NOT MEASUREMENT SENSITIVE

MIL-STD-1518E
w/ CHANGE 1
12 August 2019

SUPERSEDING
MIL-STD-1518E
17 January 2014

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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FOREWORD

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

2. Address comments, suggestions, or questions on this document to AFPET/PTMT, 2430 C Street, Bldg. 70, Area B, Wright-Patterson AFB OH 45433-7632 or e-mailed to AFPET.PTMT@us.af.mil. Since contact information can change, verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

SUMMARY OF CHANGE 1 MODIFICATIONS

1. In Table II,
   a. Updated the FSII and flash point requirements for JP-5.
   b. Updated the conductivity requirement, also added the Celsius flash point limit, for JP-8.
   c. Updated the conductivity requirement for Jet A/Jet A1/F-24.

2. In 3.1, changed the maximum conductivity limits of 450 CU to 600 CU (so as to be consistent with Table II).

3. In 4.2.c, changed the Appendix reference for ASTM D2624 from Appendix 3 to Appendix X1.

4. In 5.4.8, updated the minimum flash point requirement for JP-5 to 60.0 °C (consistent with changes made to Table II) so as to be consistent with MIL-DTL-5624.

5. In section 6.2, eliminated reference to the DoDISS (6.2.b). The DoDISS was officially canceled in 2007.

6. Made several other lesser changes, mostly typographical and punctuation corrections, to the Standard. These include:
   a. Foreword section: changed FORWARD to FOREWORD.
   b. Changed AFPA to AFPET throughout the Standard.
   c. Section 2.2.1, updated title to MIL-DTL-5624.
   d. Section 2.2.2, updated title to TO 42B-1-1.
   e. Section 3.6.3, added DSN area code 312 for CONUS.
   f. Section 5.1.6.1, changed end of first sentence to "… PRIST, or DIEGME."

7. The following modifications to MILSTD-1518E have been made.

PARAGRAPH	MODIFICATION
FOREWORD	Changed
2.2.1	Changed
2.2.2	Changed
3.1	Changed
3.6.3	Changed
4.2.c	Changed
5.1.6.1	Changed
6.2	Changed
Table II	Changed

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TABLES

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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (NATO S-1747)
MIL-PRF-52308	Filter-Coalescer Element, Fluid Pressure
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8 + 100 (NATO F-37)
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 this document are available online at http://quicksearch.dla.mil.)

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 (TO)

00-25-172	Ground Servicing of Aircraft and Static Grounding/Bonding
37-1-1	General Operation and Inspection of Installed Fuel Storage and Dispensing Systems
42B-1-1	Quality Control of Fuels

(Copies of these documents are available online at https://www.my.af.mil/etims/ETIMS/index or from AFPET/PTMT, 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.

AIRLINES FOR AMERICA (A4A)

ATA SPEC 103	Standards for Jet Fuel Quality Control at Airports

(Copies of these documents are available online at http://www.airlines.org or from Airlines for America (A4A) 1301 Pennsylvania Ave., NW, Suite 1100 Washington, DC 20004 T: 202.626.4000)

ASTM INTERNATIONAL

ASTM D56	Standard Test Method for Flash Point by Tag Closed Cup Tester
ASTM D1298	Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D1655	Standard Specification for Aviation Turbine Fuels
ASTM D2276	Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling
ASTM D2386	Standard Test Method for Freezing Point of Aviation Fuels (DoD Adopted)
ASTM D2624	Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
ASTM D4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D4176	Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
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 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

ASTM D5972	Standard Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method) (DoD Adopted)

(Copies of these documents are available at ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken PA 19428-2959. Electronic copies of ASTM standards may be obtained from https://www.astm.org.)

ENERGY INSTITUTE

EI 1529	Aviation fuelling hose and hose assemblies
EI 1542	Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage and Mobile Fueling Equipment
EI 1581	Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators
EI 1583	Specification and Laboratory Tests for Aviation Fuel Filter Monitors with Absorbent Type Elements

(Copies of these documents are available from the Energy Institute, 61 New Cavendish Street, London, WIG 7AR, UK. Electronic copies of Energy Institute documents may be obtained from http://www.energyinst.org)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

BS EN ISO 1825	Rubber hoses and hose assemblies for aircraft ground fuelling and defueling.

