



Standard Practice for Preparation of Insulating Paper and Board Impregnated with a Liquid Dielectric¹

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1. Scope

1.1 This practice covers the preparation of insulating paper and board impregnated with a liquid dielectric. Where this practice states only “paper,” the same procedure shall apply to board.

1.2 This practice has been found practicable for papers having nominal thickness of 0.05 mm (2 mil) and above. It has been used successfully for insulating board as thick as 6 mm (¼ in.) when care is taken to ensure the specimen geometry necessary for valid measurement of dielectric properties. Suitable geometry depends on the electrode system used. Rigid solid opposing electrodes require flat specimens that have essentially parallel surfaces.

1.3 The values stated in SI units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:

- D 117 Guide to Test Methods and Specifications for Electrical Insulating Oils of Petroleum Origin²
- D 149 Test Methods for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies³
- D 150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials³
- D 202 Test Methods for Sampling and Testing Untreated Paper Used for Electrical Insulation³
- D 257 Test Methods for D-C Resistance or Conductance of Insulating Materials³
- D 924 Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids²
- D 1711 Terminology Relating to Electrical Insulation³
- D 1816 Test Method for Dielectric Breakdown Voltage of

Insulating Oils of Petroleum Origin Using VDE Electrodes²

D 1933 Specification for Nitrogen Gas as an Electrical Insulating Material²

D 3394 Methods of Sampling and Testing Electrical Insulating Board⁴

D 3426 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials Using Impulse Waves⁴

3. Terminology

3.1 *Definitions*—Use Terminology D 1711 for definitions of terms used in this practice and associated with electrical or electronic materials.

4. Summary of Practice

4.1 The paper is heated and vacuum dried and the liquid dielectric degassed. The paper may be dried in loose form or assembled between electrodes. The liquid dielectric may be heated and degassed prior to introducing it into the chamber containing the dried paper or it may be degassed as it is introduced into the evacuated chamber containing the dried paper. A sufficient length of time is allowed for the impregnating process depending on the apparent density of the paper and method of impregnation. The impregnated specimens are subsequently tested for various selected electrical properties.

5. Significance and Use

5.1 *Dissipation Factor and Relative Permittivity*—Knowledge of these properties is important in the design of electrical equipment such as cables, transformers, insulators, etc. The numerical product of these two properties of a dielectric system is proportional to the energy loss converted to heat, and is called its loss index (see Terminology D 1711). The energy loss reduces the efficiency of electrical equipment. The heat produced tends to chemically degrade the dielectric material and may even lead to thermal runaway. Test results of impregnated specimens can disclose significant differences between combinations of papers and oils that appear similar when the papers and the oils are tested separately. Dissipation factor, particularly at elevated temperatures, is often changed

¹ This practice is under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.19 on Dielectric Sheet and Roll Products.

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² *Annual Book of ASTM Standards*, Vol 10.03.

³ *Annual Book of ASTM Standards*, Vol 10.01.

⁴ *Annual Book of ASTM Standards*, Vol 10.02.