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An American National Standard

Standard Specification for Lubricants for Two-Stroke-Cycle Spark-Ignition Gasoline Engines-TC[1]

This standard is issued under the fixed designation D 4859; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers lubricants intended for use in two-stroke-cycle spark-ignition gasoline engines, typically other than outboard motors, that are particularly prone to ring sticking, but which are also liable to suffer damage arising from deposit induced preignition, piston scuff, spark plug fouling and piston varnish.

~~1.2The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.~~

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and ~~the~~ Calculation of Dynamic Viscosity)

D 664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D 874 Test Method for Sulfated Ash from Lubricating Oils and Additives

D 2270 Practice for Calculating Viscosity Index from Kinematic Viscosity at ~~40°~~40 and ~~100°C~~[2]100C

D 2896 Test Method for Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration

D 4857 Test Method for Determination of the Ability of Lubricants to Minimize Ring Sticking and Piston Deposits in Two-Stroke-Cycle Gasoline Engines Other Than Outboards

D 4858 Test Method for Determination of the Tendency of Lubricants to Promote Preignition in Two-Stroke-Cycle Gasoline Engines

D 4863 Test Method for Determination of Lubricity of Two-Stroke-Cycle Gasoline Engine Lubricants

2.2 *Coordinating European Council (CEC) Standard:*

CEC L-19-T-77 The Evaluation of the Lubricity of Two-Stroke Engine Oils[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *cold sticking—of piston rings*, a condition in which the ring is free in its groove while the engine is running but stuck when the piston is cold, normally indicated by the absence of varnish or other deposits on the outer face of the ring and of signs of blowby on the piston skirt. **D 4857**

3.1.2 *combustion chamber—in reciprocating internal combustion engines*, the volume bounded by the piston crown and any portion of the cylinder walls extending above the piston crown when in the top dead center position, and the inner surface of the cylinder head including any spark plugs and other inserted components. **D 4858**

3.1.3 *hot sticking—of piston rings*, a condition in which the ring is stuck in its groove while the engine is running, normally indicated by varnish or other deposits on the outer face of the ring, by signs of blowby on the piston skirt, or both. **D 4857**

3.1.4 *lubricity*—a qualitative term describing the ability of a lubricant to minimize friction between and damage to surfaces in relative motion under load. **D 4863**

3.1.5 *preignition—in a spark-ignition engine*, ignition of the mixture of fuel and air in the combustion chamber before the passage of the spark. **D 4858**

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[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.B0.06 on ~~Automotive Lubricants.~~ Two-Stroke Cycle Gasoline.

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[2] 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* ~~, Vol 05.01.~~volume information, refer to the standard's Document Summary page on the ASTM website.

~~[3] Annual Book of ASTM Standards, Vol 05.02.~~

[3] Order from the Coordinating European Council, 61 New Cavendish Street, London, W1M 8AR, England.

3.1.6 *scuff, scuffing—in lubrication* , damage caused by instantaneous localized welding between surfaces in relative motion which does not result in immobilization of the parts. **D 4863**

3.1.7 *seizure—in lubrication* , welding between surfaces in relative motion that results in immobilization of the parts. **D 4863**

3.1.8 *spark plug fouling*—deposition of essentially nonconducting material onto the electrodes of a spark plug that may, but will not necessarily, prevent the plug from operating. **D 4857**

3.1.9 *spark plug whiskering, or spark plug bridging*—a deposit of conductive material on the spark plug electrodes which tends to form a bridge between them, thus shorting out the plug. **D 4857**

3.2 ~~Definition~~*Definitions of Terms Specific to This Standard:*

3.2.1 *benchmark reference oil*—an oil meeting the requirements of a test of this specification and whose performance on that test is equalled or exceeded by that of the candidate oil within the specified tolerances.

3.2.2 *major preignition*—preignition indicated by an increase in the combustion chamber temperature of 10°C ~~(18°F)~~ or more over a period of less than a minute.

3.2.3 *minor preignition*—preignition indicated by an increase in the combustion chamber temperature of 7°C ~~(13°F)~~ or more but less than 10°C ~~(18°F)~~ over a period of less than a minute.

