Designation: D 2945 – 90 (Reapproved 2003)

Standard Test Method for Gas Content of Insulating Oils[1]

This standard is issued under the fixed designation D 2945; 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 gas content of electrical insulating oils of low and medium viscosities in the general range of 100 SUS and below at 100°F (37.8°C), and is suitable for field or laboratory use.

NOTE 1—For testing insulating oils with viscosities above 100 SUS, see Test Method D 831. For individual gas concentrations, see Method D 3612.

1.2 *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]

D 831 Test Method for Gas Content of Cable and Capacitor Oils

D 3612 Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography

D 3613 Practice for Sampling Insulating Liquids for Gas Analysis and Determination of Water Content

3. Summary of Test Method

3.1 This test method consists essentially of allowing oil to flow into an evacuated chamber as a thin film so that the oil is thoroughly exposed to the vacuum, allowing free volatilization of the gaseous component. The system is brought back to atmospheric pressure, and the evolved gases measured. From the volume of oil degassed in the chamber and the volume of released gas, the percent gas content may be estimated. The apparatus used produces the necessary vacuum without resorting to use of a vacuum pump. This test method partially degases the oil. The degree of degasification varies with the solubility of each gas in the oil.

4. Significance and Use

4.1 In filling electrical apparatus, it is desirable to use low gas content transformer oil in order to prevent foaming and to avoid air pockets that might result in gaseous ionization. This procedure provides a simple method to measure the gas content of the oil, and may be used as a factory-control test and as a control or functional test in installation and maintenance work by utilities.

5. Apparatus

5.1 *Dissolved Gas Content Analyser*—Fig. 1 shows the assembled instrument, not drawn to scale, to permit magnification of small details. A borosilicate glass gas buret, 100-mL capacity, graduated in ⅕-mL divisions, serves as a vacuum chamber. A three-way stopcock, 120° bore with TFE-fluorocarbon plug, 3 stem, 2-mm bore is fused to the buret or joined by a vinyl sleeve so that the joint is vacuum tight.

5.1.1 *Rubber Vacuum Tubing*—About 1200 mm of 8-mm rubber vacuum tubing is securely fastened with a 20-mm Hoffman pinch clamp to the lower tip of the buret, while the other end is secured to a 250-mL capacity leveling bulb.

5.1.2 *Stubs 20 Gage Needle*—A short section, about 40 mm long, is cut and cemented to the three-way stopcock, Fig. 2. This serves to accommodate the vinyl tubing attached to the syringe. All the glassware should be clamped to a suitable 1500 by 700 by 20-mm mounting board with rubber-covered wall-type clamps.

5.1.3 *Metal Rod*, 12 mm, 1500 mm long, fitted with an adjustable leveling bulb support is fastened to the wooden apparatus mounting board as in 5.1.2.

5.2 *Syringe Assembly* (see Fig. 3)—A 50-mL Luer syringe with 5-mL subdivisions or a 5-mL Luer syringe with ⅕-mL subdivisions is fitted with a 150-mm length of 0.8-mm inside diameter capillary vinyl tubing. An upper and lower collar of plastic or metal is attached to the syringe to support the rubber bands required to create positive pressure in the syringe. A20-mm Hoffman pinch clamp is used on the capillary tubing after sampling.

5.3 *Oil Sampler* (see Fig. 3)—A 3.2-mm tee is fitted with a syringe needle stem in one arm and a short length of 6.4-mm. Vinyl tubing is attached to the other arm. During sampling, the tee is attached to the sampling valve and the vinyl capillary tubing of the syringe assembly is attached to the needle of the tee.

[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 D27.03 on Analytical Tests.