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

SAE INTERNATIONAL

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 SAE International, 400 Commonwealth Dr., Warrendale, PA USA 15096-0001.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 Conductivity additive. A conductivity additive is added to aviation turbine fuels 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 600 picosiemens per meter 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 600 CU.

3.2 Corrosion inhibitor/lubricity improver (CI/LI). 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. CI/LI 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.

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

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

3.5 Fuel. Aviation gasoline or aviation turbine fuels.

3.6 Aviation turbine fuels.

3.6.1 JP-5 (NATO F-44). A high flash point (≥ 60°C) aviation turbine fuel. JP-5 is the primary fuel for naval aircraft and is used in aircraft of all services operating off of Navy ships. Procured to the requirements of MIL-DTL-5624, JP-5 contains both fuel system icing inhibitor (FSII) and CI/LI.

3.6.2 JP-8 (NATO F-34). The standard fuel for US Army and USAF turbine engine powered aircraft and for some shore based Navy aircraft. JP-8 is similar to commercial Jet A-1 with the addition of CI/LI, FSII, and conductivity additives. Procured to meet MIL-DTL-83133, JP-8 is the standard fuel for NATO use in Europe.

3.6.3 JP-8+100 (NATO F-37). JP-8 containing a thermal stability additive is JP-8+100 (NATO F-37). The additive improves the thermal stability of JP-8 by approximately 100°F. For downgrading and/or blending procedures involving JP-8+100 contact AFPET/PTMTat (937) 255-8070, DSN (312-)785-8070, for guidance.

3.6.4 JET A (NATO F-24). This fuel is commercial Jet A with the addition of CI/LI, FSII, and conductivity additives. Procured to meet ASTM D1655, Jet A is the standard fuel for use in the continental United States.

3.6.5 JET A/JET A1. These are commercial aviation turbine engine fuels procured to meet ASTM D1655, Jet A is the standard fuel for use in the continental United States.

3.6.6 Aviation Turbine Engine Fuel, Not Otherwise Specified (N.O.S.) This fuel is the result of commingling two or more aviation turbine fuel products. Commingling of JP-5, JP-8, Jet A (F-24), and Jet A/Jet A1 is generally acceptable. (Commingling of JP-8+100 is not authorized, see 3.6.3) Commingled aviation turbine fuel that meets the minimum requirements of Table III should be considered Jet A fuel unless additional testing is accomplished. If additional testing is performed then the fuel may be classified as that grade of fuel for which all specifications are met. Use of commingled fuel in

U.S. Government aircraft will be approved by the appropriate Government representative.

3.7 Fuel system icing inhibitor (FSII). FSII conforming to MIL-DTL-85470 (diethylene glycol monomethyl ether – DIEGME) is added to aviation turbine fuel to lower the freezing point of free water in the fuel/system. This precludes the formation of ice in the fuel, which can clog filter elements and result in engine fuel starvation. The inhibitor also exhibits biocidal properties restricting bacterial growth in fuel systems. Water removes FSII from fuel, therefore, the introduction of water into a fuel system must be avoided and free water must be removed at any point in the system where it accumulates. A drop in the FSII content of fuel is a definite indication of the presence of water in a system and requires immediate investigation and corrective action. It should be noted that FSII does not affect the freezing point of the fuel itself but only the freezing point of free water in the fuel.

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

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

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

4. GENERAL REQUIREMENTS

4.1 Safety summary. General safety precautions and instructions ensure personal safety and health and the protection of Air Force property.

