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DEPARTMENT OF DEFENSE
STANDARD PRACTICE

STORAGE, HANDLING, AND SERVICING OF AVIATION FUELS, LUBRICATING OILS, AND HYDRAULIC FLUIDS AT CONTRACTOR FACILITIES

AMSC N/A

FSC 91GP

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FORWARD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense (DOD).

2. Comments, suggestions, or questions on this document should be addressed to DET 3, WR-ALC/AFTH, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB OH 45433-7632 or e-mailed to AFPET.AFTH@wpafb.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

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1. SCOPE

1.1 Scope. This standard establishes the minimum performance and quality requirements for the storage, handling, and servicing of aviation fuels, lubricating oils, and hydraulic fluids at contractor owned/operated aircraft maintenance facilities.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-791	Lubricants, Liquid Fuels, and Related Products; Methods of Testing

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble
MIL-PRF-52308	Filter-Coalescer Element, Fluid Pressure
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4, JP-5
MIL-DTL-83133	Turbine Fuels, Aviation, Kerosene Types, NATO F-34 (JP-8), NATO F-35, and JP-8 + 100
MIL-DTL-85470	Inhibitor, Icing, Fuel System, High Flash NATO Code Number S-1745

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-161	Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

MILITARY STANDARD

MS24484	Adapter, Pressure Fuel Servicing, Nominal 2.5 Inch Diameter

(Copies of these documents are available online at http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

TECHNICAL ORDER

42B-1-1	Quality Control of Fuels and Lubricants
37-1-1	General Operation and Inspection of Installed Fuel Storage and Dispensing Systems

(Copies of these documents are available online at https://afpet.wpafb.af.mil/ or from DET 3, WR-ALC/AFTT, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB OH 45433-7632.)

UNIFIED FACILITIES CRITERIA

UFC 3-460-03	Operation and Maintenance: Maintenance of Petroleum Systems

(Copies of these documents are available online at http://dod.wbdg.org/)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN PETROLEUM INSTITUTE (API)

API-STD-1529	Aviation Fueling Hose
API-STD-1542	Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage and Mobile Fueling Equipment
API/IP SPEC 1581	Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators
IP SPEC 1583	Specification and Laboratory Tests for Aviation Fuel Filter Monitors with Absorbent Type Elements

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://www.api.org or from the American Petroleum Institute, 1220 L Street, Northwest Washington DC, 20005-4070.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS, INC. (ASTM)

ASTM D910	Standard Specification for Aviation Gasolines
ASTM D2276	Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling
ASTM D2624	Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
ASTM D3240	Standard Test Method for Undissolved Water in Aviation Turbine Fuel
ASTM D3241	Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels
ASTM D4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D4171	Standard Specification for Fuel System Icing Inhibitors
ASTM D4177	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products
ASTM D4306	Standard Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination

ASTM D5001	Standard Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-On Cylinder Lubricity Evaluator (BOCLE)
ASTM D5006	Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels
ASTM D5452	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
ASTM D5854	Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products

(Copies of these documents are available online at http://www.astm.org or the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959.)

AIR TRANSPORT ASSOCIATION (ATA)

ATA SPEC 103	Standards for Jet Fuel Quality Control at Airports

(Copies of these documents are available online at http://www.air-transport.org or from the Air Transport Association of America, 1301 Pennsylvania Ave. NW, Suite 1100, Washington, DC 20004.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

BS EN 1361	British Standard Specification for Rubber Hoses and Hose Assemblies for Aviation Fuel Handling

(Copies of these documents are available online at http://www.bsonline.bsi-global.com or from the British Standards Institution, No. 2 Park Street, London WIA 285, England or from the American National Standards Institute, 11 West 42nd St., New York, New York 10036.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 407	Standard for Aircraft Fuel Servicing

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://www.nfpa.org or from the National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.)

SOCIETY OF AUTOMOTIVE ENGINEERS

SAE ARP5818	Design and Operation of Aircraft Refueling Tanker Vehicles
SAE AS5877	Detailed Specification for Aircraft Pressure Refueling Nozzle

(Copies of these documents are available online at http://www.sae.org or from the Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA USA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Bulk storage system. Bulk storage systems consist of above or below ground storage tanks equipped for receiving and transferring product to truck fillstands and hydrant system operating tanks.

3.2 Conductivity additive. A conductivity additive is added to, JP-8, and at some locations JP-5, turbine fuel to decrease the time required to relax any electrical charge accumulated in the fuel during movement, pumping or filtration. The usual concentration of this additive is one or two parts per million (PPM). The conductivity level of the fuel on receipt at the using facility should be between 150 and 450 picosiemens or conductivity units (CU). Fuel serviced to aircraft should be between 50 and 700 CU. Commercial jet fuel procured outside the U.S. is usually supplied with conductivity levels between 50 and 450 CU.

