



Designation: D8447 – 22^{ε1}

Standard Test Method for Determination of Turbo Charger Deposits by Thermo- Oxidation Engine Oil Simulation Test¹

This standard is issued under the fixed designation D8447; 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.

^{ε1} NOTE—Editorially corrected 1.1 in May 2022.

1. Scope

1.1 This test method covers the procedure to determine the amount of deposits formed by automotive engine oils utilizing the thermo-oxidation engine oil simulation test (TEOST²).³ The range and applicability of the TEOST Turbo² test method as derived from an interlaboratory study is approximately 5 mg to 90 mg. However, experience indicates that deposit levels of up to 150 mg or greater can be obtained.

1.2 This test method uses a patented instrument, method and patented, numbered, and registered depositor rods traceable to the manufacturer⁴ and made specifically for the practice and precision of the test method.

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 Milligrams (mg), grams (g), milliliters (mL), and liters (L) are the units provided because they are an industry accepted 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *ceramic isolator, n*—the fitting that compresses the O-ring into the depositor rod casing and isolates the depositor rod casing from the voltage applied to the depositor rod.

2.1.2 *depositor rod⁴, n*—a patented, specially made, numbered, and registered steel rod (used once for each test) on which the deposits are collected; it is resistively heated and controlled by a thermocouple inserted to a pre-determined depth in the hollow rod.

2.1.3 *drain tube, n*—the tube connecting the lower end cap of the glass mantle to the reactor chamber.

2.1.4 *end cap, n*—the fitting used to tighten the ceramic isolators onto the O-rings at both ends of the glass mantle.

2.1.5 *filter deposits, n*—the mass in milligrams of the deposits collected after test on a special multi-layer filter cartridge used once for each test.

2.1.6 *glass mantle, n*—the glass sleeve that surrounds the depositor rod.

2.1.7 *pump, n*—the gear pump that is used to control the flow rate of the test oil through the depositor rod casing.

2.1.8 *pump inlet tube, n*—the tube connecting the reactor chamber to the pump.

2.1.9 *pump outlet tube, n*—the tube connecting the pump to the glass mantle.

2.1.10 *reactor chamber, n*—the heated reservoir that contains the 20 mL test oil sample circulated past the deposit rod during the test; the reactor is equipped with a magnetic stir-bar to continuously mix the chamber contents.

2.1.11 *rod deposits, n*—the mass, in milligrams, of the deposits collected on the depositor rod.

2.1.12 *rod O-rings, n*—the O-rings that seal the outside of the rod and the depositor rod casing to prevent sample leaks.

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 on Oxidation of Lubricants.

Current edition approved April 1, 2022. Published May 2022. DOI: 10.1520/D8447-22E01.

² TEOST and TEOST Turbo are registered trademarks of the Tannas Co., 4800 James Savage Rd., Midland, MI 48642.

³ The Development of Thermo-Oxidation Engine Oil Simulation Test (TEOST), Society of Automotive Engineers (SAE No. 932837), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

⁴ The sole source of supply of the item known to the committee at this time is Tannas Co., 4800 James Savage Rd., Midland, MI 48642. 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, which you may attend.

2.1.13 *thermocouple lock collar, n*—a fitting that tightens on the thermocouple to ensure the thermocouple is at the correct depth when placed inside the rod.

2.1.14 *total deposits, n*—the rod deposits plus the filter deposits.

3. Summary of Test Method

3.1 To a 30 mL aliquot of engine oil, 0.44 g of 6 % ferric naphthenate catalyst are added then stirred for 10 min. The catalyzed test oil is then transferred to the reactor chamber set to a temperature of 100 °C and 10 mL catalyzed oil is used to flush the pump. This catalyzed oil is pumped over a tared depositor rod that is resistively heated to 290 °C for 18 h with a 1.5 min pre-programmed thermal spike to 320 °C. When the temperature program is complete, the depositor rod is rinsed of oil residue and dried, and the gross rod mass obtained. The remaining test oil sample, including the remaining washes from the deposit rod, is flushed from the system and filtered through a tared filter. The mass of deposits on the rod plus the mass of deposits on the filter is recorded as the total deposit mass.

