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An American National Standard

Standard Test Methods for Bondable Silicone Rubber Tapes Used for Electrical Insulation[1]

This standard is issued under the fixed designation D 2148; 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.

ϵ^1 NOTE—The units statement in subsection 1.3 was corrected editorially in July 2008.

1. Scope

1.1 These test methods cover tests for bondable silicone rubber tapes which form a sealed structure either with the application of heat (and pressure if needed) or by the process of auto-adhesion (self-fusing).

1.2 The methods appear in the following sections:

Test Method	Section
Adhesion	3-9
Bond Strength	10-17
Dielectric Breakdown Voltage	18-25
Hardness	40
Length	32 and 33
Thickness	26-31
Width	35-39

~~1.3The values stated in inch-pound units are to be regarded as the standard except for °C.~~

1.3 The values stated in inch-pound units are to be regarded as standard, except for °C. The values in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard statement see 22.1.1.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 149 Test ~~Methods~~Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D 374 Test Methods for Thickness of Solid Electrical Insulation

~~D618Practice for Conditioning Plastics and Electrical Insulating Materials for Testing [2].~~ 1000 Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications

~~D1000Test Methods for Pressure-Sensitive Adhesive Coated Tapes Used for Electrical and Electronic Applications[2]~~ 1458 Test Methods for Fully Cured Silicone Rubber-Coated Glass Fabric and Tapes for Electrical Insulation

~~D1458Test Methods for Fully Cured Silicone Rubber-Coated Glass Fabric and Tapes for Electrical Insulation[2]~~ 2240 Test Method for Rubber PropertyDurometer Hardness

~~D2240Test Method for Rubber Property—Durometer Hardness~~ 6054 Practice for Conditioning Electrical Insulating Materials for Testing

2.2 *ASTM Adjuncts:*

Tack tester (one drawing)[3]

~~[1] These methods are under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and are the responsibility of Subcommittee D09.07 on Flexible and Rigid Insulating Materials.~~

~~Current edition approved Jan. 15, 1995. Published March 1995. Originally published as D2148–63T. Last previous edition D2148–90.~~

[1] These methods are under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and are the direct responsibility of Subcommittee D09.07 on Flexible and Rigid Insulating Materials.

Current edition approved May 1, 2008. Published July 2008. Originally approved in 1963. Last previous edition approved in 2002 as D 2148 – $02^{\epsilon 1}$.

[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* ~~, Vol 10.01.~~volume information, refer to the standard's Document Summary page on the ASTM website.

~~[3] Annual Book of ASTM Standards, Vol 08.01.~~

[3] Available from ASTM International Headquarters. Order Adjunct No. ADJD2148. Original adjunct produced in 1965.

ADHESION

3. Scope

3.1 This test method covers the determination of the self-adhesion of unsupported, self-fusing silicone rubber rectangular and taper-edge (Note 1) tape designed for use as electrical insulation.

NOTE 1—Taper-edge tape includes such cross sections as triangular, lens, etc.

4. Significance and Use

4.1 Self-adhesion is a primary initial property since it affects layer-to-layer bonding. The integrity of the bond can significantly affect the electrical and physical performance of the insulation system. Therefore, the degree of self-adhesion is directly related to apparatus performance.

4.2 A high degree of self-adhesion is desirable for most electrical applications. In this test, a short unwinding length indicates a high degree of self-adhesion.

4.3 This test method has been found useful as a quality control test for lot acceptance.

5. Apparatus

5.1 *Inclined Mandrel Tack Test Fixture*— A suggested fixture is shown in Fig. 1.[3] The mandrel shall consist of a 5/8-in. (15.9-mm) diameter aluminum rod mounted in low-friction bearings. Good alignment of bearings is necessary for accurate results. When properly assembled, the mandrel shall turn freely when loaded with a 1-oz (30-g) weight suspended from a cotton thread wound in a single layer at the center of the mandrel.

5.2 *Weights*, as specified in Section 7 and means for attachment.

6. Test Specimen

6.1 A test specimen shall consist of two pieces of tape 12 to 15 in. ~~(25~~(300 to 380 mm) long. Divisions spaced 1 in. (25.4 mm) apart shall be marked off on one piece of tape. If tapes contain an interliner, the interliner shall be removed just prior to wrapping the mandrel. Dirt and other forms of contamination shall be avoided.

7. Procedure

7.1 *Winding*—Half lap the unmarked specimen perfectly on the mandrel of the test fixture, using the suggested weight as shown in Table 1. These weights are not critical. However, they are necessary to get intimate contact and conformability of the tape. To obtain perfect half lapping, tilt the tack tester at an appropriate angle as shown in Fig. 1. Wrap the tape on the mandrel at a speed of approximately 18 in. (450 mm)/min. Using the winding procedure and weights just described, half lap the marked tape sample on the mandrel over the first piece of tape. With the winding weight attached, return the test fixture to a horizontal position and allow the tape to bond for 1 min. Remove the winding weight from the tape and the handle from the fixture and proceed with the unwinding test.

