Designation: D816 – 06 (Reapproved 2016)

Standard Test Methods for Rubber Cements[1]

This standard is issued under the fixed designation D816; 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.

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

1. Scope

1.1 These test methods cover tests to measure the properties of adhesives, commonly called rubber cements, that may be applied in plastic or fluid form and that are manufactured from natural rubber, reclaimed rubber, synthetic elastomers, or combinations of these materials. All tests are not to be considered as applicable to a particular type of adhesive nor is every test included that may be applicable to a particular type. The tests do provide standard procedures for evaluating the more important properties of the usual adhesives ordinarily classed as rubber cements.

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

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D413 Test Methods for Rubber Property—Adhesion to Flexible Substrate

D429 Test Methods for Rubber Property—Adhesion to Rigid Substrates

D573 Test Method for Rubber—Deterioration in an Air Oven

D1084 Test Methods for Viscosity of Adhesives

D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D3184 Practice for Rubber—Evaluation of NR (Natural Rubber)

2.2 *Other Document:*

SAE Handbook[3]

3. Summary of Test Methods

3.1 The tests described in these test methods may be grouped into two classes, the first including those procedures in which the adhesive is applied to specimens of materials to be bonded together after which the quality of the bond is evaluated, and the second including those procedures applicable to the adhesive itself without consideration of the bonding properties. The classes are as follows:

Class I:	Section
Adhesion strength	8 to 15
Bonding range	16 to 18
Softening point	19 to 21
Cold flow	22 to 24
Class II:	
Viscosity	25
Stability	26 to 27
Cold brittleness	28 to 29
Density	30 to 31
Plastic deformation	32 to 33

4. Significance and Use

4.1 These tests are used as a means of classifying, evaluating, and controlling cement compositions. Adhesion strength in tension, shear, and in a peeling mode are necessary where rubber materials are used in various engineering applications where forces are encountered both normal to the adhesion plane and parallel to the plane of the adhesive interface.

5. Materials for Bonded Specimens

5.1 The following materials shall be used as specified for the preparation of specimens bonded with the test cement for tests of Class I and shall be reported with the result of the test:

5.1.1 *Aluminum Sheet, Cladded Material,* gauge 1.6 mm (0.064 in.),

[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.

Current edition approved July 1, 2016. Published August 2016. Originally approved in 1951. Last previous edition approved in 2011 as D816 – 06 (2011). DOI: 10.1520/D0816-06R16.

[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] Available from American Society of Mechanical Engineers, ASME International Headquarters, Three Park Ave., New York, NY 10016–5990.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

Documents
Document Sharing Hub
Full document details: ASTM D816-06(2016)

5.1.2 *Standard Rubber Test Sheets,* refer to Test Methods D3184 for a typical rubber formulation, and refer to Practice D3182 for preparing the sheets.

5.1.3 *Cotton Duck,* medium texture 1030 g/m^2, and

5.1.4 *Coated Fabrics,* of which the fabric strength and the adhesion of coating to fabric exceed the strength of the adhesive bond.

5.1.5 *Rolled Sheet or Machined Steel,* SAE No. 1020, sand blasted or sanded with medium/fine abrasive, and

5.1.6 Special materials such as leather, cork, felt, etc.

6. Sampling

6.1 Before sampling, the cement to be tested shall be thoroughly agitated to uniform consistency throughout, after which a sample shall be taken of sufficient quantity for performance of the tests required. The sample shall be kept in a tightly closed container to prevent evaporation and shall be agitated or stirred to uniform consistency immediately before test or use in preparation of test specimens.

7. Test Conditions

7.1 The tests of adhesives shall be conducted at a temperature of 23 ± 2°C (73.4 ± 3.6°F) and relative humidity of 50 ± 5 %. All material and equipment shall be held at these conditions prior to test for a sufficient time to assure equilibrium.

