



Designation: D2440 – 13 (Reapproved 2021)

Standard Test Method for Oxidation Stability of Mineral Insulating Oil¹

This standard is issued under the fixed designation D2440; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method determines the resistance of mineral transformer oils to oxidation under prescribed accelerated aging conditions. Oxidation stability is measured by the propensity of oils to form sludge and acid products during oxidation. This test method is applicable to new oils, both uninhibited and inhibited, but is not well defined for used or reclaimed oils.

NOTE 1—A shorter duration oxidation test for evaluation of inhibited oils is available in Test Method [D2112](#).

NOTE 2—For those interested in the measurement of volatile acidity, reference is made to IEC Method 61125.²

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

[B1 Specification for Hard-Drawn Copper Wire](#)

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 [D27.06](#) on Chemical Test.

Current edition approved Nov. 1, 2021. Published November 2021. Originally approved in 1965 as D2440 – 65 T. Last previous edition approved in 2013 as D2440 – 13. DOI: 10.1520/D2440-13R21.

² Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D27-1001. Contact ASTM Customer Service at service@astm.org.

³ 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.

[D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration](#)

[D974 Test Method for Acid and Base Number by Color-Indicator Titration](#)

[D2112 Test Method for Oxidation Stability of Inhibited Mineral Insulating Oil by Pressure Vessel](#)

[D2272 Test Method for Oxidation Stability of Steam Turbine Oils by Rotating Pressure Vessel](#)

[D3487 Specification for Mineral Insulating Oil Used in Electrical Apparatus](#)

2.2 IEC Publication:

[IEC 61125: 1992 Unused Hydrocarbon-Based Insulating Liquids—Test Methods for Evaluating the Oxidation Stability](#)⁴

3. Summary of Test Method

3.1 A test specimen of mineral transformer oil is oxidized at a bath temperature of 110 °C, in the presence of a copper catalyst coil, by bubbling oxygen through duplicate test specimens for 72 and 164 h, respectively. The oil is evaluated at the end of each aging period by measuring the amount of sludge and acid formed. The test specimen is diluted with *n*-heptane and the solution filtered to remove the sludge. The sludge is dried and weighed. The sludge-free solution is titrated at room temperature with standard alcoholic base to the end point indicated by the color change (green-brown) of the added *p*-naphthol-benzene solution.

4. Significance and Use

4.1 The oxidation stability test of mineral transformer oils is a method for assessing the amount of sludge and acid products formed in a transformer oil when the oil is tested under prescribed conditions. Good oxidation stability is necessary in order to maximize the service life of the oil by minimizing the formation of sludge and acid. Oils that meet the requirements specified for this test in Specification [D3487](#) tend to minimize electrical conduction, ensure acceptable heat transfer, and preserve system life. There is no proven correlation between performance in this test and performance in service, since the

⁴ International Electrotechnical Commission. Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.