



Test Method for Determination of the Relative Content Of Dissolved Decay Products in Mineral Insulating Oils by Spectrophotometry¹

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1. Scope

1.1 This test method characterizes by spectrophotometry the relative level of dissolved decay products in mineral insulating oils of petroleum origin. While new oil is almost transparent to a monochromatic beam of light in the visible spectrum, the increasing concentration of dissolved decay products shift the absorbance curve to longer wavelengths.

1.2 This test method is applicable to compare the extent of dissolved decay products for oils in service. It can assess the effectiveness of used or stored oil purification during the reclamation process, as well.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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 to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D923 Practices for Sampling Electrical Insulating Liquids
D1524 Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field
D3487 Specification for Mineral Insulating Oil Used in Electrical Apparatus

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

¹ This test method is under the jurisdiction of 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.

3.1.1 *aged oil, n*—an oil that no longer complies with the standard specifications for mineral insulating oils used in electrical apparatus according to D3487.

4. Summary of Test Method

4.1 A test specimen of mineral insulating oil is placed in a 10-mm path length glass cuvette, which is installed in an UV-VIS scanning spectrophotometer. The instrument is first zeroed with spectral grade heptane. The absorbance curve of oil is then recorded from 360 to 600 nm. Integration of the area under this curve indicates the numeric value of the dissolved decay products in the oil sample. Because of the high sensitivity of spectral analysis, the deterioration of oil purity can be assessed in the early stages of the decay process.

5. Significance and Use

5.1 The content of dissolved decay products in insulating oils is made up of a variety of compounds, such as peroxides, aldehydes, ketones, and organic acids. Each of them is partially adsorbed on the large surface of paper insulation leading to the premature aging of power transformers. The relative assessment of byproduct formation, therefore, can be used as an indicator of the aging of the mineral oil.

6. Interferences

6.1 The condition of the oil specimen should be clear according to the requirement of Test Method D1524.

6.2 The oil specimen, therefore, should be filtered through 50- μ m filter paper.

7. Apparatus

7.1 *Recording UV-Visible Automated Spectrophotometer*, capable of scanning the range between 360 and 600 nm is required. The software should permit the calculation of area under the absorbance curve of the oil specimen.

8. Reagents and Materials

8.1 *Absorption Cuvettes*—To determine the absorbance curve of a mineral insulating oil, two matched glass cuvettes having a path length of 1-cm $\pm$ 0.01-cm should be used.