



Standard Test Methods for Relative Permittivity And Dissipation Factor of Expanded Cellular Polymers Used For Electrical Insulation¹

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INTRODUCTION

Although fundamentally similar to test methods used for solid electrical insulating materials in sheet or plate form, certain modifications in the procedures and measurement techniques are necessary for the proper determination of the relative permittivities and dissipation factors of foamed or expanded cellular polymers. This is occasioned by the fact that in many, if not most, instances expanded cellular materials have surfaces that preclude the use of conventional electrodes such as metal foil attached by petrolatum and similar adhesives, or conducting silver paint applied by brushing or spraying. Furthermore, it is generally true that slabs or plates of expanded cellular materials are available only in substantially greater thicknesses than those commonly used for test specimens of solid insulation.

1. Scope

1.1 These test methods cover procedures for determining the relative permittivities and dissipation factor of flat sheets or slabs of expanded cellular polymers of both the rigid and flexible types, at frequencies from 60 Hz to 100 MHz. Provision is made for measurements on specimens up to 50 mm (2 in.) in thickness, but it is recommended that specimens greater than 25 mm (1 in.) in thickness shall be tested at frequencies up to a maximum of only about 1 MHz.

1.2 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

D 150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation

D 374 Test Methods for Thickness of Solid Electrical Insulation

D 1056 Specification for Flexible Cellular Materials
Sponge or Expanded Rubber

D 1711 Terminology Relating to Electrical Insulation

3. Terminology

3.1 For definitions of relative permittivity, dissipation factor, and loss index, refer to Test Methods D 150 or Terminology D 1711.

4. Significance and Use

4.1 Relative Permittivity:

4.1.1 Because a relatively large proportion of their volumes are composed of more or less uniformly distributed, isolated, or interconnected gas-filled cells, foamed or expanded cellular polymers always have lower relative permittivities, at a given frequency and temperature, than the solid base resins from which they are prepared.

4.1.2 The relative permittivities of expanded cellular polymers are important because they determine the increase in capacitance between conductors, or between conductors and ground, that will result when a circuit or component is encapsulated in such a material, over their corresponding values before encapsulation (when air is the surrounding medium). Likewise, the relative permittivities of an expanded cellular polymer may serve as a measure of the decrease of such capacitances caused by substitution of the expanded material for a solid encapsulating compound or resin of known relative permittivity.

4.1.3 In transmission lines, such as coaxial cable, television lead-in cables, and so forth, the reduction of relative permittivity of an expanded material from its value in the original solid state has significant usefulness in design, since the

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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.