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

a. Receipt, storage, and issue of aviation products shall comply with ATA Specification 103 or IATA Joint Into-plane Guidelines (JIG 1) respectfully, except as noted herein.

b. The fuel shall conform to the applicable product specification. The exception is when product is reclaimed and identified as Aviation Turbine Engine Fuel, N.O.S. referenced in paragraph 3.6.6.

c. Fuel delivered to aircraft will pass particulate matter assessment. Determination shall be made by the Color and particle assessment method (ASTM D2276 Appendix X1). 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 (ASTM D5452). Test limits on retake samples are addressed in TABLE II.

d. 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 Aeronautical Engine Laboratory (AEL) free water methods or equivalent.

e. When the fuel specification requires FSII, fuel serviced to the aircraft shall be within the “USE” limits identified in Table II.

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

g. Defueled product shall not be serviced to U.S. government aircraft unless tested and meets

the limits of Table III. Defueled commingled product meeting the requirements of Table III shall not be serviced to aircraft which require JP-5 when the flash point is below 60°C (140°F).

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 affected. 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 microorganisms are found in water deposits in the systems. 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 that 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.

4.4.1 Dissolved Water. Fuel always contains some dissolved water. The amount of water that is in solution, and can be retained in solution, is dependent upon the temperature and chemical composition (percent aromatics) of the fuel.

4.4.2 Entrained Water. This is free water that is present in suspension in the fuel in the form of extremely fine droplets. Small amounts, up to 30 PPM, usually are not visible to the naked eye, but increased percentages create a milky haze or cloud in the fuel. Water can become entrained in the fuel by condensation of the moisture in the atmosphere or in the vapor/air mixture in a tank resulting from a reduction in the ambient temperature. Most entrained water will settle out of fuel, provided the fuel does not contain contaminants or materials such as surfactants, which hold water in suspension. Entrained water is removed by the coalescing action of filter/separators and/or water absorption filters installed in the fuel system.

4.4.3 Free Water. All water that is not in solution in the fuel is a form of free water. Usually, the term free water is used to indicate water that has settled out of the fuel or has been coalesced into large droplets for removal from the system.

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 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 type and grade of product shall be received, stored, and issued in a segregated system. Defueled/reclaimed product that meets the definition of paragraph 3.6.6 shall be placed in its own segregated system. (EXCEPTION, if the defueled/reclaimed product meets the specification requirements of a specific grade of fuel then it may be returned to that storage system with the approval of the appropriate Government representative.) 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 SPEC 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, tanker/barge, or 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 TO 37-1-1.

5.1.5 Refueling truck product tank. The refueling truck product tank shall be constructed in accordance with SAE ARP5818.

5.1.6 Filtration. Aviation fuel must pass through two separate filter separator vessels downstream of storage. In the event a system is used that has operating tanks (hydrant system) then at least one filtration must be downstream of operating tanks (TO 42B-1-1). A filter separator shall be provided on the fueling equipment that connects to the aircraft. (The intent is that the final filtration should be as close to the point of entering the aircraft as possible.) The filters shall meet the performance requirements of EI 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.

5.1.6.1 Fuel Absorption Filters/Monitors Fuel absorption filters/monitors (EI 1583) shall never be used with fuels containing anti-icing additives such as FSII, PRIST, or DIEGME. This includes pre-mixed and military fuels containing these additives. The use of monitor cartridges with fuels containing anti-icing additives may result in a failure of the monitor cartridge and/or migration of filtration media into the fuel stream, either of which could potentially cause damage to or sudden failure of the corresponding engine(s).

5.1.6.2 Filtration element replacement. Replacement of elements in filtration equipment is required as follows:

a. In accordance with manufacturer's requirement, not to exceed in service time requirements of TO 37-1-1 and UFC 3-460-03. Date of filter element change shall be stenciled on the filter housing or imprinted on a metal tag permanently attached to the housing. (Note, it is recommended to change filtration elements on a 12 month cycle)

b. When differential pressure reaches the maximum recommended by the element manufacturer or 15 psi, whichever is lower.

c. When solids and/or water test on samples taken downstream of the filter fail.

5.1.6.3 Draining Filter Separator Sumps. Drain all fixed and mobile filter separator vessels under pressure daily when used. 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 and recorded daily when used. Any drop in differential pressure at the same fuel flow rate is cause for concern and shall be cause to stop fuel transfer/servicing operations. The cause of the drop in differential pressure shall be determined and corrective action taken prior to resuming use of the associated dispensing and filtration system.

