



Designation: D6203 – 22

## Standard Test Method for Thermal Stability of Way Lubricants<sup>1</sup>

This standard is issued under the fixed designation D6203; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This test method covers the evaluation of the thermal stability of hydrocarbon-based way lubricants, although oxidation may occur during the test.

1.2 The values stated in SI units are to be regarded as standard.

1.2.1 *Exception*—The values given in parentheses are for information only.

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:<sup>2</sup>

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

#### 2.2 Other Standards:

UNS C11000 Electrolytic Tough Pitch Copper<sup>3</sup>

AISI W1 1% Carbon Tool Steel<sup>4</sup>

<sup>1</sup> 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.L0.01 on Metal Removal Fluids and Lubricants.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from Copper Development Assoc., 2 Greenwich Office Park, Box 1840, Greenwich, CT 06836.

<sup>4</sup> Available from American Iron and Steel Institute (AISI), 1140 Connecticut Ave., NW, Suite 705, Washington, DC 20036, <http://www.steel.org>.

### 3. Terminology

#### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology D4175.

### 4. Summary of Test Method

4.1 A beaker containing test oil and copper and steel rods is placed in a gravity convection electric oven for 24 h at a test temperature of 100 °C. At the completion of the test, the copper and steel rods are visually rated for discoloration and the beaker is visually evaluated for deposits.

### 5. Significance and Use

5.1 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 way lubricant in the presence of copper and steel rods at 100 °C. Deposits and rod colors are the evaluation criteria. No correlation of the test to field service has been made.

5.2 This test method is intended for use in qualifying a way lubricant, rather than for quality control or condition monitoring purposes.

### 6. Apparatus

6.1 *Gravity Convection Electric Oven*, capable of maintaining the samples at a test temperature of 100 °C  $\pm$  2 °C.

6.2 *Calibrated Temperature Indicator*, suitable for measuring and controlling the oven temperature.

6.3 *Griffin Beakers*, borosilicate glass, 100 mL.

6.4 *Copper Test Specimens*, in accordance with UNS C11000, 99.9 % pure electrolytic tough pitch copper, 6.4 mm in diameter by 7.6 cm in length (0.25 in. by 3.0 in.).

6.5 *Steel Test Specimens*, in accordance with AISI W1 1 % carbon steel, 6.4 mm in diameter by 7.6 cm in length (0.25 in. by 3.0 in.).

6.6 *Silicon Carbide Abrasive*, 320 grit with cloth backing.

6.7 *Crocus Cloth*.

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

**TABLE 1 Results of Interlaboratory Testing**

Cooperator: Waylube:	Copper Rod Rating				Steel Rod Rating				Deposits (Y/N)			
	3	4	5	6	3	4	5	6	3	4	5	6
A	1	2	2	1	1	1	1	1	N	N	N	N
	1	2	2	1	1	1	1	1	N	N	N	N
B	5	5	3	5	1	1	1	1	N	N	N	N
	5	5	4	5	1	1	1	1	N	N	N	N
C	3	3	4	2	1	1	1	1	Y	N	N	N
	3	3	4	2	1	1	1	1	Y	N	N	N
D	3	3	5	2	1	1	1	1	N	N	N	N
	3	3	5	2	1	1	1	1	N	N	N	N

6.8 *Fives Cincinnati Color Chart*.<sup>5</sup>

6.9 *Facial Tissue*.

## 7. Reagents

7.1 *Reagent Grade Acetone*. (**Warning**—Flammable, health hazard.)

7.2 *Reagent Grade Heptane*. (**Warning**—Flammable, health hazard.)

## 8. Preparation of Metal Rods

8.1 Handle the rods at all times using forceps, facial tissue, or suitable gloves.

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

8.3 Prepare surfaces finally with a crocus cloth. Remove all grind marks. Finish the rods to a lightly polished surface finish.

8.4 Wash the rods individually with acetone and air dry on completion of the polishing operation.

## 9. Test Procedure

9.1 Place a representative 75 mL sample of test oil obtained in accordance with Practice **D4057** sampling procedure in a clean 100 mL Griffin beaker containing one each of the cleaned and polished iron and copper rods.

9.2 Place the rods crossed in the beaker so that they are in contact at one point. The contact point of the rods should be below the surface of the fluid.

9.3 Place the beaker and its contents on a tray in the oven. Keep the beakers as far from the walls as possible.

9.4 Maintain the temperature at the center of the oven at 98 °C to 102 °C for 24.0 h to 24.5 h.

9.5 Keep the oven doors closed during the entire test period.

9.6 At the completion of 24 h, remove the beakers from the oven and allow to cool to room temperature before proceeding. Continue within 2 h. Individually remove the rods from the oil sample. Inspect for deposits clinging to the rods. Wipe with a piece of facial tissue and inspect for color and etching.

9.7 *Copper Rod Inspection*—Wash the rod with heptane to remove all oil and allow to air dry. Visually evaluate the color of the rod against the Fives Cincinnati color chart and record. Record any etching that is evident to the naked eye.

9.8 *Steel Rod Analysis*—Wash the rod with heptane to remove all oil and allow to air dry. Visually evaluate the color of the rod against the Fives Cincinnati color chart and record. Record any etching that is evident to the naked eye.

9.9 *Beaker Inspection*—Invert the beaker and allow the sample to drain for at least 30 min. Rinse with two 50 mL portions of heptane. Inspect the beaker and record any deposits that are visible to the naked eye.

## 10. Report

10.1 Report the following information:

10.1.1 Color of the copper and steel rods using the numerical designations on the chart.

10.1.2 Any etching.

10.1.3 Whether any deposits were found on the rods or beaker

## 11. Precision and Bias

11.1 *Precision*—It is not possible to specify the precision of the procedure in this test method for measuring the thermal stability of way lubricants, because the results are visual ratings, not numerical values. Therefore, a statistical treatment is inappropriate. The results of interlaboratory testing are shown in **Table 1**.

11.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure, bias has not been determined.

## 12. Keywords

12.1 bed lubricants; Cincinnati Milacron; copper corrosion; deposits; heat test; oil sludging; slideway lubricants; steel corrosion; thermal stability; way lubricants

<sup>5</sup> The sole source of supply of the apparatus known to the committee at this time is Fives Cincinnati, Lubricants Laboratory, 2200 Litton Lane, Hebron, KY 41048; [www.Fivesmsi.com](http://www.Fivesmsi.com) or by e-mail at [FMS.LubricantsLab@FIVESGROUP.com](mailto:FMS.LubricantsLab@FIVESGROUP.com). If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

**SUMMARY OF CHANGES**

Subcommittee D02.L0.01 has identified the location of selected changes to this standard since the last issue (D6203 – 17) that may impact the use of this standard. (Approved Nov. 1, 2022.)

(1) Added Terminology **D4175** to Section **2**.

(2) Added Section **3**.

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