4. Significance and Use

4.1 The test method is designed to predict the elevated temperature deposit forming tendencies of an engine oil subject to the added oxidizing stress of a turbocharger. This test method can be used to screen oil samples or as a quality assurance tool.

5. Apparatus

5.1 *Thermo-oxidation Engine Oil Simulation Test (TEOST) Turbo Test Instrument⁴*—See Fig. 1.

5.2 *Balance*, capable of weighing to the nearest 0.1 mg.

5.3 *Vacuum Source*, floor model or house.

5.4 *Magnetic stirrer and stir bars*.

5.5 *Digital timer*.

5.6 *Petroleum and temperature resistant O-rings*.

5.7 *Ceramic isolators*.

5.8 *End-cap, Upper*, holds the upper end of the glass mantle and depositor rod in place and allows air and oil to enter the deposit-forming zone separately.

5.9 *End-cap, Lower*, holds the lower end of the glass mantle and depositor rod in place and provides an outlet for the oil to pass into the sample flask and subsequently to the recirculating pump inlet tubing.

5.10 *Glass Mantle*—The glass casing that surrounds the depositor rod and promotes condensation of the oil.

5.11 *Filtering Flask*, 1000 mL.

5.12 *Graduated Filter Funnel*, 500 mL with Luer lock fitting.

5.13 *Beaker*, large enough to clean the depositor rod casing (for example, 600 mL).

5.14 *Graduated Cylinder*, 10 mL.

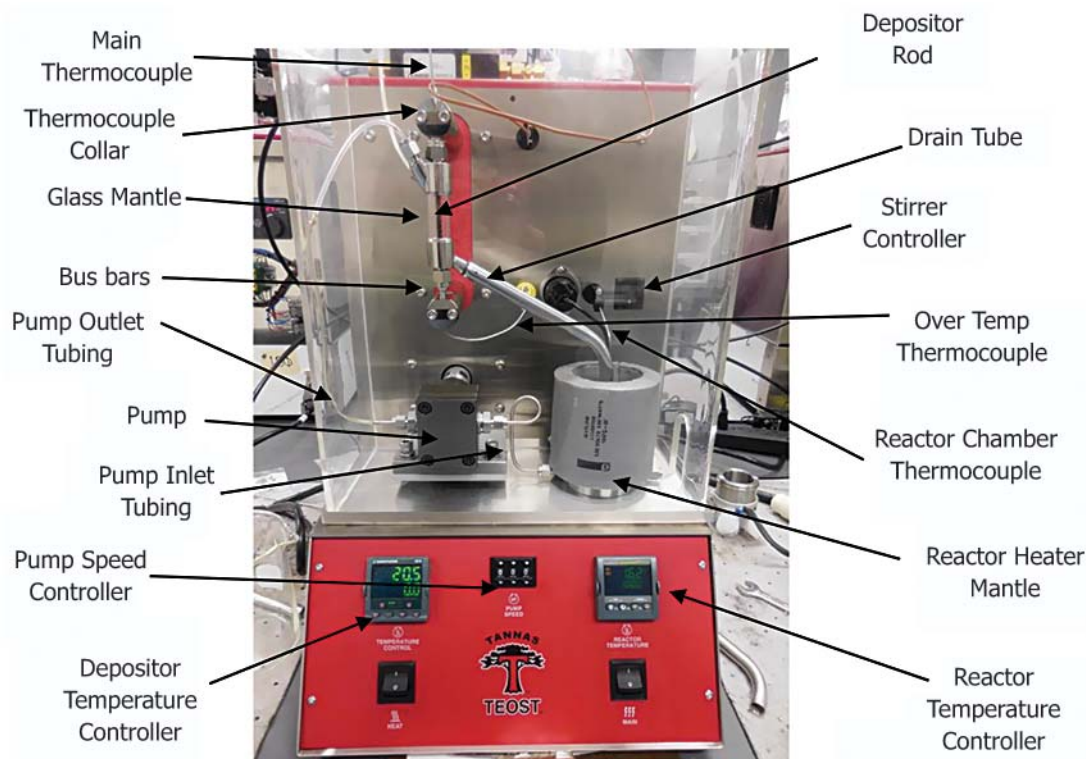


FIG. 1 Thermo-oxidation Engine Oil Simulation (TEOST) Turbo Test Apparatus