Designation: D150 – 11

Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation[1]

This standard is issued under the fixed designation D150; 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 the determination of relative permittivity, dissipation factor, loss index, power factor, phase angle, and loss angle of specimens of solid electrical insulating materials when the standards used are lumped impedances. The frequency range addressed extends from less than 1 Hz to several hundred megahertz.

NOTE 1—In common usage, the word relative is frequently dropped.

1.2 These test methods provide general information on a variety of electrodes, apparatus, and measurement techniques. A reader interested in issues associated with a specific material needs to consult ASTM standards or other documents directly applicable to the material to be tested.[2,3]

1.3 *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 hazard statements, see 7.2.6.1 and 10.2.1.

2. Referenced Documents

2.1 *ASTM Standards:*[4]

D374 Test Methods for Thickness of Solid Electrical Insulation (Withdrawn 2013)[5]

D618 Practice for Conditioning Plastics for Testing

D1082 Test Method for Dissipation Factor and Permittivity (Dielectric Constant) of Mica

D1531 Test Methods for Relative Permittivity (Dielectric Constant) and Dissipation Factor by Fluid Displacement Procedures (Withdrawn 2012)[5]

D1711 Terminology Relating to Electrical Insulation

D5032 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Glycerin Solutions

E104 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions

E197 Specification for Enclosures and Servicing Units for Tests Above and Below Room Temperature (Withdrawn 1981)[5]

3. Terminology

3.1 *Definitions:*

3.1.1 Use Terminology D1711 for definitions of terms used in these test methods and associated with electrical insulation materials.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *capacitance, C, n*—that property of a system of conductors and dielectrics which permits the storage of electrically separated charges when potential differences exist between the conductors.

3.2.1.1 *Discussion*—Capacitance is the ratio of a quantity, q, of electricity to a potential difference, V. A capacitance value is always positive. The units are farads when the charge is expressed in coulombs and the potential in volts:

$$C = q/V \tag{1}$$

3.2.2 *dissipation factor, (D), (loss tangent), (tan δ), n*—the ratio of the loss index (κ") to the relative permittivity (κ') which is equal to the tangent of its loss angle (δ) or the cotangent of its phase angle (θ) (see Fig. 1 and Fig. 2).

$$D = \kappa''/\kappa' \tag{2}$$

3.2.2.1 *Discussion—a:*

[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 D09.12 on Electrical Tests.

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[2] R. Bartnikas, Chapter 2, "Alternating-Current Loss and Permittivity Measurements," Engineering Dielectrics, Vol. IIB, Electrical Properties of Solid Insulating Materials, Measurement Techniques, R. Bartnikas, Editor, STP 926, ASTM, Philadelphia, 1987.

[3] R. Bartnikas, Chapter 1, "Dielectric Loss in Solids," Engineering Dielectrics, Vol IIA, Electrical Properties of Solid Insulating Materials: Molecular Structure and Electrical Behavior, R. Bartnikas and R. M. Eichorn, Editors, STP 783, ASTM Philadelphia, 1983.

[4] 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.

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

***A Summary of Changes section appears at the end of this standard**

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