



Standard Test Method for Relative Resistance to Vented Water-Tree Growth in Solid Dielectric Insulating Materials¹

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1. Scope

1.1 This test method covers the relative resistance to vented water-tree growth in solid translucent thermoplastic or cross-linked electrical insulating materials. This test method is especially applicable to extruded polymeric insulation materials used in medium-voltage cables.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 limitation prior to use.* For specific hazard statements see 8.1.

1.4 There is no similar or equivalent IEC standard.

2. Referenced Documents

2.1 ASTM Standards:²

D1711 Terminology Relating to Electrical Insulation

D1898 Practice for Sampling of Plastics (Withdrawn 1998)³

D1928 Practice for Preparation of Compression-Molded Polyethylene Test Sheets and Test Specimens (Withdrawn 2001)³

D2275 Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface

D3756 Test Method for Evaluation of Resistance to Electrical Breakdown by Treeing in Solid Dielectric Materials Using Diverging Fields

¹ This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.12 on Electrical Tests.

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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.

³ The last approved version of this historical standard is referenced on www.astm.org.

3. Terminology

3.1 Definitions:

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *water tree length (WTL), n*—the maximum length of a stained tree-like micro-channel path in millimeters, measured from the tip of the conical defect in the direction of the conical axis.

3.2.2 *resistance to water-tree growth (RWTG), n*—a dimensionless value which is L divided by the WTL.

3.2.3 *thickness of point-to-plane specimen (L), n*—the vertical distance in millimeters from the tip of the conical defect to the opposite surface of the solid dielectric material.

3.2.4 *semiconductive shield, n*—polymer/carbon black composite material used in medium voltage cables with volume resistivity between 10^4 and 10^5 ohm-cm.

4. Summary of Test Method

4.1 Ten compression-molded disk specimens, each containing a conical-shaped defect, are subjected to an applied voltage of 5 kV at 1 kHz and $23 \pm 2^\circ\text{C}$ in an aqueous conductive solution of 1.0 N sodium chloride (NaCl) for 30 days. This controlled conical defect is created by a sharp needle with an included angle of 60° and a tip radius of $3\ \mu\text{m}$. The electrical stress at the defect tip is enhanced and is estimated by the Mason's Hyperbolic point-to-plane stress enhancement equation.⁴ This enhanced electrical stress initiates the formation of a vented water-tree grown from the defect tip. Each treed specimen is stained and sliced. The water-tree length and point-to-plane specimen thickness measured under microscope are used to calculate a ratio that is defined as the resistance to water-tree growth.

⁴ The sole source of supply of the base, Dow Corning 3110RTV, the catalyst, Dow Corning RTV Catalyst S, and the sealant, Dow Corning Multipurpose Silicone Sealant 732, known to the committee at this time is Dow Corning, Inc., Midland, MI 48686. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.