



Designation: D 2285 – 99

## Standard Test Method for Interfacial Tension of Electrical Insulating Oils of Petroleum Origin Against Water by the Drop-Weight Method<sup>1</sup>

This standard is issued under the fixed designation D 2285; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers a comparatively rapid procedure particularly applicable for field use for measuring, under nonequilibrium conditions, the interfacial tensions of electrical insulating oils of petroleum origin against water. This test method has been shown by experience to give a reliable indication of the presence of hydrophilic compounds. This test method may not be applicable for highly viscous insulating fluids.

1.2 *This standard does not purport to address 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:

D 971 Test Method for Interfacial Tension of Oil Against Water by the Ring Method<sup>2</sup>

D 1298 Practice for Density (Specific Gravity) or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method<sup>3</sup>

### 3. Summary of Test Method

3.1 Interfacial tension is determined by measuring the volume of a drop of water formed in oil. A larger water drop means a higher interfacial tension. The instrument is calibrated to read approximately in millinewtons per metre (dynes per centimetre). The measurement is completed within 1 min after the formation of the water drop in oil.

### 4. Significance and Use

4.1 This test method indicates the presence of hydrophilic compounds. These compounds can be an indicator of contaminants in new oil and in used oil, oxidation or deterioration of the oil or materials of construction in contact with the oil.

### 5. Apparatus

5.1 *Tensiometer*<sup>4</sup> that provides a simple way of injecting a measured quantity of water into oil. The scale attached to the piston forcing the water into the oil is graduated in millinewtons per metre (dynes per centimetre).

5.2 *Test Specimen Container*—Glass beaker or transparent cylindrical vessel having a minimum diameter of 1 in. (25.4 mm).

5.3 *Needle*, supplied with the tensiometer having a blunt end with a 90° angle. Follow manufacturer's guidelines for selection.

### 6. Preparation of Apparatus

6.1 Wipe the needle free of oil with clean lint free paper, avoiding any upward motion that may embed a bit of fiber on the sharp needle. Do not use an oil solvent on the needle or barrel.

6.2 Force distilled water through the barrel and needle to clean the inside. Only when contamination is suspected should detergents or solvents be used for cleaning, followed by a thorough rinsing with distilled water. Detergents will lower interfacial tension results

6.3 Clean the test specimen container by removing any residual oil with petroleum naphtha (see Note 1) or other suitable hydrocarbon solvents followed by washing with a detergent solution. Rinse thoroughly with tap water, then distilled water.

NOTE 1—**Warning:** Petroleum naphtha is flammable and harmful if inhaled.

### 7. Calibration of Apparatus

7.1 Interfacial tension, in millinewtons per metre (dynes per centimetre), is determined by the following equation:

$$\text{Interfacial tension, m N/m} = R_1(D - d)(S/R_2)$$

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.07 on Physical Test.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 10.03.

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

<sup>4</sup> Use a tensiometer that employs the drop weight principle for measuring interfacial tension. The sole source of supply of the apparatus known to the committee at this time is a tensiometer available from Gerin Corp., 1109 7th Avenue, Neptune, NJ 00753. If you are aware of alternative suppliers, please provide this information to ASTM headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.