



Designation: D117 – 18

# Standard Guide for Sampling, Test Methods, and Specifications for Electrical Insulating Liquids<sup>1</sup>

This standard is issued under the fixed designation D117; 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 guide describes methods of testing and specifications for electrical insulating liquids intended for use in electrical cables, transformers, liquid circuit breakers, and other electrical apparatus where the liquids are used as insulating, or heat transfer media, or both.

1.2 The purpose of this guide is to outline the applicability of the available test methods. Where more than one is available for measuring a given property, their relative advantages are described, along with an indication of laboratory convenience, precision, (95 % confidence limits), and applicability to specific types of electrical insulating oils.

1.3 This guide is classified into the following categories: Sampling Practices, Physical Tests, Electrical Tests, Chemical Tests, and Specifications. Within each test category, the test methods are listed alphabetically by property measured. A list of standards follows:

| Category                                         | Section | ASTM Standard                    |
|--------------------------------------------------|---------|----------------------------------|
| <i>Sampling:</i>                                 | 3       | D923                             |
| <i>Physical Tests:</i>                           |         |                                  |
| Aniline Point                                    | 4       | D611                             |
| Coefficient of Thermal Expansion                 | 5       | D1903                            |
| Color                                            | 6       | D1500                            |
| Examination: Visual Infrared                     | 7       | D1524, D2144, D2129              |
| Flash and Fire Point                             | 8       | D92                              |
| Interfacial Tension                              | 9       | D971, D2285                      |
| Pour Point of Petroleum Products                 | 10      | D97, D5949, D5950                |
| Particle Count in Mineral Insulating Oil         | 11      | D6786                            |
| Refractive Index and Specific Optical Dispersion | 12      | D1218, D1807                     |
| Relative Density (Specific Gravity)              | 13      | D287, D1217, D1298, D1481, D4052 |
| Specific Heat                                    | 14      | D2766                            |
| Thermal Conductivity                             | 15      | D2717                            |
| Turbidity                                        | 16      | D6181                            |
| Viscosity                                        | 17      | D445, D2161                      |
| <i>Electrical Tests:</i>                         |         |                                  |
| Dielectric Breakdown Voltage                     | 18      | D877, D1816, D3300               |

| Category                                                           | Section | ASTM Standard       |
|--------------------------------------------------------------------|---------|---------------------|
| Dissipation Factor and Relative Permittivity (Dielectric Constant) | 19      | D924                |
| Gassing Characteristic Under Thermal Stress                        | 20      | D7150               |
| Gassing Tendency                                                   | 21      | D2300               |
| Resistivity                                                        | 22      | D1169               |
| Stability Under Electrical Discharge                               | 23      | D6180               |
| <i>Chemical Tests:</i>                                             |         |                     |
| Acidity, Approximate                                               | 24      | D1534               |
| Carbon-Type Composition                                            | 25      | D2140               |
| Compatibility with Construction Material                           | 26      | D3455               |
| Copper Content                                                     | 27      | D3635               |
| Elements by Inductively Coupled Plasma (ICP-AES)                   | 28      | D7151               |
| Furanic Compounds in Electrical Insulating Liquids                 | 29      | D5837               |
| Dissolved Gas Analysis                                             | 30      | D3612               |
| Gas Content of Cable and Capacitor Oils                            | 31      | D831, D1827, D2945  |
| Inorganic Chlorides and Sulfates                                   | 32      | D878                |
| Neutralization (Acid and Base) Numbers                             | 33      | D664, D974          |
| Oxidation Inhibitor Content                                        | 34      | D2668, D4768        |
| Oxidation Stability                                                | 35      | D1934, D2112, D2440 |
| Polychlorinated Biphenyl Content (PCB)                             | 36      | D4059               |
| Relative Content of Dissolved Decay                                | 37      | D6802               |
| Sediment and Soluble Sludge                                        | 38      | D1698               |
| Sulfur, Corrosive                                                  | 39      | D1275               |
| Water Content                                                      | 40      | D1533               |
| <i>Specification:</i>                                              |         |                     |
| Mineral Insulating Oil for Electrical Apparatus                    | 41      | D3487               |
| High Firepoint Electrical Insulating Oils                          | 42      | D5222               |
| Silicone Fluid used for Electrical Insulation                      | 43      | D4652               |
| Natural (Vegetable Oil) Ester Fluids used in Electrical Apparatus  | 44      | D6871               |

1.4 The values stated in SI units are to be regarded as standard. The values stated in parentheses are provided for information only.

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.*

<sup>1</sup> This guide 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.

Current edition approved Nov. 1, 2018. Published December 2018. Originally published as D117 – 21 T. Last previous edition approved in 2010 as D117 – 10. DOI: 10.1520/D0117-18.