3.3 Corrosion inhibitor/lubricity improver. This additive, conforming to MIL-PRF-25017, is required in JP-5 and JP-8 fuel to inhibit corrosion of steel surfaces in contact with fuel. Corrosion inhibitor also provides added lubricity to fuel for more effective operation of aircraft fuel components such as pumps and fuel controls. Since there are several qualified manufacturers of inhibitors, the amount blended into the fuel depends on the type used. This is governed by the Qualified Products List (QPL) for MIL-PRF-25017 and ranges from a minimum of 3.15 pounds to a maximum of 11.03 pounds per 1000 barrels of jet fuel.

3.4 Filter differential pressure. The decrease in pressure as measured from the inlet to the outlet of a filter vessel.

3.5 Filter vessel. A cylindrical vessel housing filter elements (either coalesced/separator or absorption type) designed for removing solid contaminants and free water from fuel.

3.6 Fuel. Aviation gasoline or aviation turbine fuels.

3.7 Aviation turbine fuels.

3.7.1 JP-5 (NATO F-44). JP-5 is a high flash point (>140°F) aviation turbine fuel. It is the primary fuel for naval aircraft and is used in aircraft of all services operating off of Navy ships. It is procured to the requirements of MIL-DTL-5624. JP-5 contains both fuel system icing inhibitor and corrosion inhibitor.

3.7.2 JP-8 (NATO F-34). JP-8 is the standard fuel for US Army and USAF turbine engine powered aircraft and for some shore based Navy aircraft. This fuel is similar to commercial Jet A-1 with the addition of corrosion inhibitor, fuel system icing inhibitor and conductivity additives. It is procured to meet MIL-DTL-83133. JP-8 is the standard fuel for NATO use in Europe.

3.7.3 JP-8+100 (NATO F-37). JP-8 containing a thermal stability additive is referred to as JP-8+100 (NATO F-37). The additive improves the thermal stability of JP-8 by approximately 100°F. It reduces aircraft engine nozzle injector coking and is used primarily in fighter/trainer and selected helicopter and C-130 aircraft. For downgrading/blending procedures involving JP-8+100 contact DET 3, WR-ALC/AFTH at (937) 255-8070, DSN 785-8070, for guidance.

3.8 Fuel system icing inhibitor (FSII). FSII conforming to MIL-DTL-85470 (diethylene glycol monomethyl ether – DIEGME) is added to JP-5 and JP-8 to inhibit the formation of ice.

3.9 Gauge pressure. Fuel pressure measured by a pressure measurement device containing a scale calibrated in pressure units, such as kilo pascals (kPa) or pounds per square inch (psi).

3.10 Hydrant servicing units. Hydrant hose trucks or hose carts, equipped with filtration, used in conjunction with hydrant systems to service aircraft.

3.11 Intragovernmental transfer. Transfer of fuel from a government-owned location to another government-owned location.

4. GENERAL REQUIREMENTS

4.1 Safety summary. The following are general safety precautions and instructions that people must understand and apply during many phases of operations in fuel handling and laboratory operations to ensure personal safety and health and the protection of Air Force property.

WARNING AND CAUTION STATEMENTS

Practices or conditions considered essential to the protection of personnel are identified by a (WARNING). Procedures essential to the protection of equipment or property are identified by a (CAUTION). WARNING and CAUTION statements have been placed throughout this text prior to the performance of the affected step in the operation of procedure. A WARNING and CAUTION will apply each time the related step is repeated. Prior to starting any task, the WARNING or CAUTION included in the text for that task should be reviewed and understood.

SPECIAL CARE FOR CLEANERS/CHEMICALS

Keep cleaners/chemicals in approved safety containers and in minimum quantities. Some cleaners/chemicals may have an adverse effect on skin, eyes, and respiratory tracts. Observe manufacturer WARNING labels and current safety directives. Use cleaners/chemicals only in authorized areas. Discard soiled cloths into safety cans.

PERSONAL PROTECTIVE EQUIPMENT

The use of personal protective equipment is mandatory to ensure compliance with Occupational Safety and Health Administration, Department of Labor and standard safety practices.

4.2 Product quality. Acceptable quality of fuels delivered to U.S. government aircraft shall be as follows:

a. The fuel shall conform to the applicable product specification.

b. Fuel delivered to aircraft will not contain more than 0.5 mg/liter or 2.0 mg/gal of total solids. Determination shall be made on the basis of solids retained on a 0.8 micron membrane filter. The filter will be evaluated either by weight or by comparing it to the color and particle assessment guide.

c. There shall be no evidence of free water when the fuel is examined visually. Aircraft shall not be serviced with jet fuel containing more than10 PPM of water as determined by the Gammon Aqua Glow or AEL free water methods or their equivalent.

d. When the fuel specification requires FSII, fuel serviced to the aircraft shall contain a minimum concentration of 0.07 percent by volume and a maximum of 0.20 percent.

e. Where conductivity additive is required, the conductivity level serviced shall be between 50 and 700 CU.

