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DETAIL SPECIFICATION

TURBINE FUEL, AVIATION, GRADES JP-4 and JP-5

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers two grades of aviation turbine fuel NATO F-40 (JP-4) and NATO F-44 (JP-5) (see 6.1).

1.2 Classification. Aviation turbine fuel will be of the following grades, as specified (see 6.2).

Grade	NATO Code No.	Description
JP-4 (Inactive for New Design)	F-40	Wide cut, gasoline type
JP-5	F-44	High flashpoint, kerosene type

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification 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 specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Naval Air Systems Command Fuels & Lubricants Division, AIR 4.4.5, 22229 Elmer Rd, Bldg 2360, Patuxent River, Md, 20670, or emailed to Douglas.Mearns@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://www.dodssp.daps.mil.

AMSC N/A FSC 9130

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards 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 (Metric)
MIL-DTL-85470 - Inhibitor, Icing, Fuel System, High Flash, NATO Code Number S-1745 (Metric)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-290 - Packaging and Marking of Petroleum and Related Products

QUALIFIED PRODUCTS LIST

QPL-25017 - Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric)

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

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.

ASTM INTERNATIONAL STANDARDS

ASTM D56 - Standard Test Method for Flash Point by Tag Closed Tester (DoD adopted)
ASTM D86 - Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure (DoD adopted)
ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester (DoD adopted)
ASTM D130 - Standard Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test (DoD adopted)
ASTM D156 - Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method) (DoD adopted)
ASTM D323 - Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method) (DoD adopted)
ASTM D381 - Standard Test Method for Existent Gum in Fuels by Jet Evaporation (DoD adopted)

ASTM D445	-	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity) (DoD adopted)
ASTM D976	-	Standard Test Methods for Calculated Cetane Index of Distillate Fuels (DoD adopted)
ASTM D1094	-	Standard Test Method for Water Reaction of Aviation Fuels (DoD adopted)
ASTM D1266	-	Standard Test Method for Sulfur in Petroleum Products (Lamp Method) (DoD adopted)
ASTM D1298	-	Standard Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (DoD adopted)
ASTM D1319	-	Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption (DoD adopted)
ASTM D1322	-	Standard Test Method for Smoke Point of Kerosine and Aviation Turbine Fuel (DoD adopted)
ASTM D2276	-	Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling (DoD adopted)
ASTM D2386	-	Standard Test Method for Freezing Point of Aviation Fuels (DoD adopted)
ASTM D2622	-	Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-Ray Fluorescence Spectrometry (DoD adopted)
ASTM D2624	-	Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels (DoD adopted)
ASTM D2887	-	Standard Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography (DoD adopted)
ASTM D3120	-	Standard Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry (DoD adopted)
ASTM D3227	-	Standard Test Method for Mercaptan Sulfur in Gasoline, Kerosene, Aviation Turbine, and Distillate Fuels (Potentiometric Method) (DoD adopted)
ASTM D3241	-	Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure) (DoD adopted)
ASTM D3242	-	Standard Test Method for Acidity in Aviation Turbine Fuel (DoD adopted)
ASTM D3338	-	Standard Test Method for Estimation of Net Heat of Combustion of Aviation Fuels (DoD adopted)
ASTM D3343	-	Standard Test Method for Estimation of Hydrogen Content of Aviation Fuels (DoD adopted)

ASTM D3701	-	Standard Test Method for Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry (DoD adopted)
ASTM D3828	-	Standard Test Methods for Flash Point by Small Scale Closed Tester (DoD adopted)
ASTM D3948	-	Standard Test Methods for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer (DoD adopted)
ASTM D4052	-	Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter
ASTM D4057	-	Standard Practice for Manual Sampling of Petroleum and Petroleum Products (DoD adopted)
ASTM D4177	-	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products (DoD adopted)
ASTM D4294	-	Standard Test Method for Sulfur in Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectroscopy (DoD adopted)
ASTM D4306	-	Standard Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination (DoD adopted)
ASTM D4529	-	Standard Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
ASTM D4737	-	Standard Test Method for Calculated Cetane Index by Four Variable Equation
ASTM D4809	-	Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method) (DoD adopted)
ASTM D4952	-	Standard Test Method for Qualitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test) (DoD adopted)
ASTM D4953	-	Standard Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
ASTM D5006	-	Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels (DoD adopted)
ASTM D5190	-	Standard Test Method for Vapor Pressure of Petroleum Products (Automatic Method)
ASTM D5191	-	Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method) (DoD adopted)
ASTM D5452	-	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration (DoD adopted)
ASTM D5453	-	Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence
ASTM D5972	-	Standard Test Method for the Freezing Point of Aviation Fuels (Automatic Phase Transition Method)

ASTM D6045	-	Standard Test Method for Color of Petroleum Products by the Automatic Tristimulus Method
ASTM E29	-	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications (DoD adopted)

(Copies of these documents are available from the American Society for Testing and Materials International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959; (610) 832-9500; or through their website at http://www.astm.org.)

