



Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Under Impulse Conditions¹

This standard is issued under the fixed designation D3300; 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.

1. Scope

1.1 This test method covers the determination of the dielectric breakdown voltage of insulating oils in a highly divergent field under impulse conditions.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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 limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D923 Practices for Sampling Electrical Insulating Liquids
D2864 Terminology Relating to Electrical Insulating Liquids and Gases

2.2 *IEEE Documents:*

IEEE Standard 4-1995 Techniques for High-Voltage Testing³

3. Significance and Use

3.1 This test method is most commonly performed using a negative polarity point opposing a grounded sphere (NPS). The NPS breakdown voltage of fresh unused oils measured in the highly divergent field in this configuration depends on oil composition, decreasing with increasing concentration of aromatic, particularly polyaromatic, hydrocarbon molecules.

¹ This test method is under the jurisdiction of ASTM Committee D27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.05 on Electrical Test.

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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 Available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08855-1331.

3.2 This test method may be used to evaluate the continuity of composition of an oil from shipment to shipment. The NPS impulse breakdown voltage of an oil can also be substantially lowered by contact with materials of construction, by service aging, and by other impurities. Test results lower than those expected for a given fresh oil may also indicate use or contamination of that oil.

3.3 Although polarity of the voltage wave has little or no effect on the breakdown strength of an oil in uniform fields, polarity does have a marked effect on the breakdown voltage of an oil in nonuniform electric fields.

3.4 Transient voltages may also vary over a wide range in both the time to reach crest value and the time to decay to half crest or to zero magnitude. The IEEE standard lightning impulse test (see 2.2) specifies a 1.2 by 50- μ s negative polarity wave.

4. Apparatus

4.1 *Impulse Generator*, capable of producing a standard 1.2 by 50- μ s full wave adjustable to positive or negative polarity. The generator shall have a nominal voltage rating of at least 300 kV adjustable in 10-kV steps. Generators having a capability of 1000 W·s (1000 J) at 300 kV have been found satisfactory.

4.2 *Voltage-Control Equipment*—The controls shall include a suitable measuring device for predetermining the crest voltage to within $\pm 5\%$. A voltage stabilizer is desirable at the input to the d-c power supply used for charging the impulse-generator capacitors.

4.3 *Electrodes:*

4.3.1 The electrodes shall consist of a polished steel or brass sphere of 0.5 in. (12.7 mm) diameter and a steel point. The point may be an ordinary steel phonograph needle with a 0.06 mm $\pm 20\%$ radius of curvature of point.⁴ Needles with drawn tips are *not* recommended.

⁴ The following steel needle has been found satisfactory for this method: Type L Nickel Plated Steel Phonograph Needle.

The sole source of supply of the apparatus known to the committee at this time is Victrola Repair Service, 206 Cliff St., St. Johnsbury, VT, 05819. 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,¹ which you may attend.