



Designation: D7038 – 23

Standard Test Method for Evaluation of Moisture Corrosion Resistance of Automotive Gear Lubricants¹

This standard is issued under the fixed designation D7038; 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) 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 use 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.

1. Scope*

1.1 This test method covers a test procedure for evaluating the rust and corrosion inhibiting properties of a gear lubricant while subjected to water contamination and elevated tempera-

ture in a bench-mounted hypoid differential housing assembly.² This test method is commonly referred to as the L-33-1 test.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical

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 Until the next revision of this test method, the ASTM Test Monitoring Center (TMC) will update changes in this test method by means of Information Letters. This edition includes all Information Letters through 23-1. Information Letters may be obtained from the ASTM Test Monitoring Center, 203 Armstrong Drive, Freeport, PA 16229, Attention: Director.

*A Summary of Changes section appears at the end of this standard

conversions to SI units that are provided for information only and are not considered standard.

1.2.1 *Exceptions*—(1) where there is no direct SI equivalent such as screw threads and national pipe threads/diameters, and (2) the values stated in SI units are to be regarded as standard for the definitions in 12.2, and for SI units where there are no direct inch-pounds equivalent units.

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:*³

D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *Society of Automotive Engineers Standards:*⁴

J308 Information Report on Axle and Manual Transmission Lubricants

J2360 Lubricating Oil, Gear Multipurpose (Metric) Military Use

2.3 *U.S. Military Specifications:*⁵

MIL-PRF-2105E Lubricating Oil, Gear, General Multipurpose

MIL-P-3420F NOX-RUST Paper

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *corrosion, n*—an alteration of a finished metal surface by discoloration, accompanied by roughening not attributable to mechanical action.

3.1.2 *downtime, n*—an interruption of power to the test unit for a period greater than ten seconds.

3.1.3 *rust, n*—a special case of corrosion, which always deteriorates or alters the original surface condition.

3.1.3.1 *Discussion*—Rust always has color (usually, but not limited to red, yellow, brown, black) and one of the following descriptive characteristics: (1) depth; the rusted surface is built up relative to that of adjacent areas. (2) texture; the surface may appear to be etched, scaly or otherwise visibly different than adjacent areas.

3.1.4 *stain, n*—a surface modification that is attributable to discoloration only.

4. Summary of Test Method

4.1 This procedure uses a new hypoid differential assembly as the primary test unit. The differential assembly is installed on a motoring rig and charged with test lubricant and a small amount of water. The test unit is then sealed and driven until the lubricant temperature has increased to 180 °F (82.2 °C). The motoring phase is continued for 4 h and the test unit is then removed from the motoring rig and placed in a storage box for 162 h with the lubricant temperature controlled at 125 °F (51.7 °C). The test is completed at that time and the differential assembly is drained, disassembled, and inspected for rust, stain, and other deposits.

5. Significance and Use

5.1 This test simulates a type of severe field service in which corrosion-promoting moisture in the form of condensed water vapor accumulates in the axle assembly. This may happen as a result of volume expansion and contraction of the axle lubricant and the accompanied breathing in of moisture-laden air through the axle vent. The test screens lubricants for their ability to prevent the expected corrosion.

5.2 The L-33-1 test procedure is used or referred to in the following documents: ASTM Publication STP-512A,⁶ SAE J308, SAE J2360, and U.S. Military Specification MIL-PRF-2105E.

6. Apparatus

6.1 *Laboratory Ambient Conditions:*

6.1.1 *Test Operating Area*—The ambient laboratory atmosphere shall be free of dirt, dust, and other contaminants as required by good laboratory standards.

6.1.2 *Parts Cleaning and Abrasive Blasting (6.2.8) Areas*—Provide adequate ventilation in areas where solvents (7.2) are used. (**Warning**—Combustible, vapor harmful.)

6.1.3 *Build-up Area*—It is recommended that the atmosphere in the test unit build-up area be filtered and maintained at uniform temperature and low humidity to prevent accumulation of dirt or rust on test parts. Otherwise it shall conform to requirements of 6.1.1.

6.1.4 *Parts Rating Area*—Conduct the rating of all test parts under conditions as defined in ASTM Distress Rating Manual 21.⁷

6.2 *Test Unit*—This procedure uses a hypoid differential assembly (without axle tubes). See the critical parts list under the L-33-1 Information Letter section of the Test Monitoring Center website, www.astmtmc.org, for hardware approved for test use.

6.2.1 Mount the differential housing assembly on the motoring rig so that the housing cover attaching face is in the

³ 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.

⁴ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

⁵ Available from the Defense Printing Service Office, 700 Robbins Ave., Bldg. 4D, Philadelphia, PA 19111-5094.

⁶ ASTM Publication STP-512A, Laboratory Performance Tests for Automotive Gear Lubricants Intended for API GL-5 Service, ASTM International, West Conshohocken, PA.

⁷ For stock #TMCNML21, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org.