



Standard Test Method for Thermal Stability of Hydraulic Oils¹

This standard is issued under the fixed designation D 2070; 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 method² is designed primarily to evaluate the thermal stability of hydrocarbon based hydraulic oils although oxidation may occur during the test.

1.2 The values stated in SI units are to be regarded as the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products³

2.2 Copper Development Association Standard

UNS C11000 Electrolytic Tough Pitch Copper⁴

2.3 American Iron and Steel Institute Standard (AISI)

W-1 Carbon Tool Steel⁵

3. Summary of Test Method

3.1 A beaker containing test oil, copper and iron rods is placed in an aluminum block in an electric gravity convection oven for 168 h at a test temperature of 135°C. At the completion of the test, the copper and steel rods are rated visually for discoloration and the oil is analyzed for the quantity of sludge.

4. Significance and Use

4.1 Thermal stability characterizes physical and chemical property changes which may adversely affect an oil's lubricating performance. This test method evaluates the thermal stability of a hydraulic oil in the presence of copper and steel at 135°C. Rod colors are the evaluation criteria. Sludge values

are reported for informational purposes. No correlation of the test to field service has been made.

5. Apparatus

5.1 An aluminum block with equally spaced holes is used. An example is described in Fig. A1.1 of Annex A1.

5.2 Electric gravity convection oven capable of maintaining the aluminum block at a test temperature of 135°C ± 1°C.

5.2.1 Calibrated thermocouple and temperature indicator centered in aluminum block.

5.3 250 mL Griffin beakers of borosilicate glass.

5.4 Copper test specimens are to be UNS C11000, 99.9 % pure electrolytic tough pitch copper, 6.35 mm in diameter by 7.6 cm in length (0.25 in. by 3.0 in.).

5.5 Steel test specimens are to be AISI W-1 1 % carbon steel, 6.35 mm in diameter 7.6 cm in length (0.25 by 3.0 in.).

5.6 Silicon carbide abrasive 320 grit with cloth backing.

5.7 Crocus cloth.

5.8 No. 41 Whatman filter paper,⁶ 47 mm diameter.

5.9 Millipore filter,⁷ 8 micron Type SC, 47 mm diameter.

5.10 Millipore glass filter holder, 47 mm, Cat #XX10.04700 or equivalent.

5.11 Cincinnati Milacron color chart.⁸

5.12 25 mL pipette.

6. Reagents

6.1 *Reagent Grade Heptane*—(Warning— Flammable. Health hazard.)

6.2 *Reagent Grade Acetone*—(Warning— Flammable. Health hazard.)

7. Preparation of Apparatus

7.1 Handle the rods at all times using forceps or clean cotton gloves.

7.2 Catalyst preparation—Clean the iron and copper catalyst rods, whether new or previously used, prior to use. Clean the rods with the 320 silicon carbide abrasive cloth while rotating the rods in a drill chuck at 1700 to 1800 r/min. Clean the surface until it has a bright copper or steel appearance. Discard rods when diameter is less than 6.2 mm.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.N0.08 on Stability.

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² This procedure was adopted from the Cincinnati Milacron Thermal Stability Test, Cincinnati Milacron Manual 10-SP-89050.

³ *Annual Book of ASTM Standards*, Vol 05.02.

⁴ Available from Copper Development Assoc., 2 Greenwich Office Park, Box 1840, Greenwich, CT 06836.

⁵ Available from AISI, 1133 15th St., NW, Washington, DC 20005.

⁶ Whatman Int. Ltd., Maidstone, England.

⁷ Millipore Filter Corp., Bedford, MA.

⁸ Cincinnati Milacron, 4701 Marburg Ave., Dept 97B Lubricants and Tribology, Cincinnati, Ohio, 45209, 513-841-8660.