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. Comply with the following:

a. Verify that accuracy of gauges used to monitor fuel delivery to aircraft is within ± 2% of full scale.

b. Verify proper operation of filter differential gauge(s) in accordance with gauge manufacturers' procedures. Accuracy must be within ± 2 PSI.

c. Replace, or repair and calibrate defective 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 shall be calibrated 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 IE 1529 or BS EN ISO 1825.

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 shall be marked in accordance with IE 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 reels and/or cable assemblies utilized during fuel related operations shall be checked with a voltage/ohm meter (multi-meter) at the beginning of the contract period and every six months thereafter. Resistance, of cables (measured from plug/clamp to plug/clamp) and reels on servicing units,(measured from the plug/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. A change of the type product (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. Removal of all previous product is required prior to introducing the new product in tank.

5.2.3 Settling time. After each receipt or tank fill by any transportation mode, a minimum of two hours settling time is required prior to product transfer. Product received through a filter separator into a coated tank may be issued prior to two hours settling time if it is free of sediment and water.

5.2.4 Servicing of drummed product. Drums containing aviation fuel shall be stored on their sides, bung side up when not in use. Aviation fuel issued from drums to a refueling truck or directly to an aircraft must pass through a filter separator.

5.2.5 Positioning equipment. Fuel servicing vehicles shall not be driven closer than 8 meters (25 feet) from an aircraft unless a spotter is used to direct vehicle movement. Under no circumstances shall the vehicles be positioned closer than 3 meters (10 feet) from the aircraft. Refuelers shall be positioned so the operator's side of the equipment is adjacent to the aircraft. Always maintain a clear path from the aircraft for rapid evacuation of vehicles in an emergency situation.

5.2.6 Bonding and grounding. Bonding and grounding of aircraft during fuel servicing shall be as required by TO 00-25-172 and the specific aircraft technical data. Should a conflict occur, the aircraft specific technical data guidance shall be utilized.

5.2.7 Single point refueling. Single point (underwing) refueling pressure shall not exceed 55 psi (380kPa) or the pressure specified by the specific aircraft technical data, whichever is lower.

5.2.8 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.

5.2.9 Handling of lubricants and hydraulic fluids.

5.2.9.1. General requirements:

a. Aircraft engine oils, lubricants, and hydraulic fluids shall not be stored outside unprotected from the elements. All containers shall be properly stored and handled to protect the containers and prevent contamination of the tops, openings, and contents.

b. Drums of aircraft oils and hydraulic fluid will be stored on their sides with bungs flooded prior to opening. After opening, drums will be stored indoors or protected from external contamination with appropriate covers to prevent contamination of the openings and contents. When not in actual use, 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.

c. When opening cans of aircraft engine oils and hydraulic fluids, proper opening devices (specifically designed for such purpose) shall be used in all cases to prevent contamination. Maintenance tools such as screwdrivers, punches, etc., shall not be used to open cans. Opening devices shall be protected from contamination by storing in a plastic bag or similar devices when not in use.

d. Funnels, spouts and other such devices used to service aircraft engine oil and hydraulic fluid shall be kept clean and free of contaminants.

e. Unused portions of 1-quart or 1-gallon containers of aircraft oils and hydraulic fluid shall be discarded or transferred to servicing equipment.

5.2.9.2 Aircraft (turbine and reciprocating) engine lubricating oil.

a. Aircraft engine oil furnished in 1-quart or smaller, sealed containers may be serviced to aircraft without further filtration.

b. Aircraft engine oil furnished in 55-gallon drums may be serviced directly to engines through a mesh screen (100 mesh for turbine engines and nominal 60 mesh for reciprocating engines).

c. For engine oil servicing equipment other than cans or drums, the requirements of individual aircraft technical orders will apply for the specific servicing equipment.

5.2.9.3 Aircraft hydraulic fluid.

a. Servicing hydraulic fluid to aircraft may be direct from the 1-quart or 1-gallon cans.

b. 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.