4.3 Contamination. Fuel contamination is generally categorized as chemical, biological or material.

a. Chemical Contamination. This type of contamination results from the mixing of two hydrocarbon fuels or contact of other chemicals with the fuel. The chemical and physical properties of the fuel are effected. This type of contamination is usually detected by laboratory testing. Chemical contamination is prevented by isolating fuels in separate handling systems or positive physical separation between systems; and by alertness of operation personnel. Carelessness is the major contributing factor for this type of contamination.

b. Biological Contamination. This contamination results from growth of bacteria and fungi. The micro-organisms are found in water deposits in the systems. Growths of organisms reach a consistency of a “slime” or “mayonaise” material that extends into the fuel. This can result in contamination of aircraft by plugging filters, causing fuel quantity probe malfunctions, and contributing to corrosion of integral fuel tanks. To most effectively control biological contamination, remove water from the system.

c. Material Contamination. Material contamination of fuels usually consists of water or sediment.

4.4 Water. Water is usually present in all systems. It may be delivered to tanks during receipt of product or through leaks which permit entry of surface or ground water. It may also be introduced as vapor which condenses within the system. Both fresh and salt water can be found in fuel systems. It may be present as dissolved, entrained, or free water.

4.5 Sediment. Sediment appears as dust, powder, grains, flakes, and stains. Sources of solids or sediment include storage tanks, ferrous vessels or containers, filter or filter/separator elements, valves, pumps, meters, pipelines, hoses, grease, gaskets, diaphragms, and seals. Removal of particles in the 150 micron and larger size is accomplished with the use of screens, filters and filter/separators.

4.6 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

5. DETAILED REQUIREMENTS

5.1 Fuel equipment.

5.1.1 Storage and handling system. Each grade of product shall be received, stored, and issued in a segregated system. Systems and components used for receiving, storing and refueling aircraft shall be approved commercial systems designed specifically for aviation fuel use. Fuel system design guidance and restrictions on use of certain metals for components exposed to the fuel are detailed in ATA 103 and NFPA 407. Metals such as zinc and copper are limited primarily to protect the thermal stability property of fuel.

5.1.2 Receipt strainers. Strainers with various size openings are used as required in United Facilities Criteria (UFC) 3-460-03. Clean and inspect fixed equipment strainers in accordance with UFC 3-460-03 and TO 42B-1-1.

5.1.3 Receipt filtration. Where fuel is received directly from the supplier by pipeline, barge, of tanker, fuel must be filtered.

5.1.4 Storage tanks. Storage tanks shall be inspected and cleaned in accordance with UFC 3-460-03 and T.O. 37-1-1.

5.1.5 Refueling truck product tank. The refueling truck product tank shall be constructed in accordance with SAE ARP 5818.

5.1.6 Filtration. Aviation fuel must pass through two separate filter separator vessels downstream of bulk storage, with at least one filtration downstream of operating tanks (TO 42B-1-1).

NOTE:

Fuel absorption filters/monitors are not authorized for servicing USAF aircraft.

5.1.6.1 Filtration with operating tanks. The filters shall meet the performance requirements of API/IP-SPEC-1581 or MIL-PRF-52308. Filtration equipment shall be rated equal to or greater than the pumping capacity of the system. Filtration equipment shall be designed so that bypass is not possible.

5.1.6.2 Filtration element replacement. Replacement of elements in filtration equipment is required in accordance with T.O. 37-1-1 and UFC 3-460-03.

5.1.6.3 Draining Filter Separator Sumps. Drain all fixed and mobile filter separator vessels under pressure daily when used in accordance with T.O. 42B-1-1. Inspect the product drained from the sumps for the presence or water or a thick gelatinous substance.

5.1.7 Differential pressure. Filtration equipment shall be equipped with differential pressure gauges. The differential pressure and flow rate across each micronic filter and filter separator shall be observed daily when used and recorded weekly.

5.1.8 Pressure gauges. Reliability of pressure and differential pressure gauges is critical to the support of aircraft refueling operations. Gauges employed in this type of service will be in calibration at the start of contract and annually from the calibration date. Piston type pressure differential gauges require no calibration provided the piston returns to zero under no flow conditions. Refer to manufacturer's maintenance manual for troubleshooting and correcting problems that occur with differential gauges.