ADHESION TESTS

8. Types of Adhesion Test

8.1 The adhesion strength of a cement used to bond two materials is measured by determining the force required to produce separation by failure of the adhesive. This force may be applied as (*1*) a direct tension pull in the direction normal to the adhered surfaces, (*2*) a shearing force in the same plane as the surfaces, or (*3*) a stripping or peeling force which produces progressive separation over the adhered surfaces. It is obvious that the stripping procedure can be used only when at least one of the adhered materials is flexible. Test methods, designated A, B, and C, are given for preparing and testing bonded specimens by each of these types of adhesion test. The adhesion test may also be applied, when specified, to bonded specimens that have been subjected to deteriorating influences such as accelerated aging or action of oils or solvents after their preparation and before separation, but in this case full details concerning such treatment shall accompany the statement of the result of the adhesion test.

Test Method A—Adhesion Strength in Tension

9. Preparation of Test Specimens

9.1 For testing cements for use in vulcanized applications, the test specimens shall be those specified in Section 8 of Test Methods D429, except that after buffing or grinding the surfaces to be adhered, and washing them free from dirt or oil using acetone, they shall be coated with a uniform film of the test adhesive 0.025 mm (0.001 in.) in thickness or of an optimum thickness suitable to the products, as agreed by the parties concerned.

9.2 For testing cements for use in unvulcanized applications, test specimens similar to those specified in 9.1 shall be prepared except that the rubber cylinders used in their preparation shall be cut from vulcanized rubber and the assembly of the specimen shall be made without vulcanization in a mold. To accomplish this, the circular faces of the rubber cylinders shall be buffed smoothly and evenly to parallel planes and shall be coated with a uniform film of the test cement 0.025 mm (0.001 in.) in thickness or of an optimum thickness suitable to the products, as agreed by the parties concerned. With thin cements, the coating may be done with a brush, applying successive coats and allowing sufficient time between coats for evaporation of the solvent. The faces of the metal plates shall be freshly sand-blasted or ground to a dull finish with fine emery and washed free of dust and oil with trichloroethylene or perchloroethylene. The metal faces shall also be coated with the test cement as in the case of the rubber cylinders. When the cement films have dried to the point where there is still aggressive tackiness but no tendency for the film to lift when touched with a finger, each rubber cylinder shall be bonded firmly by hand between the cemented faces of two metal plates and the assembly shall be clamped in a suitable loading fixture under a compressive load of 44 N (10 lbf) for at least 24 h.

10. Procedure

10.1 Test the prepared specimens as described in Section 8 of Test Methods D429. Take care to use a tension testing machine of capacity and sensitivity suitable for loads of the magnitude anticipated with the particular adhesive being tested. Express the adhesion strength in kilopascals (or pounds per square inch) calculated by dividing the tension load causing failure by the original area of the adhered surface that separates.

10.2 Test two specimens and report the higher of the results as the adhesion strength in tension provided the lower value is within 10 % of the higher value. Otherwise, test additional specimens until results are obtained consisting of a high value and one that checks this within 10 %. If no check of a high value is obtained when six specimens have been tested, the average of all six results may be reported as the *average* adhesion strength in tension.

Test Method B—Adhesion Strength in Shear

11. Types of Test Specimens

11.1 Specimens for shear tests shall be of two types, namely, Type 1 lap specimens and Type 2 sandwich specimens, as shown in Fig. 1. Lap specimens shall be used when the adhesive is to be tested for bonding materials that are both extensible such as rubber, felt, or cork, or both relatively nonextensible like metal, cloth, and leather. Sandwich-type specimens shall be used when one of the bonded materials is extensible and the other nonextensible. In both types of specimens, two strips of the material 25 mm (1 in.) in width and 125 mm (5 in.) in length shall be bonded over an area 625 mm^2 (1 in.^{2}) with the free ends extending parallel in opposite directions to permit clamping in a testing machine in

AVA Documents
Document Sharing Hub

Full document details: ASTM D816-06(2016)