Designation: D1677 – 02 (Reapproved 2011)

Standard Methods for Sampling and Testing Untreated Mica Paper Used for Electrical Insulation[1]

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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These 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[2] 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
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 whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

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 Test Methods for Thickness of Solid Electrical Insulation (Metric) D0374_D0374M

D644 Test Method for Moisture Content of Paper and Paperboard by Oven Drying (Withdrawn 2010)[4]

D646 Test Method for Mass Per Unit Area of Paper and Paperboard of Aramid Papers (Basis Weight)

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 may be significantly and adversely affected if these precautions are not taken.

4. Conditioning

4.1 Condition samples in accordance with Practice D685, except that samples should 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

[1] These 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.

Current edition approved April 1, 2011. Published April 2011. Originally approved in 1959. Last previous edition approved in 2007 as D1677 – 02 (2007). DOI: 10.1520/D1677-02R11.

[2] The test methods for other properties will be added in accordance with standard ASTM procedures as their need becomes generally desirable.

[3] 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.

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

can be made about the precision of these methods when used on these materials. Neither can a statement about bias be made because of the unavailability of standard reference materials. Nevertheless, these 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. The preferred method shall be Method D with a drop rate of 12 ± 4 mil/s and a dwell time of 3 ± 1 s for thickness of 0.002 to 0.006 in. and 6 ± 2 s for + 0.006 in. Method C of Test Methods D374 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^2,
B = thickness, µm, and
D = apparent density, g/cm^3.

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, a cushion of soft kraft paper or other material may be used 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.

18. Procedure

18.1 Determine the dielectric strength in accordance with Test Method D149, except sample the material in accordance with Section 3 and condition in accordance with Section 4, and test under the same conditions. Make tests in air using 2-in. (50.8-mm) electrodes and the short-time (continuous-rise) method. Determine the average dielectric strength on the basis of ten dielectric breakdowns.

19. Report

19.1 Report the following information:

19.1.1 Average thickness of the specimen,

19.1.2 Average, high, and low breakdown voltage, and