4. General Requirements

4.1 This specification covers only specific aspects of the performance of the lubricant in an engine under the conditions of test. Requirements additional to those of this specification, such as miscibility with gasoline, may be agreed between the purchaser and the supplier.

4.2 Performance testing of each batch of lubricant shall not be required. The supplier shall certify that the product supplied meets the requirements of this specification and that it conforms in all significant respects to a batch of lubricant that has met the requirements of this specification. The supplier shall provide on request the batch and test number and the date and place of qualification of this previously qualified batch of oil, and such additional information on the physical and chemical properties of the lubricant as shall enable the purchaser to detect contamination or substitution of product.

4.3 *Ring Sticking and Piston Deposit Test*—The performance of the candidate oil shall be equal to, within the specified tolerances, or better than that of the benchmark reference oil when run under the conditions required by this specification and by the test procedure. The benchmark reference oil used when testing to this specification is ASTM 600.[4]

4.4 *Lubricity Test*—The performance of the candidate oil shall be equal to, within the specified tolerances, or better than that of the benchmark reference oil when run under the conditions required by this specification and by the test procedure. The benchmark reference oil required by this specification is ASTM 600.[4]

4.5 *Preignition Test*—Not more than one major preignition may occur when running the candidate oil. Minor preignitions shall be reported with the temperature increase and the time of occurrence in running hours to the nearest 0.1 h. The benchmark reference oil used when testing to this specification is ASTM 601.[5]

NOTE 1—Find a general description of these benchmark reference oils in Annex A1.

5. Summary of Test Methods

5.1 *Ring Sticking and Piston Deposits-Test Method D 4857*—This test is run in a 347 cm^3 Yamaha RD-350B twin-cylinder air-cooled motorcycle engine for 20 h, set up with number one cylinder supplied with a fuel mix containing the benchmark reference oil and number two cylinder with a fuel mix containing the candidate oil, both at 50:1 fuel to oil ratio by volume. The test is normally run twice, exchanging the oils between cylinders for the second run, unless the performance of the candidate oil exceeds that of the benchmark reference oil by the margins specified in 6.2.7, in which case the second run need not be made.

5.2 *Lubricity-Test Method D 4863*—The procedure is a development of CEC L-19-T-77, for which test engines are no longer available. It is run in a Yamaha CE-50 49 cm^3 single-cylinder air-cooled engine supplied with a 150:1 by volume fuel to oil mix. The engine is brought to equilibrium at 4000 ~~r/min~~rpm wide open throttle (WOT), and the cooling air flow adjusted to give a spark plug gasket temperature of 169 to ~~171°C (336 to 340°F).~~ 171°C. The cooling air to the cylinder is then cut off and the output torque recorded when the plug gasket temperature reaches 200°C ~~(392°F)~~ and again when it reaches ~~350°C (662°F),~~350°C, when the cooling air flow is restored. The smaller the reduction in torque output at constant engine speed during this interval, the better the ability of the oil to lubricate the piston. Tests are run alternately on the benchmark reference oil, ASTM 600, and on the candidate oil. This test does not normally damage the engine.

5.3 *Preignition-Test Method D 4858*—This is run in a Yamaha CE-50 engine. For the purposes of this specification the engine is run for 50 h at 4000 ~~r/min~~rpm at wide open throttle (WOT) using a 20:1 volumetric fuel to oil ratio. The number of incidences of preignition, as determined by an increase in the temperature of the combustion chamber over the normal running level, is observed.

~~[4] Order from the Coordinating European Council, 61 New Cavendish Street, London, W1M 8AR, England.~~

[4] Order as Citgo No. 93734 from Citgo Petroleum Corp., 555 East Butterfield Rd., Lombard, IL 60148.

~~[5] Order as Citgo No. 93734 from Citgo Petroleum Corp., 555 East Butterfield Rd., Lombard, IL 60148.~~

[5] Order from Lubrizol Corp., 29400 Lakeland Boulevard, Wickliffe, OH 44092.