5.1.9 Meters. Meters shall be used for quantity determination of fuel delivered to aircraft. Meters shall be calibrated to an accuracy of ± ½ gallon per 100 gallons dispensed. Meters will be in calibration at the start of contract and annually from the calibration date.

5.1.10 Hoses and couplings. Fuel hoses and couplings shall comply with the requirements of API-STD-1529 or BS EN 1361.

5.1.11 Aircraft refueling nozzles. Two types of aircraft refueling nozzles are in use: gravity refueling (also known as overwing refueling nozzles) and single point refueling (also known as pressure or underwing refueling nozzles). All aircraft refueling nozzles shall be equipped with 40 mesh or finer screens that can be readily removed for inspection or cleaning. Aircraft refueling nozzle screens shall be removed, inspected and cleaned monthly. Single point nozzles shall meet the requirements of SAE AS5877 and mate to the standard aircraft fueling receptacle (MS24484).

5.1.12 Identification markings.

5.1.12.1 Fuel handling equipment. Fixed and mobile equipment should be marked in accordance with API-STD-1542 or MIL-STD-161.

5.1.12.2 Packaged products. All packaged lubricating products and hydraulic fluids are marked and identified at origin to indicate name of manufacturer, origin, nomenclature and grade, specification, batch and QPL number, lot number, date filled and NSN. Product not identified in this manner will not be serviced to government aircraft.

5.1.13 Continuity resistance. The electrical continuity of bonding reel/cable assemblies on servicing units shall be checked with a voltage/ohm meter (multi-meter) at the beginning of the contract period and every six months thereafter. Resistance, measured from the plug or clamp on the cable to the frame of the refueling equipment, shall be 10 ohms or less.

5.2 Operations.

5.2.1 Fuel tanks with water bottoms. The use of fuel tanks with water bottoms is prohibited. Fuel storage tanks shall have sumps for collection and draining of accumulated water. These sumps shall be checked and drained daily or prior to issue and more often where heavy rainfall is experienced and the storage tanks are of the open floating roof design.

5.2.2 Tank product change. The change of product service from aviation gasoline to jet fuel, or vice versa, does not in itself require tank cleaning. Refer to para 5.1.4 for tank cleaning requirements.

5.2.3 Settling time. Aviation fuel received into bulk storage or operating tanks must be allowed to settle in accordance with requirements called out in TO 42B-1-1.

5.2.4 Servicing of drummed product. Drums containing aviation fuel should be stored on their sides, bung side up. Aviation fuel issued from drums to a refueling truck or directly to an aircraft must pass through a filter separator.

5.2.5 Line displacing procedures. Displace fuel in pipeline systems if the system is inactive for over 30 days. Such action shall preclude the deterioration of fuel and protect against corrosion. Quantity to be displaced is twice the contents of the pipeline.

5.2.6 Handling of lubricants and hydraulic fluids.

5.2.6.1 Turbine engine lubricating oil. Turbine engine lubricating oils are normally furnished in 55-gallon, 1-quart, and 8 ounce containers. Aircraft engine oils will be stored inside a general-purpose warehouse.

5.2.6.1.1 Cans. Hermetically sealed 1-quart cans will be serviced directly to aircraft by using the puncture type opener with spout. Proper opening devices should be used in all cases to prevent contamination of the oil. Screwdrivers and other maintenance tools shall not be used to open hermetically sealed cans. Opening devices will be protected from airborne dirt and dust by storing in a plastic bag or similar devices when not in use.

5.2.6.1.2 Drums. Turbine engine lubrication oil furnished in 55-gallon drums may be serviced directly to engines through a 100 mesh screen. Drums of oil will be stored on their sides with bungs flooded prior to opening. After drums have been set upright and bungs have been opened, drums will be stored indoors or covered with appropriate cover to prevent water and solid debris from contaminating the oil. When not in actual use to service turbine engines, all openings to the drum will be tightly closed. Servicing nozzles will be protected from contamination by use of caps, plastic covers or other similar devices.

5.2.6.1.3 Equipment other than cans or drums. For turbine engine servicing equipment other than cans or drums, the requirements of individual aircraft technical orders will apply to specialized aircraft servicing equipment.

5.2.6.2 Reciprocating engine oil. Reciprocating engine oil is furnished in 55-gallon drums and 1-quart containers.

5.2.6.2.1 Drums. Reciprocating engine oil furnished in 55-gallon drums will be stored on their sides with the bungs flooded prior to opening. After opening, drums will be stored inside buildings or protected from external contamination by covers. Reciprocating engine oil will be serviced to aircraft through nominal 60 mesh screens.