5.3 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 a minimum, the following fire extinguisher requirements shall be met during fueling operations:

(1) 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. Each fire extinguisher shall have a minimum discharge time of not less than 25 seconds.

(2) Extinguishers shall be kept clear of elements such as ice and snow. Extinguishers located in enclosed compartments shall be readily accessible, and their location shall be marked clearly in letters at least 50 mm (2 in.) high.

(3) Where the open hose discharge capacity of the aircraft fueling system or equipment is more than 750 L/min (200 gpm), at least one listed wheeled extinguisher having a rating of not less than 80-B:C and a minimum capacity of 55 kg (125 lbs.) of agent shall be provided.

(4) ABC multipurpose dry chemical fire extinguishers (ammonium phosphate) shall not be placed on aircraft fueling vehicles, airport fuel servicing ramps, or aprons, or at airport fuel facilities. Multipurpose dry chemical (ammonium phosphate) fire extinguishing agent is known to cause corrosion to aluminum aircraft components. Although the agent is capable of extinguishing fires on or near aircraft, it is likely that the agent will spread to other, uninvolved aircraft, causing damage from corrosion.

(5) Carbon dioxide extinguishers should not be selected due to their limited range and effectiveness in windy conditions.

(6) Each aircraft fuel servicing tank vehicle shall have two listed fire extinguishers, each having a rating of at least 20-B:C, with one extinguisher mounted on each side of the vehicle.

(7) One listed fire extinguisher having a rating of at least 20-B:C shall be installed on each hydrant fuel servicing vehicle or cart.

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.

g. Aircraft shall not be serviced when there are electrical storms within a five-mile radius. Consideration should be given to terminate operations when lightning is detected 25 miles out. This will ensure adequate time for operations to be safely terminated and personnel to seek appropriate shelter.

h. 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 and aviation gasoline to a U.S. Government testing laboratory designated in the contract or as directed by the Defense Contract Management Agency (DCMA) representative or contracting officer. The sample size shall be one-gallon and must be accompanied by a completed DD Form 1222. The DD Form 1222 must identify a U.S. Government fuel surveillance representative (DCMA or Contracting Officer) by name, e-mail address, and phone number. Samples received without identifying a representative shall not be tested until the proper information is received. The frequency of sample submission shall be at the beginning of the contract period and once every six months thereafter.

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 shall 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 shall consist of flash point and freezing point. Any other tests desired or required (i.e. additive concentrations when required by contract) shall be specifically requested on the DD Form 1222. The analysis of aviation gasoline shall consist of

distillation, vapor pressure, and freezing point.

5.4.2 Sampling requirements. In addition to submitting the sample addressed in 5.4.1, the contractor is responsible for performing all sampling and testing per TABLE I and TABLE III (if process is performed).

5.4.3 Sampling procedures. The validity of test results is greatly influenced by sampling procedures. 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. For sampling procedures, see the API Manual of Petroleum Measurement Standards, Chapter 8 or ASTM methods D4057, D4177, D5854, and TO 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 shall 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. Fuel returned to the same aircraft must pass through a filter separator. See 5.4.8 for fuel to be used in other aircraft. If fuel cannot be returned to the aircraft, follow the defuel/servicing clause in the contract.

5.4.8 Fuel serviced to aircraft from defueled inventory. Aviation turbine fuel N.O.S. (see 3.6.6) and fuel defueled from aircraft but dispensed to other aircraft must meet the minimum quality criteria in TABLE III. It must pass through two filter separators from storage to aircraft. Defueled commingled product meeting the requirements of Table III shall not be serviced to aircraft which require JP-5 when the flash point is below 60.0°C (140.0°F).

5.4.9 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.

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

5.4.10 Records and quality checks required.

a. Tank cleaning (see 5.1.4).

b. Filter element replacement (see 5.1.6.1).

c. Daily draining of filtration equipment sumps (see 5.1.6.2).

d. Daily draining of refueler tank sumps (see 5.1.6.2).

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

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

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

h. Beginning of contract period and six month continuity check of bonding reel/cable assemblies (see 5.1.13).

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

j. Line displacing process (see 5.2.8).

