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An American National Standard



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Standard Test Method for Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry¹

This standard is issued under the fixed designation D 3701; 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 test method covers the determination of the hydrogen content of aviation turbine fuels.

1.2 Use Test Method D 4808 for the determination of hydrogen in other petroleum liquids.

1.3 The values stated in SI units are to be regarded as standard. The preferred units are mass percent hydrogen.

1.4 *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.* For a specific precautionary statement, see 6.1.

2. Referenced Documents

2.1 ASTM Standards:

D 1322 Test Method for Smoke Point of Kerosine and Aviation Turbine Fuel²

D 1740 Test Method for Luminometer Numbers of Aviation Turbine Fuels²

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products³

D 4808 Test Method for Hydrogen Content of Light Distillates, Middle Distillates, Gas Oils, and Residua by Low-Resolution Nuclear Magnetic Resonance Spectroscopy³

3. Summary of Test Method

3.1 A sample of the material is compared in a continuous wave, low-resolution, nuclear magnetic resonance spectrometer with a reference standard sample of a pure hydrocarbon. The results from the integrator on the instrument are used as a means of comparing the theoretical hydrogen content of the standard with that of the sample, the result being expressed as

the hydrogen content (percent mass basis) in the sample.

4. Significance and Use

4.1 The combustion quality of aviation turbine fuel has traditionally been controlled in specifications by such tests as smoke point (see Test Method D 1322), smoke volatility index, aromatic content of luminometer number (see Test Method D 1740). Evidence is accumulating that a better control of the quality may be obtained by limiting the minimum hydrogen content of the fuel.

4.2 Existing methods allow the hydrogen content to be calculated from other parameters or determined by combustion techniques. The method specified provides a quick, simple, and more precise alternative to these methods.

5. Apparatus

5.1 *Nuclear Magnetic Resonance Spectrometer*⁴—A low-resolution continuous-wave instrument capable of measuring a nuclear magnetic resonance of hydrogen atoms, and fitted with:

5.1.1 *Excitation and Detection Coil*, of suitable dimensions to contain the test cell.

5.1.2 *Electronic Unit*, to control and monitor the magnet and coil and containing:

5.1.2.1 *Circuits*, to control and adjust the radio frequency level and audio frequency gain.

5.1.2.2 *Integrating Counter*, with variable time period in seconds.

5.2 *Conditioning Block*—A block of aluminum alloy drilled with holes of sufficient size to accommodate the test cells with the mean height of the sample being at least 20 mm below the

⁴ This method has been written around the Newport Analyzer Mark IIIF (Oxford Analytical Instruments, Ltd., Oxford, England) and the details of the method should be read in conjunction with the manufacturer's handbook.

This particular instrument was the only instrument available when the precision program was carried out. Any similar instrument would be accepted into the above method provided the new instrument was adequately correlated and proved to be statistically similar.

The Newport Analyzer Mark IIIF is no longer in production and is being replaced by the manufacturer with the Newport 4000. The Newport 4000 model instrument has been demonstrated to provide equivalent results to those obtained with the Mark III models which were used to generate the precision data.

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 D02.03 on Elemental Analysis.

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

³ *Annual Book of ASTM Standards*, Vol 05.02.