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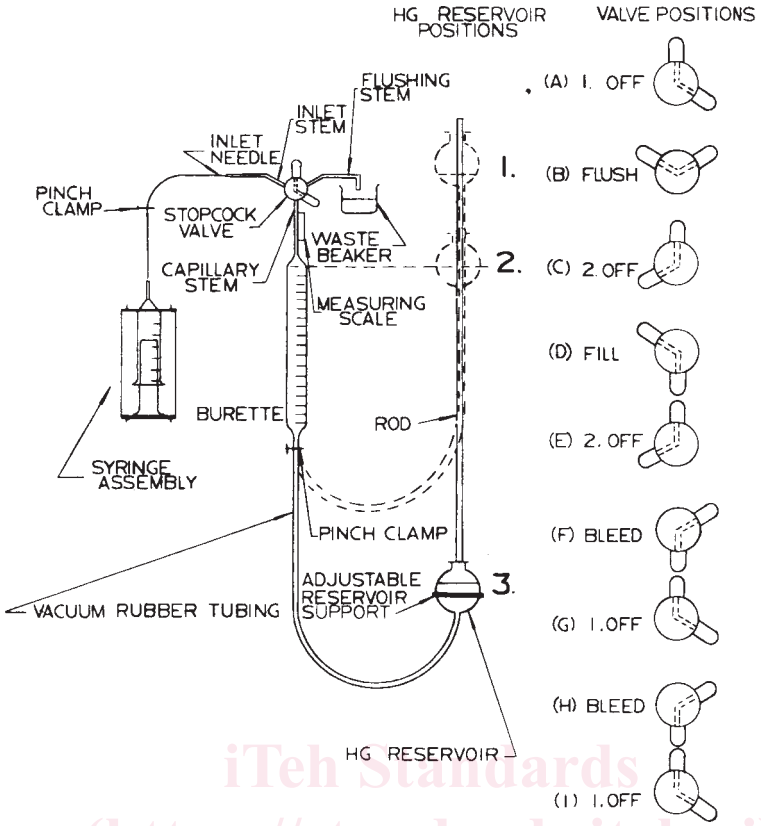
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.



1 gas buret, capacity 100 mL, graduated in ⅕-mL divisions
1 stopcock, 120° bore with TFE fluorocarbon plug, 3 stems, 2-mm bore
1 leveling bulb, capacity 250 mL
1 beaker, capacity 250 mL
1200 mm (4 ft) vacuum rubber tubing, 8-mm (3⁄16-in.) inside diameter
2 rubber tubing clamps, adjustable, cadmium-plated steel
2-pinch clamps, Hoffman swivel jaw, screw compressor, ¾ by 1 in. for vinyl tubing for 5 and 50-mL syringes
1 pinch clamp, Hoffman screw compressor for rubber tubing, ¾ by 1 in.
6 clamps, wall type with wood screw to support buret, stopcock, and rod
1 leveling bulb support, adjustable, Fisher-Castaloy-R, self-locking
1 rod, diameter 12 mm (½ in.), length 1500 mm (58 in.)
1 syringe, Luer, resistance glass, 50 mL, subdivisions 5 mL
1 syringe, Luer, resistance glass, 5 mL, subdivisions ⅕ mL
Vinyl tubing, 2.6-mm (1⁄16-in.) inside diameter, wall thickness 1.3 mm (1⁄32 in.), length 150 mm (6 in.)
4.5 kg (10 lb) mercury
1 needle, 50 mm long, Stubbs gage 20
1 wooden board 1500 by 700 by 20 mm (58 by 28 by ⅞ in.)

Components for Gas-Content Apparatus

FIG. 1 Dissolved Gas Content Analyser

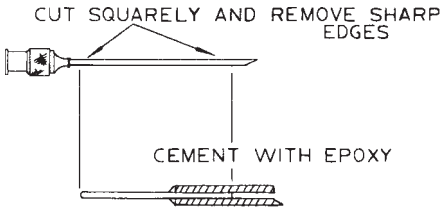


FIG. 2 Detail of Needle Inlet

5.4 *Mercury Reservoir*—A 250-mL capacity leveling bulb is filled with 4.5 kg (10 lb) of mercury.

6. Sampling

6.1 Samples should be drawn in accordance with Methods D 3613. An alternative sample container and method are given in the Sampling section of Test Method D 831.

6.2 An effective method is to take the sample directly from the pressurized line into the sampling syringe. The syringe is maintained under slight positive pressure during the taking of the sample, during sample transfer, and during the introduction of the sample into the analyzer. This can be accomplished by