



Standard Test Method for Evaluation of the Thermal and Oxidative Stability of Lubricating Oils Used for Manual Transmissions and Final Drive Axles¹

This standard is issued under the fixed designation D5704; 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.

1. Scope

1.1 This test method is commonly referred to as the L-60-1 test.² It covers the oil-thickening, insolubles-formation, and deposit-formation characteristics of automotive manual transmission and final drive axle lubricating oils when subjected to high-temperature oxidizing conditions.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.2.1 *Exceptions*—The values stated in SI units for catalyst mass loss, oil mass and volume, alternator output, and air flow are to be regarded as standard.

1.2.2 SI units are provided for all parameters except where there is no direct equivalent such as the units for screw threads, or where there is a sole source supply equipment specification.

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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific warning information is given in Sections 7 and 8 and Annex A3.

2. Referenced Documents

2.1 *ASTM Standards:*³

B224 Classification of Coppers

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)

D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D893 Test Method for Insolubles in Used Lubricating Oils

D6984 Test Method for Evaluation of Automotive Engine Oils in the Sequence IIIF, Spark-Ignition Engine

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

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 *ANSI Standard:*⁴

ANSI/ISA-S7.3 Quality Standard for Instrument Air

2.3 *Military Specification:*⁵

MIL-L-2105D Lubricating Oil, Gear, Multipurpose

2.4 *ASTM Adjuncts:*⁶

Engineering Drawings

3. Terminology

3.1 *Definitions:*

3.1.1 *carbon, n*—in manual transmissions and final drive axles, a hard, dry, generally black or gray deposit that can be removed by solvents but not by wiping with a cloth.

3.1.2 *lubricant, n*—any material interposed between two surfaces that reduces the friction or wear, or both, between them. **D6984**

3.1.3 *sludge, n*—in manual transmissions and final drive axles, a deposit principally composed of the lubricating oil and oxidation products that do not drain from parts but can be removed by wiping with a cloth.

3.1.4 *thermal and oxidative stability, n*—in lubricating oils used for manual transmissions and final drive axles, a lack of deterioration of the lubricating oil under high-temperature

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.B0.03 on Automotive Gear Lubricants & Fluids.

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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. Information Letters may be obtained from the ASTM Test Monitoring Center, 6555 Penn Ave., Pittsburgh, PA 15206-4489. Attention: Administrator. This edition incorporates revisions in all Information Letters through 09–1. The TMC is also the source of reference oils.

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 Joint standard of ANSI/ISA. Available from Instrument Society of America, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, NC 27709.

⁵ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

⁶ Detailed drawings necessary for rig construction. Available from ASTM International Headquarters. Order Adjunct No. **ADJD5704A**.