



Designation: D6750 – 19<sup>ε</sup><sup>1</sup>

## Standard Test Methods for Evaluation of Engine Oils in a High-Speed, Single-Cylinder Diesel Engine—1K Procedure (0.4 % Fuel Sulfur) and 1N Procedure (0.04 % Fuel Sulfur)<sup>1</sup>

This standard is issued under the fixed designation D6750; 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.

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<sup>ε</sup><sup>1</sup> NOTE—Editorially updated TMC governance information in June 2022.

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### INTRODUCTION

Portions of this test method are written for use by laboratories that make use of ASTM Test Monitoring Center (TMC)<sup>2</sup> services (see [Annex A1 – Annex A4](#)).

The TMC provides reference oils, and engineering and statistical services to laboratories that desire to produce test results that are statistically similar to those produced by laboratories previously calibrated by the TMC.

In general, the Test Purchaser decides if a calibrated test stand is to be used. Organizations such as the American Chemistry Council require that a laboratory utilize the TMC services as part of their test registration process. In addition, the American Petroleum Institute and the Gear Lubricant Review Committee of the Lubricant Review Institute (SAE International) require that a laboratory use the TMC services in seeking qualification of oils against their specifications.

The advantage of using the TMC services to calibrate test stands is that the test laboratory (and hence the Test Purchaser) has an assurance that the test stand was operating at the proper level of test severity. It should also be borne in mind that results obtained in a non-calibrated test stand may not be the same as those obtained in a test stand participating in the ASTM TMC services process.

Laboratories that choose not to use the TMC services may simply disregard these portions.

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.

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<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.B0.02 on Heavy Duty Engine Oils.

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<sup>2</sup> Until the next revision of this test method, the ASTM Test Monitoring Center will update changes in the test method by means of information letters. Information letters may be obtained from the ASTM Test Monitoring Center, 203 Armstrong Drive, Freeport, PA 16229. Attention: Director. This edition incorporates revisions in all information Letters through No. 18-1.

## 1. Scope\*

1.1 These test methods cover the performance of engine oils intended for use in certain diesel engines. They are performed in a standardized high-speed, single-cylinder diesel engine by either the 1K (0.4 % mass fuel sulfur) or 1N (0.04 % mass fuel sulfur) procedure.<sup>3</sup> *The only difference in the two test methods is the fuel used.* Piston and ring groove deposit-forming tendency and oil consumption are measured. Also, the piston, the rings, and the liner are examined for distress and the rings for mobility. These test methods are required to evaluate oils intended to satisfy API service categories CF-4 and CH-4 for 1K, and CG-4 for 1N of Specification **D4485**.

1.2 These test methods, although based on the original Caterpillar 1K/1N procedures,<sup>3</sup> also embody TMC information letters issued before these test methods were first published. These test methods are subject to frequent change. Until the next revision of these test methods, TMC will update changes in these test methods by the issuance of information letters which shall be obtained from TMC (see **Annex A1 – Annex A4**).

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 *Exception*—Where there is no direct SI equivalent such as screw threads, national pipe threads/diameters, tubing size, or single source equipment specified. Also Brake Specific Fuel Consumption is measured in kilograms per kilowatt-hour.

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<sup>3</sup> These 1K/1N test procedures were developed by Caterpillar Inc., P.O. Box 610, Mossville, IL 61552-0610.

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1.5 *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.* Specific precautionary statements appear throughout the text. Being engine tests, these test methods do have definite hazards that shall be met by safe practices (see **Annex A19** on Safety Precautions).

1.6 *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>4</sup>

- 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**

<sup>4</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.

**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)  
**D287** Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)  
**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  
**D1298** Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method  
**D1319** Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption  
**D1796** Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)  
**D2425** Test Method for Hydrocarbon Types in Middle Distillates by Mass Spectrometry  
**D2500** Test Method for Cloud Point of Petroleum Products and Liquid Fuels  
**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  
**D3117** Test Method for Wax Appearance Point of Distillate Fuels (Withdrawn 2010)<sup>5</sup>  
**D3524** Test Method for Diesel Fuel Diluent in Used Diesel Engine Oils by Gas Chromatography  
**D4485** Specification for Performance of Active API Service Category Engine Oils  
**D4737** Test Method for Calculated Cetane Index by Four Variable Equation  
**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  
**D5844** Test Method for Evaluation of Automotive Engine Oils for Inhibition of Rusting (Sequence IID) (Withdrawn 2003)<sup>5</sup>  
**D5862** Test Method for Evaluation of Engine Oils in Two-Stroke Cycle Turbo-Supercharged 6V92TA Diesel Engine (Withdrawn 2009)<sup>5</sup>  
**D6202** Test Method for Automotive Engine Oils on the Fuel

Economy of Passenger Cars and Light-Duty Trucks in the Sequence VIA Spark Ignition Engine (Withdrawn 2009)<sup>5</sup>  
**D6594** Test Method for Evaluation of Corrosiveness of Diesel Engine Oil at 135 °C  
**D7422** Test Method for Evaluation of Diesel Engine Oils in T-12 Exhaust Gas Recirculation Diesel Engine  
**E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications  
 IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System

## 2.2 SAE Standard:

**SAE J183** Engine Oil Performance and Engine Service Classification<sup>6</sup>

## 2.3 API Standard:

**API 1509** Engine Service Classification and Guide to Crankcase Oil Selection<sup>7</sup>

## 2.4 Other ASTM Document:

**ASTM Deposit Rating Manual 20** (Formerly CRC Manual 20)<sup>8</sup>

## 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 from the test facility. **D5844**

3.1.2 *calibration test, n*—an engine test conducted on a reference oil under carefully prescribed conditions, the results of which are used to determine the suitability of the engine stand/laboratory for such tests on non-reference oils.

3.1.2.1 *Discussion*—A calibration test also includes tests conducted on parts to ensure their suitability for use in reference and non-reference tests.

3.1.3 *calibrated test stand, n*—a test stand on which the testing of reference material(s), conducted as specified in the standard, provided acceptable test results.

3.1.3.1 *Discussion*—In several automotive lubricant standard test methods, the TMC provides testing guidance and determines acceptability. **Sub. B Glossary**<sup>2</sup>

3.1.4 *candidate oil, n*—an oil that is intended to have the performance characteristics necessary to satisfy a specification and is to be tested against that specification. **D5844**

3.1.5 *debris, n—in internal combustion engines*, solid contaminant materials unintentionally introduced into the engine or resulting from wear. **D5862**

3.1.6 *double-blind test, n*—a standard test performed on a double-blind reference oil.

<sup>6</sup> Available from the Society of Automotive Engineers Inc., 400 Commonwealth Dr., Warrendale, PA 15096. Order *SAE Handbook*, Vol 3; the standard is not available separately.

<sup>7</sup> Available from the American Petroleum Institute, 1220 L St., NW, Washington, DC 20005.

<sup>8</sup> For Stock #TMCMN20, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM International Customer Service at [service@astm.org](mailto:service@astm.org).

<sup>5</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).