5.2.6.2.2 Cans. Reciprocating engine oil furnished in 1-quart containers may be serviced to aircraft without further filtration. The puncture type opener with spout will be used in all cases. Screwdrivers and other maintenance tools shall not be used for opening hermetically sealed cans. Opening devices will be protected from airborne dirt and dust by storing in a plastic bag or similar device when not in use.

5.2.6.3 Aircraft hydraulic fluid. Aircraft hydraulic fluid is normally furnished in 1-quart, 1-gallon, 10-gallon, and 55-gallon drums.

5.2.6.3.1 Cans. Servicing hydraulic fluid to aircraft may be direct from the 1-quart or 1-gallon cans. In each instance, only puncture type openers with spout will be used. Maintenance tools such as screwdrivers will not be utilized for this purpose. Openers will be protected from contamination by storing in a plastic bag or other similar device when not in use.

5.2.6.3.2 Drums. Hydraulic fluid furnished in 10-or 55-gallon drums will not be serviced to aircraft except through specialized servicing equipment. Such equipment will contain a nominal 5 micron filter in the servicing system. Servicing connections will be protected from external contamination by covering hose ends with plugs or caps and placing connection in plastic bags.

5.2.6.3.3 Unused fluid. Unused portions of 1-quart or 1-gallon containers of hydraulic fluid or engine lubricating oil will be discarded or transferred to servicing equipment.

5.3 Safety requirements. The safety requirements specified in NFPA 407 or the equivalent national document shall apply. Local fire and accident prevention regulations and requirements including the following shall be complied with:

a. Smoking and/or open flames or sources of ignition shall be prohibited within 15 meters (50 feet) of fuel operations.

b. Areas where aircraft are serviced shall be kept free of combustible materials. Refueling equipment compartments and surfaces shall be kept free of debris, accumulated oil, grease, and fuel. These areas shall be kept clear of objects that can be ingested by engines.

c. Servicing personnel shall be trained how to use fire extinguishers and in the procedures to follow in the event of fire.

d. At least two serviceable, charged fire extinguishers shall be available in the immediate vicinity of each servicing operation. Access to the fire extinguisher shall be unobstructed. Minimum sizes and types shall be specified and approved by the fire department and shall be designed for extinguishing flammable liquids with a minimum discharge time of not less than 25 seconds.

e. The fuel servicing operator shall remain at the fuel servicing equipment and continuously observe the equipment and aircraft for fuel leaks. Servicing operations shall be stopped whenever a leak or deficiency of a hazardous nature is detected.

f. Aircraft with an operating radar or radio shall not be serviced. Likewise, aircraft shall not be serviced when there are electrical storms within a five-mile radius.

g. Servicing personnel shall not wear 100 percent nylon outer garments and shall not remove or put on clothing during servicing.

5.4 Quality assurance at contractor facilities. The purpose of this section is to establish minimum quality procedures required to deliver clean, dry fuel to aircraft on a continuing basis. The contractor is required to maintain written quality control procedures covering (1) source of fuel supply, (2) receiving, (3) storing, (4) servicing, (5) sampling and testing, (6) calibration of measuring and test equipment, (7) safety, (8) maintenance, (9) reports and (10) corrective actions.

5.4.1 Sample submission. The contractor is required to obtain, package and ship samples of each grade of aviation fuel to a testing laboratory designated in the contract. The sample size shall be one gallon for each grade of fuel handled and must be accompanied by a completed DD Form 1222. For turbine fuel, the frequency of sample submission shall be at the beginning of each contract period and once every three months thereafter. For aviation gasoline, the frequency of sample submission shall be at the beginning of each contract period and once every six months thereafter. Samples may be submitted to an Aerospace Fuels Laboratory any time doubt exists as to the quality or identity of petroleum products in storage or use. These samples will be authorized by the Quality Assurance Representative with fuel surveillance responsibility at that facility.

5.4.1.1 Sample container. Samples shall be taken in an epoxy coated can suitable for thermal stability testing as defined in ASTM D4306. Sample containers should be flushed 3 times with the container 10 to 20 percent filled with the same product being sampled.

5.4.1.2 Sample location. The sample to be submitted for testing shall be taken during flow downstream of the last filtration vessel prior to the aircraft or engine test cell.

5.4.1.3 Analysis of sample. The analysis of turbine fuel samples at testing laboratories shall consist of flash point, freeze point, thermal stability, Ball-On Cylinder Lubricity Evaluator (BOCLE) in accordance with ASTM D5001and FSII in accordance with ASTM D5006 if contract requires FSII to be in fuel. The thermal stability property shall be performed in accordance with ASTM D3241 and have a heater tube temperature of 260°C. The analysis of aviation gasoline samples shall consist of distillation, vapor pressure, copper strip corrosion and freeze point.