7.2 *Unwinding*—After the tape has bonded for 1 min, attach a load of 21 oz (600 g)/in. (25 mm) of the original tape width (Note 2). Attach the weight to the free end of the tape by means of a bulldog paper clamp or other suitable device. Release the weight

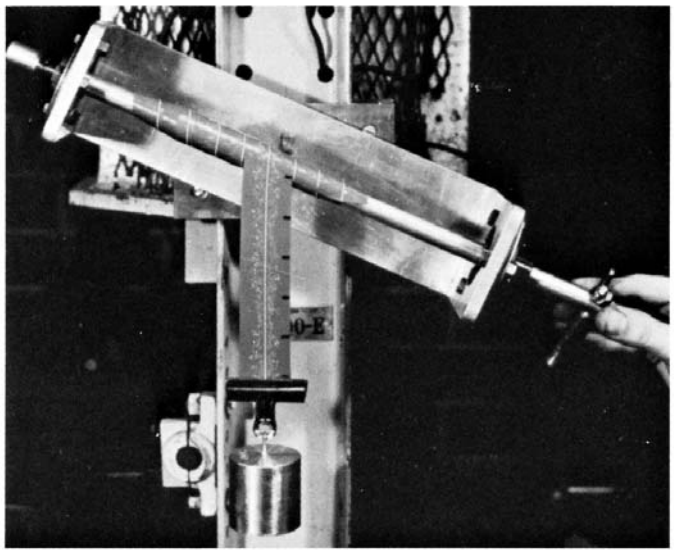

FIG. 1 Inclined Mandrel Tack Test Fixture

TABLE 1 Suggested Winding Weights For 1-in. Wide Tapes

NOTE 1—Winding weights are based on cross-sectional area and have been selected to produce approximately the same unit stress on all cross-sections. For tapes of dimensions not listed, use a winding weight of approximately 300 g/0.01 in.^{2} (6.3 mm^2)

Tape Thickness, in. (mm)		Weight, oz (g)
Triangular	Rectangular	
0.020 (0.51)	0.010 (0.25)	300
0.030 (0.76)	0.015 (0.38)	450
0.040 (1.02)	0.020 (0.51)	600
0.050 (1.27)	0.025 (0.64)	750
0.060 (1.52)	0.030 (0.76)	900
~~0.070 (1.78)~~	~~...~~	~~1050~~
0.070 (1.78)	...	37.0 (1050)
~~0.080 (2.03)~~	~~...~~	~~1200~~
0.080 (2.03)	...	42.3 (1200)

and record the length of tape unwound in 3 min. Although the original 1-in. dimensions will elongate due to the unwind weight, consider each division as one unit. While the winding weights are not critical, the use of proper unwinding weights is mandatory. Consistent and comparable results depend upon accurate width measurements and the use of the proper unwinding weight.

NOTE 2—Commercial tapes are usually made to a ±1⁄16-in. (±1.59- mm) tolerance. Therefore a 600-g weight shall be used for tapes varying in width from 15⁄16 to 1 1⁄16 in. (23.8 to 27 mm); a 750-g weight shall be used for tapes varying in width from 1 3⁄16 to 1 5⁄16 in. (30.2 to 33.3 mm) and a 900-g weight shall be used for tapes varying in width from 1 7⁄16 to 1 9⁄16 in. (36.5 to 39.7 mm). Tapes with widths outside these ranges shall be tested in accordance with their width (determined to the nearest 1⁄16 in. (1.59 mm). For example, a 1 1⁄8-in. (28.6 mm) wide tape shall be tested with a 675-g weight. The unwinding weights shall be made to a tolerance of ± 2 %.

8. Report

8.1 Report the following information:

8.1.1 Description of material, type of cross-section, tape width and thickness,

8.1.2 Winding weight, in grams,

8.1.3 Unwinding weight, in grams, and

8.1.4 Length of unwind, to the nearest ¼ unit.

9. Precision and Bias

~~9.1The precision of this test method has not been determined. Since there is no accepted reference material, no statement on bias is being made.~~

9.1 This test method has been in use for many years, but no information has been presented to ASTM upon which to base a statement of precision. No activity has been planned to develop such information.

9.2 This test method has no bias because the value for adhesion is determined solely in terms of this test method itself.

BOND STRENGTH

10. Terminology

10.1 *Definitions of Terms Specific to This Standard:*

10.1.1 *bond strength, of unvulcanized and semivulcanized supported silicone rubber tapes*—the strength of chemical linkages achieved between successive layers of tape under controlled vulcanizing conditions.

