



ASTM INTERNATIONAL  
Manual

# Aviation Fuel Quality Control Procedures

## 5th Edition

Jim Gammon, Editor





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# Aviation Fuel Quality Control Procedures: 5th Edition

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## Foreword

This publication, *Aviation Fuel Quality Control Procedures: 5th Edition*, is sponsored by ASTM Subcommittee J on Aviation Fuels, Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants. It provides guidance on common procedures used to assess and protect aviation fuel quality. Even though the manual was not subject to full Society consensus balloting, a ballot vote by task force members of Subcommittee J was conducted before publication. The task force members who wrote or reviewed this manual are listed in the introduction.

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## Introduction

This manual is sponsored by ASTM International Subcommittee J on Aviation Fuels, Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants. It was written and reviewed by a task force under Section 5 on Fuel Cleanliness. The following task force membership represents a broad spectrum of interests, including oil companies, airlines, pipeline companies, third-party refueling companies, filter companies, fueling vehicle builders, consultants, aviation product distributors, and other aviation-associated organizations.

This manual provides guidance material on common procedures that are used to assess and protect aviation fuel quality. Aviation fuel, by its unique use, is one of the most carefully controlled petroleum products, and therefore, it is required to meet exacting fuel-quality standards. In many cases, the field procedure or test method listed herein is a simplified version of the corresponding ASTM method or standard practice. It should be emphasized that the formal ASTM standard method supersedes the instructions given in this publication. In other cases, when there is no ASTM procedure, a non-ASTM procedure is included to make this publication as complete a reference as possible. Some of the procedures have resulted from practical experience in dealing with numerous airport systems.

This document explains a number of ASTM test methods used as field tests. For a complete list of methods used to qualify an aviation fuel, reference should be made to the pertinent ASTM fuel specification.

Obviously, not all field situations can be predicted. However, the purpose of presenting the extra information is to acquaint

the reader with as many aspects of aviation fuel handling as possible. It is the intent of this publication to provide sufficient information for fuel handlers to make an informed approach to aviation fuel quality. In particular, this manual should be useful to third-party refueling organizations and independent fixed base operators.

Ballot vote by members of ASTM Committee D02, Subcommittee J, was required for publication of this manual. However, the methods in this manual were not subjected to full Society consensus; therefore, these methods have not been subjected to collaborative study (round-robins). Detailed information can be obtained from the unabridged methods referenced throughout the manual. All methods in the manual will be periodically reviewed by the subcommittee.

The procedures presented in this manual may involve hazardous materials, operations, and equipment. This manual does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to consult and establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

### SCOPE

This document is produced to provide both procedures and educational information regarding the handling of aviation fuels at the airport. Some elements of this document may also be applied to fuel handling at terminals and refineries. This document is not a specification. As a reference, it is not meant to cover any subject in its entirety.



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## Glossary

**adsorption.** A separation method in which certain components are concentrated on the surface of a porous solid. Surfactants (surface active agents) are separated from jet fuel by adsorption on clay.

**ambient temperature.** The air temperature surrounding a specific area.

**API gravity.** The U.S. petroleum industry's scale and method of measuring density of petroleum products at a given temperature.

**aviation gasoline (avgas).** Specially blended gasoline used to power reciprocating piston aircraft engines.

**clay treater.** A treating unit that uses activated clay (Fuller's earth) to remove surfactants from turbine fuel.

**coalescence.** The property of a filter cartridge to bring together fine droplets of free and entrained water to form large droplets that are heavy enough to fall to the bottom of the filter/separator vessel.

**contaminants.** Substances, either foreign or native, that may be present in fuel that detract from its performance.

**cyclone separator.** A device that uses the principle of centrifugal force to cause the contaminant in a fuel to settle to the bottom of the vessel without the use of filter media.

**density.** The amount of mass (weight) in a unit volume of a material at a given temperature.

**differential pressure (Delta P).** The measured difference in pressure between any two points, generally at the inlet and outlet of a filter, monitor, or a filter separator.

