cord adhesive and a specific rubber compound. This test method is also used to evaluate (1) tie cord adhesives, and (2) the process of adhesive reaction on the cord using one consistent form of tire core and one consistent rubber compound. This test method may be used to evaluate cords in industrial hose and belting products and other cord reinforced rubber products.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound units which are provided in this method are not necessarily exact equivalents of the SI units. Either system of units may be used in this method.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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 Machines for Textiles²
- D 123 Terminology Relating to Textiles²
- D 1566 Terminology Relating to Rubber³
- D 2138 Test Methods for Rubber Property—Adhesion to Textile Cord³
- D 2229 Test Method for Rubber Property—Adhesion to Steel Cord³
- D 4393 Test Method for Strap Peel Adhesion of Reinforcing Cords or Fabrics to Rubber Compound⁴

3. Terminology

3.1 Definitions:

3.1.1 *adhesion, n*—the property denoting the ability of a material to resist delamination or separation into two or more layers.

3.1.2 *adhesion, n—in tire fabrics*, the force required to separate a textile material from rubber or other elastomers by a definite prescribed method.

3.1.3 *curing, n*—see the preferred term *vulcanization*.

3.1.4 *holland cloth, n*—a completely filled woven fabric having a smooth gloss finish on both sides used as a separating medium for sheeted rubber compounds.

3.1.5 *industrial yarn, n*—a yarn composed of continuous filaments, usually of high breaking tenacity, produced with or without twist, and intended for applications in which functional properties are of primary importance; for example, in reinforcing material in elastomeric products (tires, hose, belting), in protective coverings, and in cordage and webbing, etc.

3.1.6 *reinforcing cord, n*—a cord made from industrial yarns and used to provide added support to other materials, such as tires, hose, belting, protective coverings, webbings, etc.

3.1.7 *rubber, n*—a material that is capable of recovering from large deformations quickly and forcibly, and can be, or already is, modified to a state in which it is essentially insoluble (but can swell) in boiling solvent, such as benzene, methylethyl ketone, and ethanol-toluene azeotrope.

3.1.8 *rubber compound, n*—as used in the manufacture of rubber articles, an intimate mixture of elastomer(s) with all the materials necessary for the finished article.

3.1.9 *tire cord*—a twisted or formed structure composed of two or more single or plied industrial yarn elements having the same nominal twist, direction of twist, length, and tension.

3.1.9.1 *Discussion*—The direction of twist used to combine the single or plied yarn elements into a cord structure is in the direction opposite to that used in the yarns. Frequently tire and other reinforcing cords consist of a single yarn strand having little or no twist. These cords are used synonymously with twisted and plied cords in this method.

3.1.10 *vulcanization, n*—an irreversible process, usually accomplished through the application of heat, during which a rubber compound through a change in its chemical structure (for example, cross-linking) becomes less plastic and more resistant to swelling by organic liquids, and elastic properties are conferred, improved, or extended over a greater range of temperature.

3.1.11 For definitions of textile terms used in this standard, refer to Terminology D 123. For definitions of other terms relating to rubber, refer to Terminology D 1566.

3.2 Description of Terms Specific to This Standard:

¹ This test method is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.19 on Tire Cord and Fabrics.

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² Annual Book of ASTM Standards, Vols 07.01 and 07.02.

³ Annual Book of ASTM Standards, Vol 09.01.

⁴ Annual Book of ASTM Standards, Vol 07.01.