5.4.2 Sampling requirements. The validity of test results is greatly influenced by sampling procedures; see Table 1 for requirements. The basic principle of any sampling procedure is to obtain a sample or composite of several samples in such a manner that the sample to be submitted for testing will be truly representative of the product.

5.4.3 Sampling procedures. For sampling procedures, see the API Manual of Petroleum Measurement Standards, Chapter 8 or ASTM methods D4057, D4177, D5854 and T.O. 42B-1-1.

5.4.4 Sample size. In general, all samples of aircraft reciprocating engine fuels and jet engine fuels will be a minimum quantity of one gallon. Samples of engine lubricating oils and other liquid petroleum products will be a minimum quantity of one gallon. Grease samples will be five pounds in size and should be submitted in original package, if possible. Sample quantities larger than those mentioned are not necessary, but are acceptable.

5.4.5 Questionable quality products. Samples will be submitted to an Aerospace Fuels Laboratory any time doubt exists as to the quality or identity of petroleum products in storage or use. These samples will be authorized by the Quality Assurance Representative with fuel surveillance responsibility at that facility.

5.4.6 Disposal of samples. Unused portions of fuel samples must be accumulated in an approved container, such as a metal drum. The container should be appropriately labeled, segregated from other lab products, and kept away from sources of ignition. Return unused portions of fuel samples to storage or dispose of them in accordance with the installation recoverable and waste petroleum products management program. Every effort will be made to use this product for its original purpose.

Fuel samples containing petroleum ether used for rinse purposes should not be considered as waste fuel. This product should be returned to storage unless otherwise contaminated.

5.4.7 Aircraft defueling. Before starting the defuel operation, determine the type of fuel contained in the aircraft. Aircraft sumps shall then be drained to discard water and excess sediment. Defueled product should be returned to the aircraft if there is no reason to suspect contamination. If fuel cannot be returned to the aircraft, follow the defuel/servicing clause in the contract. When returned to aircraft, fuel must pass through a filter separator.

5.4.8 Change of product grade. In the event of a product change from jet fuel to aviation gasoline or vice-versa, contact the applicable Service Control Point (SCP)for instructions.

5.4.8.1 Controls and marking. Change the servicing controls and the unit markings as necessary to reflect the grade of fuel.

5.4.9 Records and quality checks required.

a. Tank cleaning (see 5.1.4).

b. Filter element replacement (see 5.1.6.2).

c. Daily differential pressure checks across filtration equipment and weekly recording (see 5.1.7).

d. Yearly calibration of meters and pressure gauges (see 5.1.8 through 5.1.9).

e. Monthly cleaning of nozzle screens on servicing equipment (see 5.1.11).

f. Beginning of contract period and six month continuity check of bonding reel/cable assemblies on servicing units (see 5.1.13).

g. Daily draining of storage tank sumps (see 5.2.1).

h. Maintain written quality control procedures (see 5.4).

i. Beginning of contract period and every three months for testing of turbine fuel downstream of last filtration vessel (see 5.4.1).

j. Beginning of contract period and every six months for testing of aviation gasoline downstream of last filtration vessel (see 5.4.1).

k. Daily draining of filtration equipment sumps (see 5.1.6.3).

m. Daily draining of refueler tank sumps (see 5.1.6.3).

n. Testing required in Table I (see 5.4.2).

5.5 Additive blending.

5.5.1 Handling precautions. The following precautions are recommended when handling any of the fuel additives:

a. Protective butyl rubber gloves and goggles shall be worn when handling fuel additives. An air purifying respirator is not required when handling undiluted FSII in an outdoor environment.

b. Skin contact with fuel additives should be avoided, but in the event of exposure the additive should be removed with soap and water.

c. In the event of eye contact, immediately flush the eyes with water. Continue flushing for 15 minutes and seek medical help as soon as possible.

d. When the additive is diluted with jet fuel the health hazards are significantly reduced.

5.5.2 Methods of blending. The two basic methods for putting additives into fuel are hand doping and use of a proportional injector. In all cases where hand doping is performed, the additive should first be diluted with fuel. The greater the dilution, the easier it is for the additive to be mixed properly. The preferred method is proportional injection using a fuel driven design. This type injects additives proportionately at various flow rates. The addition of fuel additives by hand doping shall only be accomplished in either bulk storage tank (see 5.5.2.1) or the product tanks of refueling trucks (see 5.5.2.2). Refer to Appendix A in T.O. 42B-1-1 for further guidance.

5.5.2.1 Bulk storage tank. Blending additives into bulk airfield tanks can be done by pouring the required quantity of additive into the tank heel followed by the receipt. The required quantity of additive may also be added to delivery tank trucks prior to unloading these trucks into the bulk system. In the case of static dissipator additive, typically an 8,000 gallon tank truck requires approximately 30 ml of the neat additive.

