



Designation: D8665 – 26

Standard Test Method for Measuring the Gelation Propensity of Automotive Engine Oils After Treatment with Acidified Water¹

This standard is issued under the fixed designation D8665; 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

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

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 engine 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. For other information, refer to the research report of this test method.³

1. Scope

1.1 This test method covers the determination of the tendency of a fully formulated automotive engine oil to form a precipitate that causes an abrupt viscosity increase due to gelation. It simulates a problem that may be encountered after

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.B0.07 on Development and Surveillance of Bench Tests Methods.

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² ASTM Test Monitoring Center, 203 Armstrong Drive, Freeport, PA 16229. 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.

³ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-2114. Contact ASTM Customer Service at www.astm.org/contact.

multiple cold starts or short drive times, resulting in a buildup of water contamination in the oil. After long storage periods, gelation of the oil/water/precipitate mixture can be observed. This method addresses contamination containing a weak acid formation from carbon dioxide; it does not directly address other forms of gel formation. The test result (average of duplicates) of interest is the Oil Volume (mL) at 120 seconds (V120) in the test, with results between 5 mL and 68 mL.

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 *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:*⁴

D1193 Specification for Reagent Water

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

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

D4485 Specification for Performance of Active API Service Category Engine Oils

3. Terminology

3.1 *Definitions:*

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

3.1.2 *calibrate, v*—to determine the indication or output of a device (for example, thermometer, manometer, engine) with respect to that of a standard.

3.1.3 *calibration test, n*—a test, using a coded reference oil, conducted as specified in the test method.

3.1.3.1 *Discussion*—The test result is used to determine the suitability of the testing facility/laboratory to conduct such tests on non-reference oils.

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

3.1.5 *engine oil, n*—a liquid that reduces friction or wear, or both, between the moving parts within an engine; removes heat, particularly from the underside of pistons; and serves as a combustion gas sealant for the piston rings.

3.1.5.1 *Discussion*—It may contain additives to enhance certain properties. Inhibition of engine rusting, deposit formation, valve train wear, oil oxidation, and foaming are examples.

3.1.6 *non-reference oil, n*—any oil other than a reference oil, such as a research formulation, commercial oil, or candidate oil.

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

3.1.7.1 *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.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *gel, n*—a colloidal mixture that is not a normal property of the test fluid and is formed under specific conditions.

3.2.2 *gelation, v*—the act of forming a gel.

3.2.3 *new oil, n*—an unused oil having the identical formulation and base stock as the test oil.

3.2.4 *test oil, n*—the new oil with water and acetic acid added.

3.2.4.1 *Discussion*—A potential gel in the test oil is induced by heating the oil and aging.

4. Summary of Test Method

4.1 The new oil is treated with an acetic acid solution equilibrated to pH 3.5 and mixed with magnetic stirring for 1 h followed by a storage period. Excess acetic acid solution is added, and the mixture is sheared at high speed to propagate the gelation. An additional storage period follows with an additional shearing step. The mixture is poured into a glass funnel above a graduated cylinder and the volume of fluid is recorded every 15 s for 120 s.

5. Significance and Use

5.1 It is normal for some of the combustion products of an internal combustion engine, such as carbon dioxide, to penetrate the engine oil and be retained in it.

5.2 When an engine is run for a period and then stored over a long period of time, the by-products of combustion might be retained in the engine system as a gel.

5.3 Under these circumstances, gels can form that impair the pumpability and filterability of the oil the next time the engine is run.

5.4 This test method is used for specification purposes and is considered of value in estimating the filterability of oils, especially those that are prone to water contamination. It should be recognized, however, that correlation between results of this method and the filterability of a lubricant in field service may vary markedly with field service conditions and with various lubricants. The precision statement for this method was determined on formulated engine oils.

5.5 Reference oils, on which the data obtained by this test method is known, are available.

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