Designation: D 2148 – 95

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.

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

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

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:*

D 149 Test Methods for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies[2]

D 374 Test Methods for Thickness of Solid Electrical Insulation[2]

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing [2,3]

D 1000 Test Methods for Pressure-Sensitive Adhesive Coated Tapes Used for Electrical and Electronic Applications[2]

D 1458 Test Methods for Fully Cured Silicone Rubber-Coated Glass Fabric and Tapes for Electrical Insulation[2]

D 2240 Test Method for Rubber Property—Durometer Hardness[4]

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.[5] The mandrel shall consist of a ⅝-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 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 to 38 mm) long. Divisions spaced 1 in. (25.4 mm) apart shall be marked off on one piece of tape. If tapes contain

[1] These methods are under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and are the responsibility of Subcommittee D 09.07 on Flexible and Rigid Insulating Materials.

Current edition approved Jan. 15, 1995. Published March 1995. Originally published as D 2148 – 63 T. Last previous edition D 2148 – 90.

[2] *Annual Book of ASTM Standards*, Vol 10.01.

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

[4] *Annual Book of ASTM Standards*, Vol 09.01.

[5] A detailed drawing of a suggested fixture is available at a nominal cost from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428. Request Adjunct No. ADJD2148.

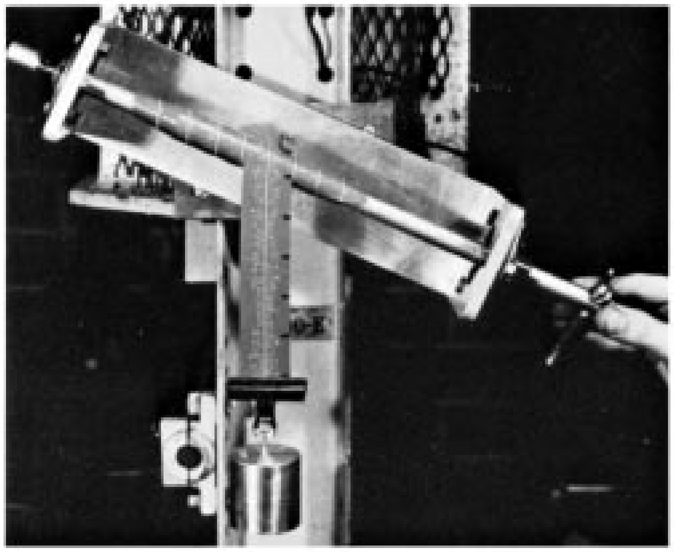

FIG. 1 Inclined Mandrel Tack Test Fixture

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 600 g/in. 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 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 %.

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, 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
0.080 (2.03)	...	1200

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 1⁄4 unit.

9. Precision and Bias

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

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).

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.