5.5.2.2 Product tanks of refueling trucks. Blending into the product tank of refueling trucks can be performed by introducing the required amount through the top hatch using a funnel and a length of hose with one end submerged below the surface of the fuel. This is best done filling the product tank approximately one third full, pouring the additive via the funnel, and then filling the product tank to capacity. Wait approximately 10 minutes and then circulate at least 100 percent of the product before servicing to aircraft. If additives are put into a full refueler, circulate at least 150 percent of the refueler capacity prior to issue.

5.5.2.3 Adding FSII to tanks. FSII shall not be added to fuel in either bulk storage or refueling truck product tanks. FSII will not blend properly into fuel using hand doping techniques. Improperly blended FSII can cause damage to aircraft fuel tanks. Damage to fuel storage tanks and handling equipment may also occur.

5.5.2.4 Adding FSII during refueling. FSII may be added using the 590 ml (20 ounce) aerosol can during overwing (gravity) refueling. Determine the fuel load and calculate the amount of additive required. It should be added gradually during filling to permit proper blending in the fuel. One can of aerosol additive will treat 840 liters (222 gallons) of fuel to 0.07 percent by volume. It is possible to over treat fuel with FSII by this technique. Fuel that has been over treated will cause damage to aircraft fuel tanks.

6. NOTES

WARNING

Protective butyl rubber gloves shall be worn when handling fuel additives, corrosion inhibiter/lubricity, Improver (CI/LI), conductivity improver (SDA), thermal stability improver (+100 additive), and FSII. Fuel additives are combustible and toxic. They are harmful if inhaled or absorbed through the skin and causes eye irritation. In laboratory animal studies, birth defects and adverse effects on pregnancy have been observed and prolonged and repeated exposure has caused damage to male reproductive organs. Before handling fuel additives, consult appropriate safety and occupational health authorities.

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The purpose of this standard is to ensure government aircraft are provided specification fuel, lubricating oils, and hydraulic fluids at aircraft maintenance facilities where a US Government Contract is in force.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this standard.

b. When this standard is used in acquisition, the applicable issue of the DoDISS must be cited in the solicitation (see 2.2.1 and 2.3).

6.3 Subject term (key word) listing.

Additive blending
Fuel equipment
Quality assurance requirements

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

TABLE I. Sampling requirements and test limits.

ITEM	SAMPLE POINT	TEST	TEST LIMITS	SAMPLE FREQUENCY
1.	**Pipeline receipts.**			
1a.	Pipeline header upstream of any filtration.	Visual for color, water and solids.	Clear and bright without visual solids or free water.	Each receipt, 1 hour after start, after line displacement, and at each 4 hour interval thereafter.
		Solids. ASTM D5452	See Table II.	Each receipt, one hour after start, after line displacement and at each six-hour interval thereafter.
		FSII.	0.07 – 0.20 percent.	
		Conductivity.	50 – 700 CU.	
		Filtration Time.	20 minutes.	
		Flash Point.	See Table II.	Any time after line displacement.
1b.	Downstream of filter separator if installed.	Solids/DP. ASTM D5452.	4.0 mg/gal.	Every 7 days or next receipt. Take one downstream sample in conjunction with any one of the upstream samples, compare the results.
		Filtration Time.	15 minutes.	
2.	**Tank Truck/Car Receipts.**			
2a.	Receiving header upstream of any filtration.	Solids. ASTM D5452.	4.0 mg/gal when receiving direct from a refinery or a destination contract. 6.0 mg/gal on Intragovernmental transfers.	One sample daily from one T/T or T/C from each supplier.
		FSII.	See Table II.	
		Conductivity.	See Table II.	
		Filtration Time.	See Table II.	
		Flash Point.	See Table II.	
2b.	Downstream of filter separator if installed.	Solids/DP. ASTM D5452.	4.0 mg/gal.	Every 7 days or next receipt. Take one downstream sample in conjunction with any one of the upstream samples, compare the results.
		Filtration Time.	15 minutes.	

TABLE I. Sampling requirements and test limits – Continued.

