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Standard Test Method for Knock Characteristics of Aviation Gasolines by the Supercharge Method¹

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1. Scope

1.1 This test method covers the determination of the knock-limited power, under supercharge rich-mixture conditions, of fuels for use in spark-ignition reciprocating aircraft engines, in terms of ASTM supercharge octane or performance number. By operational considerations, this test method is restricted to testing fuels of 85 ASTM supercharge octane number and over.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

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 precautionary statements are given in Annex A7.

2. Referenced Documents

2.1 ASTM Standards:

D 1368 Test Method for Trace Concentrations of Lead in Primary Reference Fuels²

D 2268 Test Method for Analysis of High Purity³

D 2599 Test Method for Lead in Gasoline by X-Ray Spectrometry⁴

D 2699 Test Method for Research Octane Number of Spark-Ignition Engine Fuel⁵

D 2700 Test Method for Knock Characteristics of Motor and Aviation Fuels by the Motor Method⁵

D 3237 Test Method for Lead in Gasoline by Atomic Absorption Spectrometry⁶

D 3341 Test Method for Lead in Gasoline by the Iodine

Monochloride Method⁶

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products⁶

E 1 Specifications for ASTM Thermometers⁷

3. Terminology

3.1 Definitions:

3.1.1 *ASTM supercharge octane number of a fuel below 100*—the whole number nearest the percentage by volume of isooctane (equals 100) in a blend with *n*-heptane (equals 0) that matches the knock characteristics of the fuel when compared by this test method.

3.1.2 *ASTM supercharge rating of a fuel above 100*—the amount of tetraethyllead (TEL) in isooctane, expressed in millilitres per U.S. gallon.

3.2 ASTM supercharge ratings are normally expressed as octane numbers below 100 and as performance numbers above 100. At 100, a rating may be expressed either as 100 octane number or as 100 performance number. Sometimes it is desirable to convert the ASTM supercharge octane number to performance number. This can be done by using Table 1. Table 2 lists the corresponding performance numbers for various concentrations of tetraethyllead in isooctane.

4. Summary of Test Method

4.1 ASTM supercharge octane or performance number of a fuel is determined by comparing its knock-limited power with those for bracketing blends of reference fuels under standard operating conditions. This is done at constant compression ratio by varying the manifold pressure and fuel flow rate, the independent variables of the test, and measuring indicated mean effective pressure (imep) at enough points to define the mixture response curves for the sample and the reference fuels. When the knock-limited power for the sample is bracketed between those for two adjacent reference fuels suitably chosen from the prescribed list (see 12.1.2), the rating of the sample is calculated by interpolation at the fuel-air ratio for maximum power for the lower bracketing reference fuel.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.01 on Combustion Characteristics.

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² Discontinued, see 1994 *Annual Book of ASTM Standards*, Vol 05.01.

³ *Annual Book of ASTM Standards*, Vol 05.01.

⁴ Discontinued, Replaced by Test Method D 5059, see 1992 *Annual Book of ASTM Standards*, Vol 05.02.

⁵ *Annual Book of ASTM Standards*, Vol 05.04.

⁶ *Annual Book of ASTM Standards*, Vol 05.02.

⁷ *Annual Book of ASTM Standards*, Vol 14.03.