



Designation: D 3612 – 01

Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography¹

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1. Scope

1.1 This test method covers three procedures for extraction and measurement of gases dissolved in electrical insulating oil having a viscosity of 20 cSt (100 SUS) or less at 40°C (104°F), and the identification and determination of the individual component gases extracted. Other methods have been used to perform this analysis.

1.2 The individual component gases that may be identified and determined include:

Hydrogen—H₂
Oxygen—O₂
Nitrogen—N₂
Carbon monoxide—CO
Carbon dioxide—CO₂
Methane—CH₄
Ethane—C₂H₆
Ethylene—C₂H₄
Acetylene—C₂H₂
Propane—C₃H₈
Propylene—C₃H₆

1.3 *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.* For specific precautionary statements see 6.1.8.

2. Referenced Documents

2.1 ASTM Standards:

- D 2140 Test Method for Carbon-Type Composition of Insulating Oils of Petroleum Origin²
- D 2300 Test Method for Gassing of Insulating Oils Under Electrical Stress and Ionization Modified Pirelli Method²
- D 2779 Test Method for Estimation of Solubility of Gases in Petroleum Liquids³
- D 2780 Test Method for Solubility of Fixed Gases in Liquids³
- D 3613 Test Methods of Sampling Electrical Insulating Oils for Gas Analysis and Determination of Water Content²

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 *Annual Book of ASTM Standards*, Vol 10.03.

³ *Annual Book of ASTM Standards*, Vol 05.02.

D 4051 Practice for Preparation of Low-Pressure Gas Blends³

E 260 Practice for Packed Column Gas Chromatography⁴

2.2 IEEE Standard:

C 57.104 Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers⁵

2.3 IEC Standard:

Publication No. 567 Guide for the Sampling of Gases and of Oil from Oil-Filled Electrical Equipment and for the Analysis of Free and Dissolved Gases⁶

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *gas content of oil by volume—in Method A*, the total volume of gases, corrected to 760 torr (101.325 kPa) and 0°C, contained in a given volume of oil, expressed as a percentage. *In Methods B and C*, the sum of the individual gas concentrations corrected to 760 torr (101.325 kPa) and 0°C, expressed in percent or parts per million.

3.1.2 *headspace*—a volume of gas phase in contact with a volume of oil in a closed vessel. The vessel is a headspace vial of 20-mL nominal capacity.

3.1.2.1 *Discussion*—Other vessel volumes may also be used, but the analytical performance may be somewhat different than that specified in Method C.

3.1.3 *parts per million (ppm) by volume of (specific gas) in oil*—the volume of that gas corrected to 760 torr (101.325 kPa) and 0°C, contained in 10⁶ volume of oil.

3.1.4 *sparging, v*—agitating the liquid sample using a gas to strip other gases free.

3.1.5 *volume concentration of (specific gas) in the gas sample*—the volume of the specific gas contained in a given volume of the gas sample at the same temperature and pressure (as the measured total volume), expressed either as a percentage or in parts per million.

4. Summary of Test Method

4.1 *Method A*—Dissolved gases are extracted from a sample of oil by introduction of the oil sample into a pre-evacuated known volume. The evolved gases are compressed to atmospheric pressure and the total volume measured.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ Available from IEEE, 345 E. 47th St., New York, NY 10017.

⁶ Available from IEC.