



## Designation: D1677 – 17 (Reapproved 2024)

# Standard Test Methods for Sampling and Testing Untreated Mica Paper Used for Electrical Insulation<sup>1</sup>

This standard is issued under the fixed designation D1677; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 These test methods cover procedures for sampling and testing untreated mica paper to be used as an electrical insulator or as a constituent of a composite material used for electrical insulating purposes.

1.2 The procedures<sup>2</sup> appear in the following order:

Procedures	Sections	ASTM Method References
Apparent Density	12	...
Aqueous Extract Conductivity	32 and 33	D202
Conditioning	4	D685
Dielectric Strength	16 – 19	D149
Impregnation Time	20 – 24	D202
Moisture Content	26 – 28	D644
Roll Quality	25	...
Sampling	3	...
Tensile Strength	13 – 15	D828
Thickness	6 – 10	D374/D374M
Weight	11	D646
Weight Variability	29 – 31	...

1.3 The values stated in inch-pound units are to be regarded as the 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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.*

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and are the direct responsibility of Subcommittee D09.01 on Electrical Insulating Products.

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<sup>2</sup> The test methods for other properties will be added in accordance with standard ASTM procedures as their need becomes generally desirable.

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>3</sup>

- D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- D202 Test Methods for Sampling and Testing Untreated Paper Used for Electrical Insulation
- D374/D374M Test Methods for Thickness of Solid Electrical Insulation
- D644 Test Method for Moisture Content of Paper and Paperboard by Oven Drying (Withdrawn 2010)<sup>4</sup>
- D646 Test Method for Mass Per Unit Area of Paper and Paperboard of Aramid Papers (Basis Weight) (Withdrawn 2022)<sup>4</sup>
- D685 Practice for Conditioning Paper and Paper Products for Testing
- D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus
- D1711 Terminology Relating to Electrical Insulation

## 3. Sampling

3.1 Sample in accordance with the requirements set forth in Test Methods D202.

3.2 Make the tests for physical properties on each sample insofar as the specimens are of sufficient width.

3.3 Untreated mica papers are, in general, quite fragile and friable. At all times during the operations of sampling, conditioning, specimen preparation, and testing, great care must be taken to prevent flexing and tearing, and to minimize abrasion of particles from the surfaces. The test values are significantly and adversely affected if these precautions are not taken.

<sup>3</sup> 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.

<sup>4</sup> The last approved version of this historical standard is referenced on www.astm.org.

#### 4. Conditioning

4.1 Condition samples in accordance with Practice **D685**, except that samples shall remain in the conditioned air for not less than 16 h prior to the tests.

4.2 The following physical tests shall be made in the conditioned atmosphere: thickness, weight, tensile strength, dielectric strength, and impregnation.

#### 5. Precision and Bias

5.1 Due to the range of types and grades, and nonuniform nature of commercially available mica papers, no statement can be made about the precision of these test methods when used on these materials. Neither can a statement about bias be made because of the unavailability of standard reference materials. Nevertheless, these test methods serve to distinguish basic, relative differences in properties, and variations in quality among mica papers used in electrical insulation.

### THICKNESS AND THICKNESS VARIATION

#### 6. Terminology Definition

6.1 *thickness, n*—of an electrical insulating material, the perpendicular distance between the two surfaces of interest, determined in accordance with a standard method.

#### 7. Significance and Use

7.1 Accurate determination of thickness is important for identification purposes. Thickness is related to weight and must be known in order to calculate apparent density and the dielectric strength.

7.2 Thickness variation affects the quality of roll winding and is useful in judging the uniformity of mica paper particularly with respect to dielectric breakdown voltage, impregnation time, and thickness of the end product.

#### 8. Test Specimens

8.1 Take test specimens from the original samples obtained in accordance with Section **3** and conditioned as prescribed in Section **4**, and tested under the same conditions.

8.2 For all thicknesses of mica paper, the specimen shall be a single sheet.

#### 9. Procedure

9.1 Determine the thickness in accordance with Test Methods **D374/D374M**. The preferred method shall be Method D with a drop rate of  $12 \pm 4$  mil/s and a dwell time of  $3 \pm 1$  s for thickness of 0.002 to 0.006 in. and  $6 \pm 2$  s for + 0.006 in. Method C of Test Methods **D374/D374M** is an acceptable alternative.

9.2 Take at least five measurements of thickness at regular intervals across the entire width of each specimen, preferably in a line that is at right angles to the machine direction.

#### 10. Report

10.1 Report in accordance with Test Methods **D202** and include:

10.1.1 Average, minimum, and maximum thickness.

### WEIGHT

#### 11. Procedure

11.1 Determine the weight in accordance with Test Method **D646**, except sample the material in accordance with Section **3**, condition as prescribed in Section **4**, and test under the same conditions. Report the results as weight in grams per square metre.

### APPARENT DENSITY

#### 12. Procedure

12.1 Determine the apparent density from the thickness (Sections **8 – 10**), and the weight (Section **11**). Make the thickness and weight determinations on the same sample. Calculate the apparent density as follows:

$$D = A/B \quad (1)$$

where:

$A$  = basis weight, kg/m<sup>2</sup>,

$B$  = thickness, μm, and

$D$  = apparent density, g/cm<sup>3</sup>.

### TENSILE STRENGTH

#### 13. Significance and Use

13.1 The results of the test are suitable for acceptance and product control. They are also a means of measuring the ability of mica paper to withstand the tensile stresses encountered in application processes.

#### 14. Procedure

14.1 Determine the tensile strength in accordance with Test Methods **D202**, except for specimen width and test span. Sample the material in accordance with Section **3** and condition in accordance with Section **4** and test under the same conditions. The specimen shall be 1 to 3 in. (25 to 77 mm) wide. The distance between the jaws shall be 5 in. (127 mm).

NOTE 1—If excessive fractures occur in or at the edge of either jaw, use a cushion of soft kraft paper or other material between the jaws of the clamps and the specimen.

#### 15. Report

15.1 Report the following information:

15.1.1 The thickness of test specimen, and

15.1.2 The average, minimum and maximum tensile strength in pounds-force per inch of width (or newtons per metre of width).

### DIELECTRIC STRENGTH

#### 16. Nomenclature

16.1 *dielectric strength*—Refer to Terminology **D1711**.

#### 17. Significance and Use

17.1 For mica paper to be used in the untreated state, this test gives some indication of the electrical strength. For mica paper to be subsequently treated, this test has value as a quality control test.