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

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

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

n. Testing required in TABLE I, TABLE II, and TABLE III (see 5.4.2).

5.5 Additive blending. Fuel additives are combustible and toxic. Are harmful if inhaled or absorbed through the skin and causes eye irritation. Protective butyl rubber gloves shall be worn when handling fuel additives, corrosion inhibitor/lubricity improver (CI/LI), conductivity improver (SDA), thermal stability improver (+100 additive), and FSII. 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.

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

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

b. 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.

c. 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 blending and use of a proportional injector. In all cases where hand blending is performed, the additive shall 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 blending 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).

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. If authorized, FSII may be added using the 590 ml (20 ounce) aerosol can during overwing (gravity) refueling. This is typically the commercial FSII additive, PRIST, used with commercial jet fuel (JET A/JET A-1). PRIST is equivalent to the military FSII additive. If authorized for use, determine the fuel load and calculate the amount of additive required. It shall be added gradually during filling to permit proper blending in the fuel. One can aerosol additive will treat 840 liters (222 gallons) of fuel to 0.07 percent by volume. Contact the applicable military Service Control Point for authorization to use aerosol cans of FSII as fuel is pumped into the aircraft. 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.

5.5.2.5 PRIST restriction. PRIST dispensed in aerosol cans is not permitted with US Navy aircraft.

6. NOTES

(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 should specify the title, number, and date of this standard.

6.3 Subject term (key word) listing.

Additive blending
Fuel equipment
Quality assurance requirements
Fuel System Icing Inhibitor (FSII)

6.4 Changes from previous issue. The margins of this standard are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and

contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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/DP. Color and particle assessment method (ASTM D2276 Appendix 3)	See Note [1].	Each receipt, one hour after start, after line displacement and at each six-hour interval thereafter. Not required when receipt filtration is present.
		FSII. (ASTM D5006) (when additized)	See TABLE II.	Each receipt, one hour after start, after line displacement and at each six-hour interval thereafter.
		Conductivity (when additized)	50 – 700 CU.	
		Flash Point.	See TABLE II.	Any time after line displacement.
1b.	Downstream of filter separator if installed.	Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3) Matched Weight monitor (ASTM D2276) Bottle Method (ASTM D5452)	See Note [1].	Every 7 days or next receipt. Take one downstream sample in conjunction with any one of the upstream samples, compare the results.

TABLE I. Sampling requirements and test limits – Continued.

ITEM	SAMPLE POINT	TEST	TEST LIMITS	SAMPLE FREQUENCY
2.	**Tank Truck/Car Receipts.**			
2a.	Receiving header upstream of any filtration.	Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3)	See Note [1]	One sample daily from one T/T or T/C from each supplier.
		FSII. (ASTM D5006) (when additized)	See TABLE II.	
		Conductivity. (when additized)	See TABLE II.	
		Flash Point.	See TABLE II.	
2b.	Downstream of filter separator if installed.	Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3)	See Note [1]	Every 7 days or next receipt. Take one downstream sample in conjunction with any one of the upstream samples, compare the results.
3.	Storage tanks.	Conductivity. (ASTM D2624) (when additized)	50 – 700 CU	Every 14 days.
		FSII. (ASTM D5006) (when additized)	See TABLE II.	
4.	Refueling truck fillstand. Downstream of filter separator.	Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3)	See 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.
		Water. (ASTM D3240)	10 ppm	

TABLE I. Sampling requirements and test limits – Continued.

ITEM	SAMPLE POINT	TEST	TEST LIMITS	SAMPLE FREQUENCY
5.	Refueler/engine test cell. Downstream of filter separator.	Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3)	See 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.
		Water. (ASTM D3240)	10 ppm	
		Conductivity. (ASTM D2624) (when additized)	50 – 700 CU	Refuelers/cells not used within 30 days will be sampled prior to the first servicing operation.
6.	Defuel equipment.	*Solids/DP. Color and particle assessment method (ASTM D2276 Appendix 3)*	See Note [1]	*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. See paragraphs 5.4.7 and 5.4.8.*
		Water. (ASTM D3240)	10 ppm	
7.	Aircraft sumps.	Visual for color, water, and solids.	Clear and bright without visual solids or free water.	Prior to defueling and/or when suspected contamination exists.
		Solids. ASTM D5452	Per aircraft technical guidance.	When requested.
		FSII. (ASTM D5006) (when additized)	See TABLE II.	
		Conductivity. (ASTM D2624) (when additized)	See TABLE II.	

