



Standard Test Methods for Rubber Property—Adhesion to Flexible Substrate¹

This standard is issued under the fixed designation D 413; 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 (€) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

€¹ NOTE—Section 2 was editorially updated in February 2003.

1. Scope

1.1 These test methods cover the determination of the adhesion strength between plies of fabric bonded with rubber or the adhesion of the rubber layer in articles made from rubber attached to other material. They are applicable only when the adhered surfaces are approximately plane or uniformly circular as in belting, hose, tire carcasses, or rubber-covered sheet metal.

1.2 When the adhered surfaces contain sharp bends, angles, or other gross irregularities that cannot be avoided in preparing test specimens, special test methods must be employed for evaluating adhesion.

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 problems, 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 3040 Practice for Preparing Precision Statements for Standards Related to Rubber and Rubber Testing²

D 3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets³

D 3183 Practice for Rubber—Preparation of Pieces for Test Purposes from Products³

¹ These test methods are under the jurisdiction of ASTM Committee D11 on Rubber and are the direct responsibility of Subcommittee D11.25 on Rubber Adhesive Systems.

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² Discontinued—see 1986 *Annual Book of ASTM Standards*, Vols. 09.01 and 09.02.

³ *Annual Book of ASTM Standards*, Vol 09.01.

3. Summary of Test Method

3.1 Two general test methods are given:

3.1.1 *Static-Mass Method*, in which the force required to cause separation between adhered surfaces is applied by means of gravity acting on a mass.

3.1.2 *Machine Method*, in which the force required to cause separation between adhered surfaces is applied by means of a tension machine.

3.2 Except as may be otherwise specified in these test methods, the requirements of Practices D 3182 and D 3183, shall be complied with and are made a part of these test methods.

3.3 In case of conflict between the provisions of these test methods and those of detailed specifications or test methods for a particular material, the latter shall take precedence.

3.4 As covered by these test methods, an adhesion test consists of applying to a test specimen, under specified conditions, a (measured) force sufficient to strip from the specimen at a measured rate, a layer of moderate thickness with separation (rupture, tearing) at the adhered surfaces. The numerical value of the adhesion is expressed as (1) the average force required to cause separation at a definite rate, or (2) the average rate of separation caused by a known or specified force. In the machine test method, the rate of separation is fixed and the adhesion value must be expressed in terms of the measured force. With the static-mass test method, either (1) or (2) can be used, but the latter is preferable and will be here employed.

4. Significance and Use

4.1 These test methods are used to ensure the quality of a product by determining the force per unit width required to separate a rubber layer from a flexible substrate such as fabric, fibre, wire, or sheet metal. The acceptable value of adhesion measured will, of course, vary from product to product due to different rubber formulations, flexible substrates, and types of products. However, once a product is established, minimum values of separation force can be determined and agreed to by