



Designation: D 4325 – 97

Standard Test Methods for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes¹

This standard is issued under the fixed designation D 4325; 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 Department of Defense.

1. Scope

1.1 These test methods cover the methods and procedures for testing electrically insulating and semi-nonmetallic conducting rubber tapes designed for splicing, terminating, and sheath repair of electrical wire and cable.

1.2 The test methods appear in the following sections:

	Section
Referenced Documents	2
Conditioning	5-6
Dielectric Strength	35-40
Dimensions	11-15
Dissipation Factor	22-26
Elongation	17-21
Heat Exposure	45-47
Fusion	7-10
Ozone Resistance	41-44
Permittivity	22-26
Sample Requirements	4
Tensile Strength	17-21
Volume Resistivity	27-34
Ultraviolet and Weather Resistance	48-51

1.3 The values stated in inch-pound units, except for °C, are the standard. The SI values given in parentheses are for information purposes only.

1.4 Unless otherwise stated, measurements are made on tapes from which the removable separator has been removed.

1.5 *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 specific precaution statements see 43.1.

2. Referenced Documents

2.1 ASTM Standards:

D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies²

D 150 Test Methods for A-C Loss Characteristics and

Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials²

D 257 Test Methods for D-C Resistance or Conductance of Insulating Materials²

D 374 Test Methods for Thickness of Solid Electrical Insulation²

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension³

D 470 Test Methods for Crosslinked Insulations and Jackets for Wire and Cable²

D 750 Test Method for Rubber Deterioration in Carbon-Arc Weathering Apparatus³

D 1711 Terminology Relating to Electrical Insulation²

D 4388 Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes⁴

D 4496 Test Method for D-C Resistance or Conductance of Moderately Conductive Materials⁴

E 591 Practice for Safety and Health Requirements Relating to Occupational Exposure to Ozone⁵

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *fusion, n*—that property of rubber tape which causes adjacent layers of tape to become bonded (amalgamated) or adhered together when the tape is stretched and wound upon itself in layers.

SAMPLING

4. Sample and Specimen Requirements

4.1 Unless otherwise required by the detailed product specifications, take the rubber tapes at random from each shipment as follows:

Number of Rolls in Shipment	Number of Sample Rolls
50 to 200	2
201 to 500	3
501 to 1000	4
1001 to 5000	5

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

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

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

⁴ *Annual Book of ASTM Standards*, Vol 10.02.

⁵ *Annual Book of ASTM Standards*, Vol 11.03.

4.2 For shipments in excess of 5000 rolls, take one additional roll for each additional 1000 rolls or fraction thereof.

4.3 A shipment consists of material shipped or intended for shipment to a customer and covered by one bill of lading.

4.4 Test each sample roll in conformance to all requirements of the specification.

4.5 All test methods in this standard are intended to produce a single value for a single roll. Any reference to averaging of measurements refers to test averaging on a single roll and not to the average of all sample rolls.

4.6 Remove and discard at least 24 in. (610 mm) of the outer layer of each roll before taking test specimens.

4.7 Remove the test specimen from the roll at a slow, uniform rate without jerking.

CONDITIONING

5. Significance and Use

5.1 The physical and electrical properties, including break strength, elongation, dielectric strength, dissipation factor, permittivity, fusion, etc., will vary with temperature and moisture content. Control the temperature and moisture content of the sample for these test methods to yield consistent and reproducible results.

6. Procedure

6.1 For referee purposes, subject the rolls to standard atmospheric conditions of $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 2\%$ relative humidity for a minimum period of 16 h before specimens are removed for test.

6.2 Unless otherwise specified, condition all test specimens for a period of 1 h and conduct the tests in a standard laboratory atmosphere at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 2\%$ relative humidity.

FUSION

7. Significance and Use

7.1 Fusion is responsible for holding the tape in place to form a permanent compressive force about a conductor or insulator in actual application.

8. Apparatus

8.1 *Winding Fixture*—The winding fixture is designed to hold a metal rod at each end and is fitted with a crank or other device to rotate the rod so that the specimen may be wound thereon. Attach the fixture to a rigid support with the rod held in a horizontal position.

8.2 *Rods*—Any suitable metal of 0.125-in. (3-mm) diameter and a minimum of 9.0 in. (229 mm) in length.

8.3 *Rule*, graduated in inches, 30-in. (762-mm) minimum length.

8.4 *Rule*, graduated in $\frac{1}{64}$ in. (0.4 mm).

8.5 *Razor Blades*.

8.6 *Board*, with 0.125-in. (3-mm) diameter holes spaced about 2 in. (50 mm) apart on its surface to provide a base for supporting the rods in a horizontal position.

9. Procedure

9.1 Prepare three specimens by cutting three strips of tape

11 in. (280 mm) in length from the sample roll selected and conditioned in accordance with Sections 4-6. Prepare and wind specimens in a manner that prevents oils or other contaminants from getting on the bonding surface of the tape.

9.2 Mount the rod horizontally in the winding fixture.

9.3 Attach the strip of tape near one end of the rod by winding the strip upon itself using 1 in. (25 mm) of the tape. Place the 30-in. (762-mm) rule next to the 10-in. (254-mm) tape strip. Stretch the tape strip to the desired length specified in the product specification.

9.4 Move the tape to the proper angle and rotate the rod so that the tape is wrapped on the rod with a one-half lap for a length of 7.0 in. (178 mm).

9.5 Change the angle of the tape and repeat the procedure in 9.4 winding back toward the start of the first wrap so that the second one-half overlap wrap is wound over the first wrap to provide a four layer build-up of tape.

9.6 After the final wrap, maintain constant pressure on the tape strip and score the tape with a new razor blade at the top of the rod, parallel to the rod. Break the tape on the score line, removing the tab. Remove the test specimen from the fixture and roll the specimen so formed between the palm of the hands. This completes the preparation of the test specimen.

9.7 Insert the wrapped specimen in the holes in the base of the board and allow them to condition at $23.0 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 2\%$ relative humidity for 24 h. At the end of this period, if there is any flagging (end-lifting) of the tape, measure the length of the flag to the nearest $\frac{1}{64}$ in. (0.4 mm), taking care not to cause additional unwrapping in the measuring operation. Record the maximum, minimum and average length of the flag.

10. Report

10.1 Report the following information:

10.1.1 Identification of the tape tested, and

10.1.2 Pass or fail depending on the requirements outlined in the product specification (see Specification D 4388).

DIMENSIONS—LENGTH, WIDTH, AND THICKNESS

11. Significance and Use

11.1 Measurements of length, width, and thickness are necessary to ensure a customer is receiving the correct quantity of tape. The thickness measurement is of particular value in controlling uniformity and providing design criteria, as well as being used in the measurement of physical and electrical properties.

12. Apparatus

12.1 *Steel Rule*, capable of measuring to the nearest $\frac{1}{64}$ in. (0.4 mm).

12.2 *Thickness Gage*—A dead weight dial micrometer as prescribed in Method C of Test Methods D 374, with the following modifications:

12.2.1 A micrometer with graduations to 0.001 in. (0.01 mm).

12.2.2 A micrometer with a presser foot 0.25 ± 0.01 in. (6.35 ± 0.25 mm) in diameter exerting a total force of 10.0 ± 0.1 oz (2.50 ± 0.03 N) force.