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 (ASTM D5452). Test limits on retake samples are addressed in TABLE II.

TABLE II. Minimum specification and use limits.

JP-5			
TEST	**SPECIFICATION**	**RECEIPT**	**USE**
SOLIDS (ASTM D5452)	1.0 mg/L (Max)	1.5 mg/L (Max)	Max limits per Service: • US Air Force:0.5 mg/L • US Army: 1.0mg/L • US Navy: 2.0mg/L
FSII (ASTM D5006)	0.08 – 0.11 vol %	0.07 – 0.15 vol %	Min limits per Service: • US Air Force: 0.04 vol % • US Army: 0.04 vol % • US Navy: 0.03 vol % • US Marine Corps: 0.03 vol % Max limits for all Services: 0.15 vol %
FLASH POINT (ASTM D56)	60.0 °C (140.0 °F) (Min)	60.0 °C (140.0 °F) (Min)	60.0 °C (140.0 °F) (Min)
JP-8			
TEST	**SPECIFICATION**	**RECEIPT**	**USE**
SOLIDS (ASTM D5452)	1.0 mg/L (Max)	1.5 mg/L (Max)	Max limits per Service: • US Air Force: 0.5 mg/L • US Army: 1.0 mg/L • US Navy: 2.0 mg/L
FSII (ASTM D5006)	0.07 – 0.10 vol %	0.06 – 0.15 vol %	Min limits per Service: • US Air Force: 0.04 vol % • US Army: 0.04 vol % • US Navy: 0.03 vol % • US Marine Corps: 0.03 vol % Max limits for all Services: 0.15 vol %
CONDUCTIVITY (ASTM D2624)	150 –600 CU	50 – 700 CU	50 – 700 CU
FLASH POINT (ASTM D56)	38 °C (100 °F) (Min)	38 °C (100 °F) (Min)	38 °C (100 °F) (Min)
JET A/JET A1/F-24			
TEST	**SPECIFICATION**	**RECEIPT**	**USE**
SOLIDS (ASTM D5452)	1.0 mg/L (Max)	1.5 mg/L (Max)	Max limits per Service: • US Air Force: 0.5 mg/L • US Army: 1.0 mg/L • US Navy: 2.0 mg/L

TABLE II. Minimum specification and use limits – Continued.

TEST	SPECIFICATION	RECEIPT	USE
FSII (ASTM D5006) (In F-24 fuel or when additized)	0.07 – 0.10 vol %	0.06 – 0.15 vol %	Min limits per Service: • US Air Force: 0.04 vol % • US Army: 0.04 vol % • US Navy: 0.03 vol % • US Marine Corps: 0.03 vol % Max limits for all Services: 0.15 vol %
CONDUCTIVITY (ASTM D2624) (In F-24 fuel or when additized)	150 – 600 CU	50 – 700 CU	50 – 700 CU
FLASH POINT (ASTM D56)	38 °C (100 °F) (Min)	38 °C (100 °F) (Min)	38 °C (100°F) (Min)

TABLE III. Sampling requirements and test limits for N.O.S.Fuel

Method	Test	MIN	MAX
ASTM D4176	Appearance, Clear & Bright	PASS	
ASTM D5972/D2386	Freezing Point, °C		-40
ASTM D56	Flash Point, °C	38	
ASTM D1298	Density @ 15°C, kg/m³	775	845

CONCLUDING MATERIAL

Custodians:
Army – AV
Navy – AS
Air Force – 68
DLA – PS

Review activities:
Army – AR
Navy – SA
AF – 84
DLA – CD

Preparing activity:
Air Force – 68
(Project 91GP-2019-003)

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 https://assist.dla.mil.