



Designation: D 6514 – 02

An American National Standard

Standard Test Method for High Temperature Universal Oxidation Test for Turbine Oils¹

This standard is issued under the fixed designation D 6514; 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 a procedure for evaluating the oxidation of inhibited lubricants in the presence of air, copper, and iron metals.

1.2 This test method was developed and is used to evaluate the high temperature oxidation stability and deposit forming tendency of oils for steam and gas turbines. It has been used for testing other lubricants made with mineral oil and synthetic basestocks for compressors, hydraulic pumps, and other applications, but these have not been used in cooperative testing.

1.3 The values stated in SI units are to be regarded as 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 determine the applicability of regulatory limitations prior to use.* Identified hazardous chemicals are listed in Sections 7.3, 7.4 and 7.5. Before using this standard, refer to suppliers' safety labels, Material Safety Data Sheets and other technical literature.

2. Referenced Documents

2.1 ASTM Standards:

- A 510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel²
- B 1 Specification for Hard-Drawn Copper Wire³
- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids⁴
- D 664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration⁴
- D 943 Test Method for Oxidation Characteristics of Inhibited Mineral Oils⁴
- D 974 Test Method for Acid and Base Number by Color-Indicator Titration⁴

D 3339 Test Method for Acid Number of Petroleum Products by Semi-Micro Color Indicator Titration⁵

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products⁵

D 4871 Guide for Universal Oxidation/Thermal Stability Test Apparatus⁵

D 5846 Test Method for Universal Oxidation Test for Hydraulic and Turbine Oils Using the Universal Oxidation Test Apparatus⁶

2.2 British Standards:⁷

BS 1829 Specification for Carbon Steel, alternate to Specification A 510

2.3 Institute of Petroleum Standard:⁸

IP 2546 Practice for Sampling of Petroleum Products; Alternate to Practice D 4057

2.4 ASTM Adjunct⁹

ASTM Oxidation Cell Varnish Standard⁹

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *Universal Oxidation Test*—the apparatus and procedures described in Guide D 4871.

4. Summary of Test Method

4.1 An oil sample is exposed to air at elevated temperatures in the presence of copper and iron metals. The test is run for 96 h at 155°C after which the viscosity increase, acid number increase, and sludge generated are measured. The test cell is also washed, dried, and compared with the ASTM Oxidation Cell Varnish Standard.

5. Significance and Use

5.1 Degradation of fluid lubricants because of oxidation or thermal breakdown can result in fluid thickening or in the

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² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 02.03.

⁴ Annual Book of ASTM Standards, Vol 05.01.

⁵ Annual Book of ASTM Standards, Vol 05.02.

⁶ Annual Book of ASTM Standards, Vol 05.03.

⁷ Available from British Standards Institute, 389 Chiswick High Rd., London, W4 4AL, U.K.

⁸ Available from Institute of Petroleum, 61 New Cavendish St., London, W1G 7AR, U.K.

⁹ Available from ASTM International Headquarters. Request ADJD6514. Names of suppliers in the United Kingdom can be obtained from the Institute of Petroleum. Two master standards are held by the IP for reference.

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formation of acids or insoluble solids and render the fluid unfit for further use as a lubricant.

5.2 This test method can be used for estimating the oxidation stability of oils. It can function as a formulation screening tool, specification requirement, quality control measurements, or as a means of estimating remaining service life. These last three functions of the test method are expected to be fulfilled once a precision statement has been devised for the procedure. It should be recognized, however, that correlation between results of this test method and the oxidation stability of an oil in field service can vary markedly with field service conditions and with various oils.

5.3 This test method is designed to compliment Test Method D 5846 and is intended for evaluation of fluids which do not degrade significantly within a reasonable period of time at 135°C.

6. Apparatus

6.1 *Heating Block*, as shown in Fig. 1, and as further

described in Guide D 4871, to provide a controlled constant temperature for conducting the test.

6.1.1 Test cells are maintained at constant elevated temperature by means of a heated aluminum block which surrounds each test cell. Alternate apparatus designs for sample heating and for temperature and flow control shall be acceptable, provided they are shown to maintain temperature and gas flow within the standard's specified limits.

6.1.2 Holes in the aluminum block to accommodate the test cells shall provide 1.0 mm maximum clearance for 38-mm outside diameter glass tubes. The test cells shall fit into the block to a depth of 225 ± 5 mm.

6.2 *Temperature Control System*, as shown at lower left in Fig. 1, and as further described in Guide D 4871, to maintain the test oils in the heating block at $155 \pm 0.5^\circ\text{C}$ for the duration of the test.

6.3 *Gas Flow Control System*, as shown at the upper left in Fig. 1, and as further described in Guide D 4871, to provide dry



FIG. 1 Heating Block