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An American National Standard

Standard Test Methods for Compaction Density of Electrical Grade Magnesium Oxide¹

This standard is issued under the fixed designation D 2771; 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.

ε¹ NOTE—Keywords were added editorially in October 1997.

1. Scope

1.1 These test methods cover the determination of the compaction density of electrical grade magnesium oxide in heating units.

1.2 Two alternative procedures are described:

Test Method A—Water Displacement, and

Test Method B—Absorption.

1.3 *This standard does not purport to address the safety problems 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.*

2. Referenced Documents

2.1 ASTM Standards:

D 176 Test Methods for Solid Filling and Treating Compounds Used for Electrical Insulation²

3. Apparatus

3.1 For either test method, a balance capable of weighing to 0.1 mg is required.

4. Sampling

4.1 Specimens shall be obtained by cutting lengths of about 25 mm from the heating unit.

4.2 Rough edges, metal chips, or loose oxide resulting from the cutting operation shall be removed carefully before proceeding.

TEST METHOD A—WATER DISPLACEMENT

5. Procedure

5.1 Weigh the specimen to the nearest 1 mg.

5.2 Seal the specimen against water absorption by the use of one of the following materials, the density of which must be known:

5.2.1 Canada balsam, molten paraffin wax, RTV silicone rubber,³ or heat-shrinkable poly (vinyl chloride) tubing.⁴

NOTE 1—The sealant must cover each face of the sample and extend at least 5 mm along the sheath from each end.

5.3 Dry, cure, or otherwise fix the sealant according to the standard procedure appropriate to the material used.

5.4 Weigh the sealed specimen in air to the nearest 1 mg.

5.5 Suspend the specimen in distilled water and weigh while suspended.

NOTE 2—**Caution:** Use the smallest and lightest suspension wire possible to minimize error.

5.6 Strip the seals from the specimen. Remove all magnesium oxide from the specimen by deforming the sheath with a vise or hammer to loosen the insulation. Weigh the sheath and resistance wire together in air.

5.7 Suspend the sheath and resistance wire together in water and weigh while suspended (see Note 2).

6. Calculation

6.1 Calculate the compaction density of the magnesium oxide as follows:

$$\text{Density, g/cm}^3 = \frac{W_1 - W_4}{\left[\frac{(W_2 - W_3) - (W_4 - W_5)}{D_2} \right] - \frac{(W_2 - W_1)}{D_1}}$$

where:

W_1 = weight of specimen in air,

W_2 = weight of sealed specimen in air,

W_3 = weight of sealed specimen in water,

W_4 = weight of sheath and wire in air,

W_5 = weight of sheath and wire in water,

D_1 = density of sealant, and

D_2 = density of water at test temperature.

TEST METHOD B—ABSORPTION

7. Procedure

7.1 Weigh the specimen to the nearest 1 mg.

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 D09.14 on Electric Heating Unit Insulation.

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² Annual Book of ASTM Standards, Vol 10.01.

³ Silastic RTV 731, Dow Corning Corp., has been found suitable for this purpose. Specific gravity is 1.15.

⁴ Type SCL, Rayclad Tubes, Inc., has been found suitable for this purpose. Specific gravity is 0.935.



7.2 Submerge the specimen in kerosine or low-viscosity oil⁵ of known density, and soak for at least 12 h.

7.3 Remove the specimen from the fluid and dry the surface with an absorbent paper or cloth, being careful to avoid drawing the adsorbed fluid from the insulation. Immediately weigh the specimen to the nearest 1 mg.

7.4 Remove all magnesium oxide from the specimen by deforming the sheath with a vise or hammer to loosen the insulation. Clean the sheath and resistance wire thoroughly and weigh together.

8. Calculation

8.1 Calculate the compaction density of the magnesium oxide as follows:

$$\text{Density, g/cm}^3 = \frac{\frac{W_6 - W_8}{D_3} + \frac{W_6 - W_8}{D_4}}{2}$$

where:

W_6 = weight of specimen,

W_7 = weight of specimen with absorbed fluid,

W_8 = weight of sheath and wire,

D_3 = density of fluid, and

D_4 = density of MgO, as determined per Methods D 176.

9. Report

9.1 Report the following information:

9.1.1 Proper identification of the specimen,

9.1.2 Results from 5.1 or 7.1 obtained from at least two determinations and their average, and.

9.1.3 The test method used, A or B.

10. Precision and Bias

10.1 The compaction density when determined by Test Method A is found to have a precision of $\pm 5\%$ and when determined by Test Method B, a precision of $\pm 3.5\%$. It is found that Test Method B will yield values 4.5 % higher than Test Method A.

10.2 Bias cannot be determined since the true value is unknown.

11. Keywords

11.1 compaction density; electrical grade; magnesium oxide

⁵ DC-200 Silicone Oil, Dow Corning Corp., has been found suitable for this purpose. Specific gravity of 20-cSt oil is 0.942.

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