



Designation: D1000 – 17

Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications¹

This standard is issued under the fixed designation D1000; 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 testing pressure-sensitive adhesive-coated tapes to be used as electrical insulation. These tapes are classified as follows:

1.1.1 *Class 1*—Non-elastomeric backings made from materials such as:

- Paper, flat or creped,
- Fabric, uncoated or coated,
- Cellulose ester films,
- Polyethylene terephthalate (polyester) films,
- Fluorocarbon polymer films,
- Composite filament films,
- Polyamide films,
- Polyimide films, and
- Combinations thereof.

1.1.2 *Class 2*—Elastomeric backings that are characterized by both high stretch and substantial recovery. These backings are made from materials such as:

- Vinyl chloride and co-polymers,
- Vinylidene chloride and co-polymers, and
- Polyethylene and co-polymers.

1.2 Test laminates of Class 1 and Class 2 backings according to Class 1 test methods.

1.3 The procedures appear in the sections indicated below and in alphabetical order:

Adhesion Strength to Steel and Backing at Room Temperature	46 – 53
Adhesion Strength to Steel and Backing at Low Temperatures	46 – 53
Bond Strength After Solvent Immersion	110 – 115
Breaking Strength and Elongation at Room Temperature	37 – 45
Breaking Strength and Elongation at Low Temperatures	37 – 45
Conditioning	6 – 8
Curling and Twisting	140 – 146
Dielectric Breakdown Voltage	83 – 90
Effect of Accelerated Aging on High-Temperature Tapes	97 – 103
Flagging	66 – 76
Flammability	104 – 109
Hazards/Precautions	3
Insulation Resistance at High Humidity	91 – 96
Length of Tape in a Roll	28 – 36

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 Electrical Insulating Materials.

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Oil Resistance	116 – 122
Puncture Resistance	123 – 128
Resistance to Accelerated Aging (Heat and Moisture)	129 – 139
Sampling	4
Specimen Preparation	5
Thermosetting Properties	77 – 82
Thickness	21 – 27
Unwind Force at Room Temperature	54 – 65
Unwind Force at Low Temperatures	54 – 65
Width	11 – 20

NOTE 1—These procedures apply to both Class 1 and Class 2 tapes except as noted above.

1.4 This is a fire-test response standard (see Section 104).

1.5 The values stated in SI units are the standard, unless otherwise noted. If a value for measurement is followed by a value in inch-pound or English units in parentheses, it is likely that the second value will only be approximate and it is for information only. The first stated value is the preferred unit.

NOTE 2—These test methods are similar to IEC 60454–3, but may differ sometimes in some details.

1.6 *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 hazards see Section 3.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

- 2.1 *ASTM Standards*:²
[A666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar](#)

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.

- [D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies](#)
- [D257 Test Methods for DC Resistance or Conductance of Insulating Materials](#)
- [D295 Test Methods for Varnished Cotton Fabrics Used for Electrical Insulation](#)
- [D374/D374M Test Methods for Thickness of Solid Electrical Insulation](#)
- [D1711 Terminology Relating to Electrical Insulation](#)
- [D3487 Specification for Mineral Insulating Oil Used in Electrical Apparatus](#)
- [D5032 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Glycerin Solutions](#)
- [E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)
- 2.2 *IEC Standard:*
- [IEC 60454-3 Specification for Pressure-Sensitive Adhesive Tapes for Electrical Purposes³](#)

3. Hazards

3.1 The following specific substances are flammable liquids. Do not use them in the vicinity of open flames or electrical contacts: *acetone* (see 50.1 and 94.1), *heptane* (see 50.1 and 94.1), and *toluene* (see 70.6). They must be stored in closed containers, and it is imperative to clean apparatus in a well-ventilated area.

3.2 As toluene is a toxic substance, use toluene only where adequate ventilation is provided and in such manner as to avoid any absorption through the skin (see 70.6).

