



Designation: D 6424 – 99

An American National Standard

Standard Practice for Octane Rating Naturally Aspirated Spark Ignition Aircraft Engines¹

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1. Scope

1.1 This practice covers ground based octane rating procedures for naturally aspirated spark ignition aircraft engines using primary reference fuels.

1.2 *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.*

2. Referenced Documents

2.1 ASTM Standards:

D 2700 Test Method for Motor Octane Number of Spark-Ignition Engine Fuel²

3. Terminology

3.1 Definitions:

3.1.1 *engine motor octane requirement*—one full motor octane number greater than the maximum motor octane number that results in knock (graphic knock level descriptions can be seen in Annex A1). For example, a test engine knocks on primary reference fuels with 96 and 97 motor octane numbers. The test engine does not knock on a primary reference fuel with a 98 motor octane number. The maximum motor octane number that results in knock is 97, so the motor octane requirement is 98.

3.1.2 *full rich*—condition in which the mixture control is at the full stop position with the fuel flow within manufacturer's recommended settings.

3.1.3 *house fuel, n—for octane rating*, an unleaded, straight hydrocarbon fuel used for engine warm-up and all non-octane rating testing.

3.1.4 *knock, n—in an aircraft spark ignition engine*, abnormal combustion caused by autoignition of the air/fuel mixture.

3.1.5 *knock condition, n—for octane rating*, when the knock intensity in any cylinder is light knock or greater as described in Annex A1

3.1.6 *knock number, n—for octane rating*, a numerical quantification of knock intensity.

3.1.7 *motor octane number of primary reference fuels from 0 to 100*—the volume % of isooctane (equals 100.0) in a blend with *n*-heptane (equals 0.0).

3.1.8 *motor octane number of primary reference fuels above 100*—determined in terms of the number of millilitres of tetraethyl lead in isooctane.

3.1.9 *naturally aspirated aircraft engine, n*—aircraft piston engine that breathes without forced means from either turbochargers or superchargers.

3.1.10 *no-knock condition, n—for octane rating*, when the combustion instability in all cylinders is less than light knock. Refer to Annex A1 for description of knock intensity.

3.1.11 *peak EGT, n—for octane rating*, as the mixture is manually leaned from a state rich of stoichiometric, the exhaust gas temperature will increase with the removal of excess fuel. As the mixture is continually leaned, a peak temperature will be attained, after which continued leaning will result in lower exhaust gas temperatures.

3.1.12 *primary reference fuels, n—for octane rating*, blended fuels of reference grade isooctane and *n*-heptane.

3.1.13 *stable engine conditions, n—for octane rating*, cylinder head temperatures change less than 5°C (9°F) during a 1 min period. Any changes or minor adjustments to throttle, mixture, or engine conditions mandate restarting the clock for determining stable conditions.

3.2 Symbols:

3.2.1 *CHT*—cylinder head temperature.

3.2.2 *EGT*—exhaust gas temperature.

3.2.3 *inHg*—inches of mercury.

3.2.4 *MAP*—manifold absolute pressure.

3.2.5 *mmHg*—millimeters of mercury.

3.2.6 *MON*—motor octane number.

3.2.7 *PRF*—primary reference fuel.

3.2.8 *psig*—pounds per square inch gauge.

3.2.9 *rpm*—revolutions per minute.

3.2.10 *TDC*—top dead center.

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.J on Aviation Fuels.

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² *Annual Book of ASTM Standards*, Vol 05.01.