



Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes¹

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This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This test method covers a referee and a routine procedure for determining the dielectric breakdown voltage of insulating liquids. These procedures are applicable to liquid petroleum oils, hydrocarbons, and askarels commonly used as insulating and cooling mediums in cables, transformers, oil circuit breakers, and similar apparatus. The referee procedure, with modifications, is suitable for testing silicone fluids (see Test Methods D 2225). The referee procedure is also suitable for testing alkylbenzenes. The suitability of either the referee or the routine procedure for testing liquids having viscosities exceeding 900 cSt (mm²/s) (5000 SUS) at 40°C (104°F) has not been determined.

1.2 This test method is recommended for acceptance tests on unprocessed insulating liquids received from vendors in tank cars, tank trucks, and drums. It may also be used for the routine testing of liquids from power systems apparatus rated 230 kV and below.

1.3 This test method is not recommended for testing filtered, degassed, and dehydrated oil prior to and during the filling of power systems apparatus rated above 230 kV, or for testing samples of such oil from apparatus after filling. Test Method D 1816 is more suitable for, and is recommended for, testing such oils.

1.4 Both the SI and inch-pound units are equally acceptable.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns 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 484 Specification for Hydrocarbon Drycleaning Solvents²
- D 923 Test Method for Sampling Electrical Insulating Liquids³
- D 1816 Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VDE Electrodes³
- D 2225 Test Methods of Testing Silicone Fluids Used for Electrical Insulation³
- 2.2 *Institute of Electrical and Electronics Engineers Standard:*
 - No. 4 Measurement of Voltage in Dielectric Test⁴

3. Significance and Use

3.1 The dielectric breakdown voltage of an insulating liquid is of importance as a measure of the liquid's ability to withstand electric stress without failure. It serves to indicate the presence of contaminating agents, such as water, dirt, moist cellulosic fibers, or conducting particles in the liquid, one or more of which may be present in significant concentrations when low dielectric breakdown values are found by test. However, a high dielectric breakdown voltage does not indicate the absence of all contaminants; it may merely indicate that the concentrations of contaminants that are present in the liquid between the electrodes are not large enough to deleteriously affect the average breakdown voltage of the liquid when tested by this method. See Appendix X1.

4. Apparatus

4.1 *Transformer*—The desired test voltage may be most readily obtained by a step-up transformer energized from a variable low-voltage commercial power frequency source. The transformer and controlling element shall be of such size and design that, with the test specimen in the circuit, the crest factor (ratio of maximum to mean effective) of the 60-Hz test voltage shall not differ by more than $\pm 5\%$ from that of a sinusoidal wave over the upper half of the range of test voltage. The crest factor may be checked by means of an oscilloscope, a

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² Discontinued; see 1984 Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 10.03.

⁴ Available from The Institute of Electrical and Electronics Engineers, Inc., 345 E. 47th St, New York, NY 10017.