



Designation: D7549 – 23

Standard Test Method for Evaluation of Heavy-Duty Engine Oils under High Output Conditions—Caterpillar C13 Test Procedure¹

This standard is issued under the fixed designation D7549; 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.

INTRODUCTION

Any properly equipped laboratory, without outside assistance, can use the test procedure described in this test method. The ASTM Test Monitoring Center (TMC)² provides calibration and an assessment of the test results obtained on those oils by the laboratory. By this means the laboratory will know whether its use of the test method gives results statistically similar to those obtained by other laboratories. Furthermore, various agencies require that a laboratory utilizes the TMC services in seeking qualification of oils against specifications. For example, the U.S. Army has such a requirement in some of its engine oil specifications. Accordingly, this test method is written for those laboratories that use the TMC services. Laboratories that choose not to use these services should ignore those portions of the test method that refer to the TMC. Information letters² issued periodically by the TMC may modify this test method. In addition the TMC may issue supplementary memoranda related to the test method.

ASTM International policy is to encourage the development of test procedures based on generic equipment. It is recognized that there are occasions where critical/sole-source equipment has been approved by the technical committee (surveillance panel/task force) and is required by the test procedure. The technical committee that oversees the test procedure is encouraged to clearly identify if the part is considered critical in the test procedure. If a part is deemed to be critical, ASTM encourages alternative suppliers to be given the opportunity for consideration of supplying the critical part/component providing they meet the approval process set forth by the technical committee.

An alternative supplier can start the process by initiating contact with the technical committee (current chairs shown on ASTM TMC website). The supplier should advise on the details of the part that is intended to be supplied. The technical committee will review the request and determine feasibility of an alternative supplier for the requested replacement critical part. In the event that a replacement critical part has been identified and proven equivalent, the sole-source supplier footnote shall be removed from the test procedure.

1. Scope*

1.1 The test method covers a heavy-duty engine test procedure under high output conditions to evaluate engine oil

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.B0 on Automotive Lubricants.

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² The ASTM Test Monitoring Center will update changes in this test method by means of Information Letters. This edition includes all information letters through No. 23-1. Information Letters may be obtained by from the ASTM Test Monitoring Center, 203 Armstrong Drive, Freeport, PA 16229, Attention: Director.

performance with regard to piston deposit formation, piston ring sticking and oil consumption control in a combustion environment designed to minimize exhaust emissions. This test method is commonly referred to as the Caterpillar C13 Heavy-Duty Engine Oil Test.³

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

1.2.1 *Exceptions*—Where there are no SI equivalent such as screw threads, National Pipe Treads (NPT), and tubing sizes.

³ Caterpillar Inc., Engine System Technology Development, PO Box 610, Mossville, IL 61552-0610.

*A Summary of Changes section appears at the end of this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. See **Annex A1** for general safety precautions.

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:⁴

- D86** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D93** Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D97** Test Method for Pour Point of Petroleum Products
- D130** Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D235** Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
- D445** Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D482** Test Method for Ash from Petroleum Products
- D524** Test Method for Ramsbottom Carbon Residue of Petroleum Products
- D613** Test Method for Cetane Number of Diesel Fuel Oil
- D664** Test Method for Acid Number of Petroleum Products by Potentiometric Titration
- D975** Specification for Diesel Fuel
- D976** Test Method for Calculated Cetane Index of Distillate Fuels
- D1319** Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- D2274** Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method)
- D2622** Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
- D2709** Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge
- D3524** Test Method for Diesel Fuel Diluent in Used Diesel Engine Oils by Gas Chromatography
- D4052** Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4175** Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
- D4294** Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry

- D4739** Test Method for Base Number Determination by Potentiometric Hydrochloric Acid Titration
- D5185** Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
- D5186** Test Method for Determination of the Aromatic Content and Polynuclear Aromatic Content of Diesel Fuels By Supercritical Fluid Chromatography
- D5453** Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
- D5967** Test Method for Evaluation of Diesel Engine Oils in T-8 Diesel Engine
- D6078** Test Method for Evaluating Lubricity of Diesel Fuels by the Scuffing Load Ball-on-Cylinder Lubricity Evaluator (SLBOCLE) (Withdrawn 2021)⁵
- D6681** Test Method for Evaluation of Engine Oils in a High Speed, Single-Cylinder Diesel Engine—Caterpillar 1P Test Procedure
- D6987/D6987M** Test Method for Evaluation of Diesel Engine Oils in T-10 Exhaust Gas Recirculation Diesel Engine (Withdrawn 2022)⁵
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E178** Practice for Dealing With Outlying Observations

2.2 Other ASTM Document:

- ASTM Deposit Rating Manual 20** (formerly **CRC Manual 20**)⁶

3. Terminology

3.1 Definitions:

3.1.1 *blind reference oil, n*—a reference oil, the identity of which is unknown by the test facility.

3.1.1.1 *Discussion*—This is a coded reference oil that is submitted by a source independent of the test facility. **D4175**

3.1.2 *blowby, n*—in internal combustion engines, the combustion products and unburned air-and-fuel mixture that enter the crankcase. **D4175**

3.1.3 *calibrate, v*—to determine the indication or output of a measuring device with respect to that of a standard. **D4175**

3.1.4 *heavy duty, adj*—in internal combustion engine operation, characterized by average speeds, power output, and internal temperatures that are close to the potential maximums. **D4175**

3.1.5 *heavy-duty engine, n*—in internal combustion engine types, one that is designed to allow operation continuous at or close to its peak output.

3.1.5.1 *Discussion*—This type of engine is typically installed in large trucks and buses as well as farm, industrial, and construction equipment. **D4175**

⁴ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

⁵ The last approved version of this historical standard is referenced on www.astm.org.

⁶ For Stock #TMCML20, visit the ASTM website, www.astm.org, or contact ASTM International Customer Service at service@astm.org.