



Designation: D6922 – 11

Standard Test Method for Determination of Homogeneity and Miscibility in Automotive Engine Oils¹

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1. Scope

1.1 This test method covers the determination if an automotive engine oil is homogeneous and will remain so, and if it is miscible with certain standard reference oils after being submitted to a prescribed cycle of temperature changes. This test method is very similar to the homogeneity and miscibility test described in FED–STD–791/3470.1.

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

1.3 **WARNING**—Mercury has been designated by many regulatory agencies as a hazardous material that can cause central nervous system, kidney and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website—<http://www.epa.gov/mercury/faq.htm>—for additional information. Users should be aware that selling mercury and/or mercury containing products into your state or country may be prohibited by law.

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:

- D97 Test Method for Pour Point of Petroleum Products
- D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

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.B0 on Automotive Lubricants.

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D5844 Test Method for Evaluation of Automotive Engine Oils for Inhibition of Rusting (Sequence IID) (Withdrawn 2003)²

D6557 Test Method for Evaluation of Rust Preventive Characteristics of Automotive Engine Oils

E1 Specification for ASTM Liquid-in-Glass Thermometers

E344 Terminology Relating to Thermometry and Hyrometry

2.2 *Federal Test Method Standard*.³

FED–STD–791/3470.1 Homogeneity and Miscibility of Oils

3. Terminology

3.1 Definitions:

3.1.1 *calibrate, v*—to determine the indication or output of a measuring device with the respect of that of a standard. **E344**

3.1.2 *homogeneity, n*—the ability of a test oil itself to remain the same in appearance throughout (uniform) after submission to a series of temperature changes.

3.1.3 *miscibility, n*—the ability of a reference oil and test oil to form a uniform mixture after blending and not separate into two phases after submission to a series of temperature changes.

3.1.4 *reference oil, n*—an oil of known performance characteristics, used as a basis for comparison.

3.1.4.1 *Discussion*—Reference oils are used to calibrate testing facilities, to compare the performance of other oils, or to evaluate other materials (such as seals) that interact with oils. **D5844**

3.1.5 *specimen, n*—a piece or portion of test oil used to make a test.

3.1.6 *test oil, n*—any oil subjected to evaluation in an established procedure. **D6557**

4. Summary of Test Method

4.1 Visual color determinations and observations are made on an undiluted test oil specimen, along with six blends of the same test oil that have been combined with specific reference

² The last approved version of this historical standard is referenced on www.astm.org.

³ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

oils. The pour point is then determined for the undiluted test oil specimen and the six blends. The undiluted test oil specimen and six blends are then allowed to warm to room temperature. Color determinations and observations are again made on the undiluted test oil specimen and six blends. The undiluted test oil specimen and six blends are heated to 232°C, then allowed to cool to room temperature, and then stored at their pour point temperatures for 18 to 24 h. The undiluted test oil specimen and six blends are then allowed to thaw and a series of color determinations and observations are made as they reach room temperature. All data are recorded on a report form.

5. Significance and Use

5.1 It is important that engine oils from different manufacturers be homogeneous and miscible with each other, because operators of automotive engines often do not have prior knowledge of the manufacturer of the oil that is currently used in their application, and engine failure can occur if oils are combined that do not stay homogeneous and function properly.

6. Apparatus

6.1 *Test Jar*—cylindrical, of clear glass, flat bottom, 33.2 to 34.8-mm outside diameter, and 115 to 125 mm in height. The inside diameter of the jar can range from 30.0 to 32.4 mm, within the constraint that the wall thickness be no greater than 1.6 mm. The jar shall have a line to indicate a sample height 5 ± 3 mm above the inside bottom.

6.2 *Thermometers*—ASTM 6C, calibrated with a range of (–80 to +20) °C, conforming to Specification E1. In addition, temperature measuring devices such as liquid-in-glass thermometers, thermocouples, or platinum resistance thermometers can be used, if they provide equivalent or better accuracy and precision, and cover the required temperature range.

6.3 *Stoppers*—clean stoppers, some unbored and others centrally bored for test thermometers.

6.4 *Jacket*—a glass or metal, water tight, cylindrical form with a flat bottom and approximately 120 mm in depth. The inside diameter of the jacket shall be 9.0 to 12.0 mm greater than the outside diameter of the test jar.

6.5 *Disk*—cork or felt, about 6 mm in thickness and of the same diameter as the inside of the jacket.

6.6 *Gasket*—a ring gasket, about 5.0 mm in thickness, to fit snugly around the outside of the test jar and loosely inside the jacket. The purpose of the ring gasket is to prevent the test jar from touching the jacket.

6.7 *Bath*—a liquid cooling bath suitable to obtain the required temperatures.

6.8 *Oven*—a constant temperature oven suitable to obtain the required temperatures.

6.9 *Automated Pour Point Tester (Alternative)*—There are automated pour point testers available and in use which may be advantageous. They save test time, permit the use of smaller samples, and have other factors which may merit their use. If automated testers are used, the user shall ensure that all of the manufacturer's instructions for calibration, adjustment, and operation of the instrument are followed. It shall be reported

that the pour point was determined by an automatic instrument. In some cases, precision of automatic pour point testers may not have been determined. In any case of dispute, the pour point as determined by the manual method described herein shall be considered the referee test.

7. Reagents

7.1 *Reference Oils, HMA through HMF*—These are available from the Test Monitoring Center.⁴

8. Sampling

8.1 Take samples to be tested in accordance with the instructions in Practice D4057.

9. Test Preparation

9.1 Place the seven clean test jars in a holder.

9.2 Measure and mark each test jar as follows:

9.2.1 Measuring inside the test jar, mark each jar at 23 and 54 mm from the bottom.

9.2.2 Mark the first test jar for use with the undiluted test oil specimen.

9.2.3 Mark six test jars with the letters A through F to designate which reference oil will be mixed with the test oil.

9.3 Vigorously shake the test oil.

9.4 Using test oil, fill the six jars (that were marked for use with reference oil) to the 23-mm mark.

9.5 Fill the test jar that was marked for the undiluted test oil, to the 54-mm mark.

9.6 Vigorously shake the six reference oils.

9.7 Fill the test jars marked A through F with the corresponding reference oil to the 54-mm mark.

9.8 Firmly place the unbored stoppers in each of the test jars and shake the test jars vigorously.

9.9 Remove the stoppers from each test jar.

10. Procedure

10.1 Heat the test specimens in the test jars to $46 \pm 2^\circ\text{C}$ in a constant temperature oven or liquid bath.

10.2 Remove the test jars from the oven and allow to cool to room temperature.

10.3 For each test specimen record evidence of separation, its location, color, and particle size, and the color of the test specimen on the record form under *Before Treatment* (see Fig. A1.1).

10.4 *Determination of Pour Point:*

NOTE 1—This pour point procedure is based on the method described in Test Method D97 but with the exception indicated in Note 2.

10.4.1 Place a ring gasket around each test jar just below the oil level.

⁴ ASTM Test Monitoring Center, 6555 Penn Ave., Pittsburgh, PA 15206-4489. This test method is supplemented by Information Letters and Memoranda issued by the ASTM Test Monitoring Center; users of this test method can contact the ASTM Test Monitoring Center to obtain the most recent of these.