3.3 **Warning**—*It is possible that lethal voltages will be present when conducting test methods which evaluate electrical properties. It is essential that the test apparatus, and all associated equipment electrically connected to it, be properly designed and installed for safe operation. Solidly ground all electrically conductive parts that any person might come in contact with during the test. Provide means for use, at the completion of any test, to ground any parts which: were at high voltage during the test; have the potential to acquire an induced charge during the test; or have the potential to retain a charge even after disconnection of the voltage source. Thoroughly instruct all operators in the proper way to conduct tests safely. When making high voltage tests, particularly in compressed gas or in oil, it is possible that the energy released at breakdown will be sufficient to result in fire, explosion, or rupture of the test chamber. Design test equipment, test chambers, and test specimens so as to minimize the possibility of such occurrences and to eliminate the possibility of personal injury.*

SAMPLING

4. Sample and Specimen Requirements

4.1 The producer and consumer shall agree upon the number of rolls selected. Unless otherwise specified a minimum of three rolls per lot shall be selected.

³ International Electrotechnical Commission, 446 Main St., Worcester, MA 01608, <http://www.iec.ch>.

4.2 For sampling purposes, a lot consists of identifiable materials of the same type, manufactured in one production run and offered for delivery at the same time.

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

4.4 See **Table 1** for a summary of standard requirements for the number of test specimens to select from each sample roll, the number of test measurements to make per test specimen, and the value to be reported.

4.5 Include in every report the complete identification of the tape tested.

SPECIMEN PREPARATION

5. Test Specimen Preparation

5.1 Place any roll of tape to test on a freely revolving mandrel. Except for determination of length of tape in a roll, remove and discard a minimum of three layers before removing tape for preparation of test specimens.

5.2 Remove sufficient length of tape, at the rate of approximately 50 mm/s (2 in./s), to provide the specimens required for all tests. Cut the tape with a sharp razor blade or scissors, unless otherwise specified. Place the tape on a smooth clean surface, adhesive side up, or suspend it from one end in free air. Protect the adhesive surface from dust. Do not allow the adhesive surface to contact the operator's fingers or other foreign objects. Allow flexible specimens to relax for at least two minutes. From this tape material, prepare specimens as required in the individual test methods. See also **Table 1**.

TABLE 1 Testing and Reporting

Test	Section	Tests per Specimen ^A	Specimens per Roll ^A	Report ^B
Width	14, 19	3	1	avg
Thickness	26	3	1	avg
Length of tape in a roll	35	1	1	value
Breaking strength	44	1	3	avg
Elongation	44	1	3	avg
Adhesion strength	52	1	3	avg
Unwind force				
Fast rate of removal	64	1	1	value
Slow rate of removal	64	3	1	avg
Flagging				
Class 1 Tape	71	3	1	avg
Class 2 Tape	75	1	3	avg
Thermosetting properties	81	1	3	avg
Dielectric breakdown voltage	89	3	3	avg
Insulation resistance at high humidity	95	5	1	med
Effect of accelerated aging	102	3	2	avg
Flammability	108	1	3	avg
Bond strength after solvent immersion	114	1	3	avg
Oil resistance	121	1	4	avg
Puncture resistance	127	1	5	avg
Resistance to accelerated aging	129, 133	1	6	avg
Curling and twisting	140	1	3	avg

^A When referee testing is involved, use an average of 5 determinations wherever 1 or 3 are specified above.

^B Minimum and maximum values are also occasionally required when average values are reported.

5.3 Use test specimens that are the width of the tape as received, if possible. If it is necessary to prepare narrower specimens as prescribed in the test method, use extreme care since hand trimming has the potential to materially affect the test results. Two recommended procedures are (1) to slit the specimen with a sharp razor blade free of nicks while the specimen is held down with a pattern of the desired width, or (2) to slit with mounted parallel sharp razor blades free of nicks to the desired width.

CONDITIONING

6. Terminology

6.1 Definitions:

6.1.1 *conditioning, n*—the exposure of a material to the influence of a prescribed atmosphere for a stipulated period of time or until a stipulated relation is reached between material and atmosphere.

