



Designation: D8180 – 23

Standard Specification for Rerefined Mineral Insulating Liquid Used in Electrical Apparatus¹

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1. Scope

1.1 This specification covers rerefined previously used mineral insulating liquid of petroleum origin for reuse as an insulating and cooling medium in new and existing power and distribution electrical apparatus, such as transformers, regulators, reactors, liquid filled circuit breakers, switchgear, and attendant equipment.

1.2 This specification is intended to define a rerefined mineral insulating liquid that is functionally interchangeable and miscible with existing mineral insulating liquids, is compatible with existing apparatus, and with appropriate field maintenance² will satisfactorily maintain its functional characteristics in its application in electrical equipment. This specification applies only to rerefined mineral insulating liquid as received prior to any processing. Liquids that undergo treatment in-situ are not covered by this specification.

1.3 Formulated rerefined mineral insulating liquids may contain additives such as inhibitors, passivators, pour point depressants, flow modifiers, gassing tendency modifiers, and other compounds. This specification will address some of these but not all. It is the responsibility of the supplier to disclose information concerning the presence of all known additives and their concentration to the user.

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

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standard-*

ization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:³

- D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester
- D97 Test Method for Pour Point of Petroleum Products
- D117 Guide for Sampling, Test Methods, and Specifications for Electrical Insulating Liquids
- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D611 Test Methods for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents
- D923 Practices for Sampling Electrical Insulating Liquids
- D924 Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids
- D971 Test Method for Interfacial Tension of Insulating Liquids Against Water by the Ring Method
- D974 Test Method for Acid and Base Number by Color-Indicator Titration
- D1275 Test Method for Corrosive Sulfur in Electrical Insulating Liquids
- D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D1500 Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)
- D1524 Test Method for Visual Examination of Used Electrical Insulating Liquids in the Field
- D1533 Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration
- D1816 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes

¹ This specification is under the jurisdiction of ASTM Committee D27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.01 on Mineral.

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² Refer to the Institute of Electrical and Electronic Engineers, Inc. (IEEE) C 57.106. Guide for Acceptance and Maintenance of Insulating Mineral Oil in Equipment. Available from IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 0888 – 4141, USA Phone: +1 732 981 0600.

³ 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.

- D1903** Practice for Determining the Coefficient of Thermal Expansion of Electrical Insulating Liquids of Petroleum Origin, and Askarels
- D2112** Test Method for Oxidation Stability of Inhibited Mineral Insulating Oil by Pressure Vessel
- D2300** Test Method for Gassing of Electrical Insulating Liquids Under Electrical Stress and Ionization (Modified Pirelli Method)
- D2440** Test Method for Oxidation Stability of Mineral Insulating Oil
- D2668** Test Method for 2,6-di-tert-Butyl- *p*-Cresol and 2,6-di-tert-Butyl Phenol in Electrical Insulating Oil by Infra-red Absorption
- D2717** Test Method for Thermal Conductivity of Liquids (Withdrawn 2018)⁴
- D2766** Test Method for Specific Heat of Liquids and Solids (Withdrawn 2018)⁴
- D2864** Terminology Relating to Electrical Insulating Liquids and Gases
- D3300** Test Method for Dielectric Breakdown Voltage of Insulating Liquids Under Impulse Conditions
- D4052** Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4059** Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
- D4768** Test Method for Analysis of 2,6-Ditertiary-Butyl Para-Cresol and 2,6-Ditertiary-Butyl Phenol in Insulating Liquids by Gas Chromatography
- D5837** Test Method for Furanic Compounds in Electrical Insulating Liquids by High-Performance Liquid Chromatography (HPLC)
- D5949** Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)
- D5950** Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)
- D6892** Test Method for Pour Point of Petroleum Products (Robotic Tilt Method)
- D7042** Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

2.2 IEC Standards:⁵

IEC 60666 Detection and Determination of Specific Additives in Mineral Insulating Oils

2.3 Energy Institute Standards:⁶

IP 346 Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fraction – Dimethyl sulfoxide extraction refractive index method

3. Terminology

3.1 Definitions:

3.1.1 *additives, n*—chemical compounds added to an insulating liquid for the purpose of imparting new properties or altering properties which the liquid already has.

3.1.1.1 *Discussion*—Further information on additives can be found in IEC 60666.

3.1.2 *properties, n*—those characteristics of mineral insulating liquid which are required for the design, manufacture, and operation of the apparatus.

3.1.2.1 *Discussion*—These properties are listed in Section 5.

3.1.3 *reclaimed mineral insulating liquid, n*—reference Terminology **D2864** for more information.

3.1.4 *reconditioned mineral insulating liquid, n*—reference Terminology **D2864** for more information.

3.1.5 *rerefined mineral insulating liquid, n*—reference Terminology **D2864** for more information.

3.1.6 *Type I rerefined mineral liquid, n*—liquid for apparatus where normal oxidation resistance is required; some liquids may require the addition of a suitable oxidation inhibitor to achieve this.

3.1.7 *Type II rerefined mineral liquid, n*—liquid for apparatus where greater oxidation resistance is required; this is usually achieved with the addition of a suitable oxidation inhibitor.

3.1.7.1 *Discussion*—During processing of inhibited mineral insulating liquid under vacuum and elevated temperatures, partial loss of inhibitor and volatile portions of mineral liquid may occur. The common inhibitors, 2,6-ditertiary-butyl para-cresol (DBPC/BHT) and 2,6-ditertiary-butyl phenol (DBP), are more volatile than transformer liquid. If processing conditions are too severe, oxidation stability of the liquid may be decreased due to loss of inhibitor. The selectivity for removal of moisture and air in preference to loss of inhibitor and liquid is improved by use of a low processing temperature.

3.1.7.2 *Discussion*—Conditions that have been found satisfactory for most inhibited mineral insulating liquid processing are:

Temperature, °C	Minimum Pressure	
	Pa	Torr, Approximate
40	5	0.04
50	10	0.075
60	20	0.15
70	40	0.3
80	100	0.75
90	400	3.0
100	1000	7.5

3.1.7.3 *Discussion*—If temperatures higher than those recommended for the operating pressure are used, the liquid should be tested for inhibitor content and inhibitor added as necessary to return inhibitor content to its initial value. Attempts to dry apparatus containing appreciable amounts of free water may result in a significant loss of inhibitor even at the conditions recommended above.

3.1.8 Other definitions of terms related to this specification are given in Terminology **D2864**.

3.1.9 More information on tests related to this specification can be found in Guide **D117**.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from International Electrotechnical Commission (IEC), 3, rue de Varembe, 1st floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland, <https://www.iec.ch>.

⁶ Available from Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K., <http://www.energyinst.org>.