**disarming action.** As applied to filter/separators, the rendering of the elements incapable of performing their designed functions; for example, coalescer elements incapable of coalescing water and separator elements incapable of separating water from fuel.

**dissolved water.** Water that is in solution in the fuel. This water is not free water and cannot be removed by conventional means or measured by field equipment.

**effluent.** Stream of fluid at the outlet of a filter or filter/separator. This is the opposite of influent.

**emulsion.** Liquid dispersed in another, immiscible liquid, usually in the form of droplets. (Two liquids, which will not dissolve completely into one another, mixed so that one appears as fine drops in the other.)

**entrained water.** Small droplets of free water in suspension that may make fuel appear hazy.

**filter.** Generic term for a device to remove contaminants from fuel.

**filter membrane (millipore) test.** A standard test in which fuel is passed through a fine filter membrane housed in a plastic holder. The cleanliness of the fuel can be determined by examining the membrane.

**filter/separator.** A mechanical device used to remove entrained particulate contaminants and free water from a fuel.

**fixed base operator (FBO).** Common title for aviation fuel dealer at the airport.

**flash point.** The lowest fuel temperature at which the vapor about the fuel can be ignited by an outside ignition source.

**floating suction.** A floating device used in a tank for drawing product from the upper level of the fuel.

**free water.** Water in the fuel other than dissolved water. Free water may be in the form of droplets or haze suspended in the fuel (entrained water), a water layer at the bottom of the container holding the fuel, or both. Free water may also exist in the form of an emulsion that may be so finely dispersed as to be invisible to the naked eye.

**freezing point (fuel).** The lowest fuel temperature at which there are no solid phase wax crystals.

**haze.** Undissolved free water dispersed in fuel that is visible to the eye (usually more than 30 ppm in jet fuel). Fuel appears hazy or cloudy, that is, *not* clear and bright.

**hydrophilic.** Water accepting or water wettable.

**hydrophobic.** Water repelling; lacking affinity for water.

**immiscible.** Liquids that are mutually insoluble. (Will not dissolve into one another.) This is the opposite of miscible.

**influent.** Stream of fluid at the inlet of a filter or filter/separator. This is the opposite of effluent.

**metric density.** Weight of a liquid measured in kilograms per cubic metre at a given temperature.

**micron ( $\mu\text{m}$ ).** A unit of linear measurement. One micron is equal to  $10^{-6}$  m, or 0.00039 in., and approximately 25,400/ttm equals 1 in. For example, the average human hair is about 100  $\mu\text{m}$  in diameter.

**miscible.** Liquids that are mutually soluble. This is the opposite of immiscible.

**monitor.** A device that shows or gives warning of improper performance (noun); or to test or check performance on a continuing basis (verb).

**particulate matter.** Solid contaminants (e.g., dirt, rust, scale, sand, and so forth) sometimes found in fuel.

**prefilter.** A filter that has a high dirt-holding capacity that is installed upstream of other filtration equipment.

**pressure drop.** See **differential pressure**.

**relative density (specific gravity).** In fuel, this is the ratio of the weight of any volume of fuel to the weight of an equal volume of water.

**settling time.** The time allowed for water or dirt entrained in the fuel to drop to the bottom of the storage tank.

**slime.** Soft, jelly-like substance.

**specific gravity.** See **relative density**.

**sump.** A low point in a system for collection and removal of water and solid contaminants.

**surfactants (surface active agents).** Chemical substances that make it difficult to separate fuel and water and that disarm filter/separators.

**suspended water.** Undissolved free water that is so finely dispersed as to be invisible to the naked eye. See **haze**.

**synthetic separator.** Separator made of media that is synthetic mesh material with chemically bonded hydrophobic treatment.

**thief (sump) pump.** A small pump having a suction line that extends to the low point of a tank for the purpose of drawing off water that may have accumulated.

**turbine fuel.** A group of various kerosine (or more rarely, wide-cut) fuels used to power aircraft turbine engines.

**water slug.** A large amount of free water.

