



Standard Test Methods for Varnished Cotton Fabrics Used for Electrical Insulation¹

This standard is issued under the fixed designation D295; 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 procedures for the testing of varnished cotton fabrics and varnished cotton fabric tapes (**Note 1**) to be used as electrical insulation and are directly applicable to both “straight-cut” and “bias-cut” materials, unless otherwise stated in the test method.

NOTE 1—Methods of testing varnished glass fabrics and tapes are given in Test Methods **D902**.

1.2 The procedures appear in the following order:

Procedures	Sections	ASTM Test Methods
Breaking Strength	20 to 27	...
Conditioning	5	...
Dielectric Breakdown Voltage	43 to 46	D149
Dielectric Breakdown Voltage Under Elongation	47 to 53	D149
Dissipation Factor and Permittivity	54 to 60	D150
Elongation	35 to 42	...
Resistance to Oil	68 to 73	D92
Selection of Test Specimens	4	...
Tear Resistance	28 to 34	D689
Thickness	6 to 10	D374
Thread Count	15 to 19	...
Volume Resistance	61 to 67	D257
Weight	11 to 14	...

1.3 The values stated in inch-pound units are to be regarded as the standard. The metric equivalents of inch-pound units may be approximate.

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 specific precautionary statements, see **44.4**, **51.1**, **58.1**, and **65.1**.

NOTE 2—This standard resembles IEC 60394–2 in title only. The content is significantly different.

2. Referenced Documents

2.1 ASTM Standards:²

D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

D374 Test Methods for Thickness of Solid Electrical Insulation (Withdrawn 2013)³

D689 Test Method for Internal Tearing Resistance of Paper (Withdrawn 2009)³

D902 Test Methods for Flexible Resin-Coated Glass Fabrics and Glass Fabric Tapes Used for Electrical Insulation

D1711 Terminology Relating to Electrical Insulation

2.2 IEC Standard:

IEC 60394–2 Varnished Fabrics for Electrical Purposes — Part 2: Methods of Test⁴

3. Terminology

3.1 **Definitions**—For definitions of terms used in these test methods refer to Terminology **D1711**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 **weight**—of varnished cloth and varnished cloth tapes, the weight per unit area as determined in accordance with this test method. It is usually expressed in pound per square yard for a specified nominal thickness.

3.2.2 **threads per inch**—of varnished cloths, the count of the number of warp and filling yarns present in the base cloth per linear inch of width or length, respectively.

¹ These test 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.

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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 The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American National Standards Institute, 11 W 42nd St., New York, NY 10036.

3.2.3 *elongation*—the amount of strain observed in a given length of varnished cloth or tape when subjected to prescribed loading conditions at prescribed atmospheric conditions. It is expressed as a percentage of the initial length.

3.2.4 *oil resistance*—of varnished cloth or tape, the ability of the varnish film to withstand the attack of oil without excessive impairment of its physical and electrical characteristics when the varnished cloth or tape is immersed in a specified oil for a prescribed period of time at a given temperature.

4. Selection of Test Specimens

4.1 Select specimens for test from portions of material free from defects.

4.2 In the case of rolls of material other than those packed in oil, remove the outer two layers of cloth or the outer six layers of tape and prepare test specimens from the remaining material. In the case of oil-packed tape, remove the outer layer from each roll to be tested. In the case of sheets and tape strips, remove the outer six layers of material and prepare test specimens from that remaining.

NOTE 3—In the case of bias-cut materials, exclude seams and jointed selvage from test areas.

NOTE 4—If it is desired to test seams and jointed selvages for breaking strength, prepare additional test specimens so that the seams or joints are in the center of the specimens.

5. Conditioning

5.1 *Significance and Use*—Because the physical and electrical properties of most fabrics change with variation of their moisture content, it is necessary to control this property at the time of testing in order to attain reasonably good reproducibility of test values. For example, when cotton fabric absorbs moisture it tends to swell and increase in dimensions. Also, the flexibility, elongation, and tensile strength of the material normally increase with increased relative humidity, whereas, conversely, the electrical properties are depreciated when the material is subjected to these conditions. The time of exposure to the conditioned atmosphere must be long enough to permit the moisture content of the test specimen to reach a relatively stable value. If the fabric is untreated, a few hours exposure is sufficient. Treated fabrics like varnished cloth require appreciably longer time.

5.2 Where it is desired to test in a controlled atmosphere, condition the test specimens for 48 h in the Standard Laboratory Atmosphere of 50 ± 2 % relative humidity at 23 ± 1 °C (73.4 ± 1.8 °F). If a conditioning cabinet or chamber is used, subject the specimens to test immediately upon withdrawal from the cabinet or chamber, unless otherwise specified.

5.3 If it is desired to test the material in the condition as received by the purchaser, allow the packages containing the rolls of material from which the specimens are to be taken to reach room temperature before opening. Open the packages, remove the roll and immediately prepare such test specimens as required, unless otherwise specified.

5.4 In the case of dispute, the procedure described in 5.2 shall be the referee method.

TEST METHOD A: THICKNESS

6. Significance and Use

6.1 The thickness test is necessary to determine whether the material meets specified tolerances for thickness. In addition, thickness values are essential because of the importance of space factor in designing electrical equipment.

7. Test Specimens

7.1 In the case of cloths or sheets, cut test specimens 1 in. (25.4 mm) wide across the entire width. In the case of bias-cut cloth, exclude seams or jointed selvages from the area of test.

7.2 In the case of tapes or strips, remove specimens 36 in. (910 mm) long from the sample of material selected in accordance with Section 4.

8. Procedure

8.1 Measure the thickness in accordance with Test Methods D374, with the following modifications:

8.1.1 Either Method B or Method C may be used but Method C is to be used unless otherwise specified. Method A shall not be used.

8.1.2 In making thickness measurements, use only one layer of material.

8.1.3 In the case of cloths, take ten measurements equally spaced across the width of the specimen. The thickness of the cloth shall be the average of the ten measurements.

8.1.4 In the case of tapes, unless otherwise specified, take ten measurements equally spaced along the length of each specimen. The thickness of the tape shall be the average of ten measurements.

9. Report

9.1 Report the average, maximum, and minimum thickness in inches (or centimetres).

10. Precision and Bias

10.1 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.

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

TEST METHOD B: WEIGHT

11. Significance and Use

11.1 Weight values are useful for estimating weight in designing electrical equipment containing a constituent part of varnished cloth or tape.

12. Procedure

12.1 Prepare either square or rectangular specimens of sufficient size to weigh not less than 0.18 oz (5 g). Accurately weigh on an analytical balance. Measure the length and width dimensions with sufficient precision to be able to compute the area within 0.3 %. Compute the weight per unit area.