11. Significance and Use

11.1 The bond strength is an indication of the physical integrity that can be expected under end use conditions in which the insulating tapes are applied with an overlap.

12. Apparatus

12.1 *Bonding Press*—A platen press having the following characteristics:

12.1.1 A temperature range to 205 °C (400 °F).

12.1.2 A thermostat that will allow a set temperature to be maintained ~~±9°F (±5°C).~~ ± 5 °C (± 9 °F).

12.1.3 A pressure regulator to allow setting and control of the platen pressure.

12.1.4 A pressure indicator to show the pressure being exerted between the platen faces.

12.1.5 A timer to allow measurement of bonding time. It is preferred that a controller-type timer be used which will both indicate bonding time and also cause the platen pressure to be released and the platens separated at the end of the bonding period.

12.2 *Temperature-Measuring Device(s)* to indicate face temperature of the platen(s).

12.3 *Silicone Rubber Pad*, approximately ⅛ in. (3.20 mm) thick, 60 to 70 Shore A durometer hardness, larger in dimension than the specimens to be tested. This is used as a pressure-equalizing device, compensating for irregularities in either the specimen or the platens.

12.4 *Polytetrafluoroethylene* or suitable release film, three sheets, approximately 2 to 4 mils (0.05 to 0.10 mm) thick. One sheet is placed on each side of the specimens as a release sheet, the third sheet being used to separate the ends of the two test specimens.

12.5 *Testing Machine*—A power-driven testing machine of either the cross head or dead-weight pendulum type. The machine shall be equipped with a tension weighing device having a maximum capacity of 50 lb (22.7 kg) graduated to read 0.1 lb (50 g) or less per scale division.

13. Test Specimen

13.1 The test specimen shall be selected to be representative of the material to be tested. The size of sample shall be sufficient to give six strips at least 1.25 to 1.5 in. (32 to 38 mm) wide and 6 in. (150 mm) long. Care should be taken to prevent contamination.

14. Conditioning

14.1 The specimen shall not be exposed to temperatures above ~~85°F (30°C)~~ 30 °C (85 °F) before bonding. The tests shall be conducted in the Standard Laboratory Atmosphere as described in Practice ~~D618~~D 6054.

15. Procedure

15.1 Cut the strips of material to 1.25 to 1.5 in. (32 to 38 mm) wide and at least 6 in. (150 mm) long, the length being measured in the warp or machine direction of the backing.

15.2 Remove any interliner material.

15.3 Superimpose one strip on another, front side to back side, to form a specimen.

15.4 Separate the two strips at one end for a distance of about 1 in. (25 mm) and insert a strip of release film.

15.5 Preheat the press to 177 °C (350 °F).

15.6 Assemble the test specimens between two sheets of release film. Place the assembly on the unheated silicone rubber pad and insert in the press.

15.7 Close the press and apply 50 psi (345 kPa) pressure to the specimens for 5 min.

15.8 Release the pressure, remove the specimens, and allow them to cool for at least 5 min.

15.9 Remove the release film and trim the specimens to a 1-in. (25-mm) width.

15.10 Clamp one separated end in the upper jaw of the testing machine; peel the other separated end back 180 deg and clamp it in the lower jaw.

15.11 Adjust the testing machine to provide a jaw separation rate of 20 in. (500 mm) per min. If the pendulum-type machine is used, disengage the pawls during the test. Record the average observed force for each specimen using the technique described for adhesion strength in Test Methods D 1000.

16. Report

16.1 Report the following information:

16.1.1 Bond strength of each specimen and the average in pounds per inch or newtons per metre of width, and

16.1.2 Bonding time, pressure, and temperature used, if other than as specified.

17. Precision and Bias

~~17.1The precision of this test method has not been determined. Since there is no accepted reference material, no statement on bias is being made.~~

17.1 This test method has been in use for many years, but no information has been presented to ASTM upon which to base a statement of precision. No activity has been planned to develop such information.

17.2 This test method has no bias because the value for bond strength is determined solely in terms of this test method itself.

DIELECTRIC BREAKDOWN VOLTAGE

18. Scope

18.1 This test method covers determination of the breakdown voltage of unsupported bondable silicone rubber tapes with tapered edges (Note 3) for use as electrical insulation.

18.2 The method to be used for rectangular cross section tapes is described in Test Methods D 1458.

NOTE 3—Tapes with tapered edges include such cross sections as triangular and lens-shaped.

19. Significance and Use

19.1 The level of dielectric breakdown voltage as determined by this test is one measure of the quality of both material and fabrication methods used in producing the tape. This voltage value should not be compared directly with the results of tests made on rectangular cross section tapes. For further details, refer to Test Method D 149.