Designation: D7098 – 08 (Reapproved 2015)

Standard Test Method for Oxidation Stability of Lubricants by Thin-Film Oxygen Uptake (TFOUT) Catalyst B[1,2]

This standard is issued under the fixed designation D7098; 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 oxidation stability of lubricants by thin-film oxygen uptake (TFOUT) Catalyst B. This test method evaluates the oxidation stability of petroleum products, and it was originally developed as a screening test to indicate whether a given re-refined base stock could be formulated for use as automotive engine oil[3] (see Test Method D4742). The test is run at 160 °C in a pressure vessel under oxygen pressure, and the sample contains a metal catalyst package, a fuel catalyst, and water to partially simulate oil conditions in an operating engine. In addition, the test method has since been found broadly useful as an oxidation test of petroleum products.[4]

1.2 The applicable range of the induction time is from a few minutes up to several hundred minutes or more. However, the range of induction times used for developing the precision statements in this test method was from 40 min to 280 min.

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

1.3.1 *Exception*—Pressure units are provided in psig, and dimensions are provided in inches in Annex A1 and Annex A2, because these are the industry accepted standard and the apparatus is built according to the figures shown.

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 determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[5]

A314 Specification for Stainless Steel Billets and Bars for Forging

B211 Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D1193 Specification for Reagent Water

D2272 Test Method for Oxidation Stability of Steam Turbine Oils by Rotating Pressure Vessel

D4742 Test Method for Oxidation Stability of Gasoline Automotive Engine Oils by Thin-Film Oxygen Uptake (TFOUT)

E1 Specification for ASTM Liquid-in-Glass Thermometers

E144 Practice for Safe Use of Oxygen Combustion Vessels

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *break point*—the precise point of time at which rapid oxidation of the oil begins.

3.1.2 *oxidation induction time*—the time until the oil begins to oxidize at a relatively rapid rate as indicated by the decrease of oxygen pressure.

3.1.3 *oxygen uptake*—oxygen absorbed by oil as a result of oil oxidation.

4. Summary of Test Method

4.1 The test oil is mixed in a glass container with four other liquids used to simulate engine conditions: (*1*) an oxidized/nitrated fuel component (Annex A3), (*2*) a mixture of soluble

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.09.0G on Oxidation Testing of Engine Oils.

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[2] While Catalyst B can be used for testing oxidation stability of many lubricant types, the mixture of fuel, nitro-paraffin, and catalyst components used in this test method simulates the Sequence IIIE Engine Test. Test results on several ASTM reference oils have been found to correlate with Sequence IIIE engine tests in hours for a 375 % viscosity increase. (See Ku, Chia-Soon, Pei, Patrick T., and Hsu, Stephen M., "A Modified Thin-Film Oxygen Uptake Test (TFOUT) for the Evaluation of Lubricant Stability in ASTM Sequence IIIE Test, SAE Technical Paper Series 902121, Tulsa, OK, Oct. 22-25, 1990.)

[3] Ku, C. S. and Hsu, S. M., "A Thin Film Uptake Test for the Evaluation of Automotive Lubricants," *Lubrication Engineering*, 40, 2, 1984, pp. 75–83.

[4] Selby, Theodore W., "Oxidation Studies with a Modified Thin-Film Oxygen Uptake Test", *SAE Technical Paper Series* 872127, Toronto, Ontario, Nov. 2-5, 1987.

[5] 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.

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