



# Standard Specification for Silicone Fluid Used for Electrical Insulation<sup>1</sup>

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## 1. Scope

1.1 This specification covers silicone fluid for use in transformers, capacitors, and electronic assemblies as an insulating or cooling medium, or both.

1.2 Silicone fluid covered by this specification is polydimethylsiloxane having a nominal viscosity of 50 cSt at 25°C and a fire point of 340°C or greater. This specification applies only to new silicone fluid. Information on in-service maintenance testing is available in appropriate guides.<sup>2</sup>

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 92 Test Method for Flash and Fire Points by Cleveland Open Cup<sup>3</sup>
- D 97 Test Method for Pour Point of Petroleum Products<sup>3</sup>
- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)<sup>3</sup>
- D 664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration<sup>3</sup>
- D 877 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes<sup>4</sup>
- D 923 Test Method for Sampling Electrical Insulating Liquids<sup>4</sup>
- D 924 Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids<sup>4</sup>
- D 974 Test Method for Acid and Base Number by Color-Indicator Titration<sup>3</sup>
- D 1169 Test Method for Specific Resistance (Resistivity) of Electrical Insulating Liquids<sup>4</sup>
- D 1298 Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method<sup>3</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.02 on Synthetics.

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<sup>2</sup> IEEE C57.111, IEEE Guide for Acceptance of Silicone Insulating Fluid and its Maintenance in Transformers is published by the Insulating Fluids Subcommittee of the IEEE Power Engineering Society Transformers Committee.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 10.03.

- D 1481 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Lipkin Bicapillary Pycnometer<sup>3</sup>
- D 1533 Test Methods for Water in Insulating Liquids (Karl Fischer Reaction Method)<sup>4</sup>
- D 1807 Test Methods for Refractive Index and Specific Optical Dispersion of Electrical Insulating Liquids<sup>4</sup>
- D 2129 Test Method for Color of Water White Electrical Insulating Liquids<sup>4</sup>
- D 2161 Practice for Conversion of Kinematic Viscosity to Saybolt Universal Viscosity or to Saybolt Furol Viscosity<sup>5</sup>
- D 2225 Methods of Testing Silicone Fluids Used for Electrical Insulation<sup>4</sup>
- D 2864 Terminology Relating to Electrical Insulating Liquids and Gases<sup>4</sup>
- D 4052 Test Method for Density and Relative Density of Liquids by Digital Density Meter<sup>6</sup>
- D 4059 Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography<sup>4</sup>
- D 4559 Test Method for Volatile Matter in Silicone Fluid<sup>4</sup>

## 3. Terminology

3.1 Definitions and descriptions of terms specific to this specification are given in Methods D 2225 and Terminology D 2864.

## 4. Sampling and Testing

- 4.1 Take all samples in accordance with Methods D 923.
- 4.2 Test in accordance with the methods specified in Table 1.

NOTE 1—Because of the different needs of the various users, items relating to packaging, labeling, and quality assurance are subject to buyer-seller agreement.

NOTE 2—In addition to all other tests listed herein, it is sound engineering practice for the apparatus manufacturer to perform a functional evaluation of silicone fluid in insulation systems, prototype structures, or full-scale apparatus, or any combination thereof, to assure suitable service life.

## 5. Detail Requirements

- 5.1 The silicone fluid, as received, shall conform to the

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 05.02.

**TABLE 1 Detail Requirements for Silicone Fluid**

Property	Limit	ASTM Test Method
<i>Physical:</i>		
Color, max	15	D 2129
Flash point, °C, min	300	D 92
Fire point, °C, min	340	D 92
Pour point, °C, max	-50	D 97
Refractive index, 25°C	1.4010 to 1.4040	D 1807
Viscosity, cSt, at:		D 445, D2161
0°C	81 to 92	
25°C	47.5 to 52.5	
40°C	35 to 39	
100°C	15 to 17	
Specific gravity, 25/25°C	0.957 to 0.964	D 1298, D1481, D4052
Volatile matter, weight, max%	0.5	D 4559
<i>Electrical Properties:</i>		
Dielectric breakdown voltage at 60 Hz, kV, min	35	D 877 <sup>A</sup>
Dissipation factor <sup>B</sup> at 60 Hz, 25°C, %, max	0.01	D 924
Volume resistivity at 25°C, Ω·cm, min	$1 \times 10^{14}$	D 1169
<i>Chemical:</i>		
Neutralization number, mg KOH/g, max	0.01	D 664, D974
Water content, ppm, max	50	D 1533 <sup>C</sup>
PCB content, ppm	not detectable	D 4059

<sup>A</sup> This test method must be modified as described in Methods D 2225.

<sup>B</sup> Dissipation factor and power factor are numerically equal up to 0.5 %.

<sup>C</sup> With modifications as indicated for silicone fluid.

requirements of Table 1. The significance of these properties is covered in Methods D 2225.

## 6. Keywords

### 6.1 electrical insulating liquid; silicone fluid

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