ITEM	SAMPLE POINT	TEST	TEST LIMITS	SAMPLE FREQUENCY
3.	**Storage tanks.**	Conductivity.	50 – 700 CU.	Every 14 days.
		FSII.	0.07 – 0.20 percent.	Every 14 days.
4.	**Refueling truck fillstand.** Downstream of filter separator.	Solids/DP.	Note 1	Every 7 days. If fillstand is inactive for more than one week, sample during the first refueler fill. Sample during first refueler fill after F/S elements are changed.
		Color and particle assessment method (ASTM D2276 Appendix 3)		
		Matched Weight monitor (ASTM D2276)	4.0 mg/gal	
		Bottle Method (ASTM D5452)	4.0 mg/gal	
		Water.	10 ppm.	
5.	**Refueler/engine test cell.** Downstream of filter separator.	Solids/DP.	Note 1	Every 7 days or prior to next use. After F/S elements are changed, prior to first servicing operation. After maintenance that can affect fuel quality is performed, or there is a fuel grade change, the equipment will be sampled prior to servicing aircraft.
		Color and particle assessment method (ASTM D2276 Appendix 3)		
		Matched Weight monitor (ASTM D2276)	2.0 mg/gal	
		Bottle Method (ASTM D5452)	2.0 mg/gal	
		Water.	10 ppm.	
		Fibers.	10 per quart.	After F/S elements are changed, prior to first servicing operation.
		Conductivity.	50 – 700 CU.	Take a minimum of one sample per week from one refueler/test cell. Schedule sampling to assure all active units/cells are sampled each month. Refuelers/cells not used within 30 days will be sampled prior to the first servicing operation.

TABLE I. Sampling requirements and test limits – Continued.

ITEM	SAMPLE POINT	TEST	TEST LIMITS	SAMPLE FREQUENCY
6.	**Defuel equipment.**	Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3) Matched Weight monitor (ASTM D2276) Bottle Method (ASTM D5452)	Note 1 2.0 mg/gal 2.0 mg/gal	Every 30 days or when defuel vehicle is converted to refueling service, sample prior to first servicing operation. After elements are changed, sample prior to first operation.
		Water.	10 ppm.	
7.	**Aircraft sumps.**	Visual for color, water, and solids.	Clear and bright without visual solids or free water.	Prior to defueling when suspected contamination exists.
		Solids. ASTM D5452	Max 4.0 mg/qt.	When required, after aircraft engine flameout, or aircraft electrostatic fire. Prior to defueling only when suspected contamination exists.
		FSII.	0.05 – 0.20 percent.	Sample taken from refueling truck product tank or bulk storage tank when requested. Sample taken from refueling truck product tank or bulk storage tank when requested.
		Conductivity.	50 – 700 CU	Sample taken from refueling truck product tank or bulk storage tank when requested.

Note 1: The failure criteria when comparing the membrane filter to the Color Standards are as follows: Color - 5 or greater; Particle Assessment - if there are visual particles present the sample fails. Retake the sample using a matched-weight monitor or take a one-gallon sample for bottle method analysis. Test limits on retake samples are addressed by specific Item Number in this table.

TABLE II. Minimum specification and use limits.

JP-5			
TEST	**SPECIFICATION**	**RECEIPT**	**USE**
SOLIDS	1.0 mg/liter	1.5 mg/liter [1]	2.0 mg/gallon
FSII	0.15 – 0.20 vol %	0.10 – 0.20 vol %	0.03 vol % (minimum) for USN/USMC aircraft; 0.07 vol % (minimum) for USA/USAF aircraft; 0.25 vol % (maximum) for all services
CONDUCTIVITY	Notes 2 and 3	Notes 2 and 3	Notes 2 and 4
FILTRATION TIME (MAX)	15 minutes [5]	20 minutes [5]	20 minutes [5]
FLASH POINT (MIN)	140°F	140°F	140°F
JP-8			
TEST	**SPECIFICATION**	**RECEIPT**	**USE**
SOLIDS	1.0 mg/liter	1.5 mg/liter [1]	0.5 mg/liter
FSII	0.10 – 0.15 vol %	0.09 – 0.20 vol %	0.03 vol % (minimum) for USN/USMC aircraft; 0.07 vol % (minimum) for USA/USAF aircraft; 0.20 vol % (maximum) for all services
CONDUCTIVITY	150 – 450 [2]	50 – 700 [2]	50 – 700 [2]
FILTRATION TIME (MAX)	15 minutes	20 minutes	15 minutes
FLASH POINT (MIN)	100°F	100°F	100°F

NOTES:

1. Intragovernmental receipt limit is 2.0 mg/liter.
2. Discontinue testing when fuel temperature is below 32°F (0°C
3. SDA is not required by the specification.
4. SDA is required when JP-5 is used for purging or issue to Air Force tactical aircraft. Limit is 100 – 700.
5. The flow reducer ring is not required by the specification.

CONCLUDING MATERIAL

Custodians:
Army – AR
Navy – AS
Air Force – 68

Review activities:
Army – AV
Navy – SA
DESC – PS
DLIS – CD

Preparing activity:
Air Force – 68
(Project 91GP-1192)

Note: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil .