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Standard Guide for Measurement of Remaining Primary Antioxidant Content In In-Service Industrial Lubricating Oils by Linear Sweep Voltammetry¹

This standard is issued under the fixed designation D7590; 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.

INTRODUCTION

Under normal thermal and oxidative working conditions, which degrade the chemical composition of the oil's basestock and gradually deplete the oil's additive package, good oil condition monitoring procedures are necessary to determine and planning corrective actions before the oil properties changes have passed their warning limits. Antioxidant monitoring practices are a vital part of modern oil condition monitoring practices to achieve lubrication excellence. This guide addresses the correct guidelines for voltammetric data interpretation.

1. Scope*

1.1 This guide covers the voltammetric analysis for qualitative measurements of primary antioxidants in new or in-service type industrial lubricants detectable in concentrations as low as 0.0075 % by mass up to concentrations found in new oils by measuring the amount of current flow at a specified voltage in the produced voltammogram.

1.2 This guide can be used as a resource for a condition monitoring program to track the oxidative health of a range of industrial lubricants which contain primary antioxidants. In order to avoid excessive degradation of the base-oil, these primary antioxidants play a major role to protect the lubricants against thermal-oxidative degradation. This guide can help users with interpretation and troubleshooting results obtained using linear sweep voltammetry (LSV).

1.3 When used as part of oil condition monitoring practices, it is important to apply trend analysis to monitor the antioxidant depletion rate relative to a baseline sample rather than use voltammetry for an absolute measurement of the antioxidant concentration. The trending pattern provides a proactive means to identify the level of oil degradation or abnormal changes in the condition of the in-service lubricant.

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

1.5 *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.*

1.6 *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:*²

[D1193 Specification for Reagent Water](#)

[D4057 Practice for Manual Sampling of Petroleum and Petroleum Products](#)

[D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants](#)

[D4378 Practice for In-Service Monitoring of Mineral Turbine Oils for Steam, Gas, and Combined Cycle Turbines](#)

[D6224 Practice for In-Service Monitoring of Lubricating Oil for Auxiliary Power Plant Equipment](#)

[D6304 Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration](#)

[D6810 Test Method for Measurement of Hindered Phenolic](#)

¹ This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.09.0C on Oxidation of Turbine Oils.

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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.

*A Summary of Changes section appears at the end of this standard