7. Significance and Use

7.1 The physical and electrical properties such as adhesion, elongation, breaking strength, and dielectric breakdown will vary with temperature and moisture content. Actual service results are influenced by these factors. In order that test methods yield consistent and reproducible results, control the temperature and moisture content of the sample or specimen.

8. Conditioning for Room Temperature Measurements

8.1 Condition all rolls of tape for a minimum of 24 h to a temperature of $23 \pm 5^\circ\text{C}$ ($73 \pm 9^\circ\text{F}$) before removing specimens for test.

8.2 Condition all test specimens for a period of 1 h in a controlled atmosphere at $23 \pm 5^\circ\text{C}$ ($73 \pm 9^\circ\text{F}$) and $50 \pm 10\%$ relative humidity prior to testing.

8.3 Unless otherwise specified, testing shall be conducted at $23 \pm 5^\circ\text{C}$ ($73 \pm 9^\circ\text{F}$) and $50 \pm 10\%$ relative humidity.

8.4 For referee testing purposes, subject all sample rolls to a controlled laboratory temperature of $23 \pm 1^\circ\text{C}$ ($73.4 \pm 1.8^\circ\text{F}$) for a minimum period of 24 h before removing specimens for test.

8.5 Unless otherwise specified, condition all referee test specimens for a period of 1 h in a controlled laboratory atmosphere at $23 \pm 1^\circ\text{C}$ ($73.4 \pm 1.8^\circ\text{F}$) and $50 \pm 2\%$ relative humidity.

8.6 Unless otherwise specified, referee testing shall be conducted at $23 \pm 1^\circ\text{C}$ ($73.4 \pm 1.8^\circ\text{F}$) and $50 \pm 2\%$ relative humidity.

9. Conditioning for Low Temperature Measurements

9.1 Elastomeric backings of Class 2 tapes have the potential to be subject to cold temperature tests. Condition elastomeric backings of Class 2 tapes for cold temperature tests by placing prepared specimens or rolls of tape in a cold room for at least 2 h at the desired temperature (example temperatures: 10°C , 0°C , -10°C , -18°C).

10. Apparatus for Low Temperature Conditioning

10.1 Cold room or cold chamber capable of maintaining the desired cold temperatures during testing.

WIDTH OF TAPE

Method A—Steel Ruler

11. Apparatus

11.1 A steel scale having divisions at 0.5 mm or $\frac{1}{64}$ -in. intervals.

12. Test Specimens

12.1 Select test specimens of approximately 450 mm (18-in.) lengths of tape taken from each sample roll in accordance with 5.2 and conditioned in accordance with Section 8.

13. Procedure

13.1 Place the test specimen, after conditioning, without tension or pressure, adhesive side down on a hard smooth surface. Measure the width perpendicular to the edge with the steel scale at three approximately equally-spaced points along the length.

14. Report

14.1 Report the average width in millimetres or inches, plus the maximum and minimum, if specified.

15. Precision and Bias

15.1 This test method has been in use for many years, but no statement of precision has been made and no activity is planned to develop such a statement.

15.2 This test method has no bias because the value for width is defined in terms of this test method.

Method B—Caliper

16. Apparatus

16.1 A pair of calipers with a scale length larger than width of the roll of tape, having divisions at 0.5-mm or $\frac{1}{64}$ -in. intervals.

17. Test Specimen

17.1 One roll of tape, conditioned in accordance with Section 8. Unless damaged, no outer layers need to be removed.

18. Procedure

18.1 The outer turns of the roll must have clean and sharp edges. Discard any damaged or crushed edges. After conditioning the roll of tape, place it on a table in a vertical position. Open the jaws of the calipers and slide them over the cut edges of the tape so that the scale shaft is parallel to the table. Close the caliper jaws slowly so as to just touch the sides of the tape roll. Be careful not to crush the edges and keep the caliper jaws perpendicular to the edges of the tape. Measure the width perpendicular to the edges in mm (in.) to the nearest 0.5 mm