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. REQUIREMENTS

3.1 Materials. The fuels supplied under this specification shall be refined hydrocarbon distillate fuel oils, which contain additives in accordance with 3.3. The feedstock from which the fuel is refined shall be crude oils derived from petroleum, tar sands, oil shale, or mixtures thereof.

3.2 Chemical and physical requirements. The chemical and physical requirements of the finished fuel shall meet the requirements in section 3 and table I, when tested in accordance with the specified test methods.

3.3 Additives. If specified in the contract or purchase description (see 6.2), information concerning the type and amount of each additive used shall be made available.

3.3.1 Antioxidants. Immediately after processing (i.e., during the rundown into feed/batch tank) and before the fuel is exposed to the atmosphere, an approved antioxidant shall be added to all JP-5 fuel and to JP-4 fuel that contains blending stocks that have been hydrogen treated to prevent the formation of gums and peroxides after manufacture. JP-4 fuel that does not contain hydrogen treated blending stocks may have the antioxidant added. The concentration of antioxidant to be added shall be as follows:

a. For JP-5 and hydrogen treated JP-4: Not less than 17.2 mg nor more than 24.0 mg of active ingredient per liter of fuel (6.0 to 8.4 lb/1000 barrels).

b. For JP-4 fuel not hydrogen treated, if added, not more than 24.0 mg of active ingredient per liter of fuel (8.4 lb/1000 barrels).

3.3.1.1 Formulations. The following antioxidant formulations are approved:

a. 2,6-di-tert-butyl-4-methylphenol

b. 6-tert-butyl-2,4-dimethylphenol

c. 2,6-di-tert-butylphenol

d. 75 percent min 2,6-di-tert-butylphenol
25 percent max tert-butylphenols and tri-tert-butylphenols

e. 72 percent min 6-tert-butyl-2,4-dimethyphenol
28 percent max tert-butyl-methylphenols and tert-butyl-dimethylphenols.

f. 55 percent min 2,4-dimethyl-6-tert-butylphenol and
15 percent min 2,6-di-tert-butyl-4-methylphenol and
30 percent max mixed methyl and dimethyl tert-butylphenols

3.3.2 Metal deactivator. Metal deactivator additive shall not be used in JP-4 or JP-5 unless specified in the contract or purchase description (see 6.2). A metal deactivator may be used if approved by the procuring activity and the user. If JP-5 is to be used by the Navy, written consent for the use of metal deactivator shall also be obtained from NAVAIR 4.4.5. If approved, the metal deactivator, N,N'-disalicylidene-1,2-propanediamine, shall be blended into the fuel. The concentration of active material used on initial batching of the fuel at the refinery shall not exceed 2.0 mg/L. Cumulative addition of metal deactivator when redoping the fuel shall not exceed 5.7 mg/L.

3.3.3 Corrosion inhibitor/lubricity improver. A corrosion inhibitor/lubricity improver in accordance with MIL-PRF-25017 shall be blended into the JP-4 and JP-5. The amount added shall be equal to or greater than the minimum effective concentration and shall not exceed the maximum allowable concentration for an approved source as specified in the latest revision of QPL-25017. The point of injection of the corrosion inhibitor/lubricity improver shall be as specified in the contract or purchase description (see 6.2).

3.3.4 Fuel system icing inhibitor. A fuel system icing inhibitor shall be used. The icing inhibitor shall be in accordance with MIL-DTL-85470. The point of injection of the additive for JP-4 and JP-5 shall be as specified in the contract or purchase description (see 6.2).

3.3.5 Static dissipator additive. A static dissipator additive shall be blended into JP-4 fuel in sufficient concentration to increase the conductivity of the fuel to within the range specified in table I, at the point of injection. The point of injection shall be as specified in the contract or purchase description (see 6.2) The following static dissipator additive is approved: Stadis®450, marketed by Octel Starreon LLC, Newark, DE 19702. Static dissipator additive shall not be used in JP-5 unless written consent has been obtained from NAVAIR 4.4.5.

3.3.6 Premixing of additives. Additives shall not be premixed with other additives before injection into the fuel so as to prevent possible reactions among the concentrated forms of different additives.

3.4 Workmanship. At the time of Government acceptance, the finished fuel shall be clear and bright and visually free from undissolved water, sediment, or suspended matter. In case of dispute, the fuel shall be clear and bright at 21°C and shall contain no more than 1.0 mg/L of particulate matter as specified in table I.

TABLE I. Chemical and physical requirements and test methods

REQUIREMENTS	GRADE JP-4	GRADE JP-5	TEST METHOD ASTM STANDARDS
Color, Saybolt	Report	Report	D156[1/] or D6045
Total acid number, mg KOH/g, max	0.015	0.015	D3242
Aromatics, vol percent, max	25.0	25.0	D1319
Sulfur, Mercaptan, mass percent, max or Doctor test	0.002 Negative	0.002 Negative	D3227 D4952
Sulfur, total, mass percent, max	0.40	0.30	D1266, D2622, D3120, D4294[1/] or D5453
Distillation temperature, °C (D2887 tests in parentheses) [3/] Initial boiling point 10 percent recovered, temp 20 percent recovered, temp 50 percent recovered, temp 90 percent recovered, temp End point, max temp Residue, vol %, max (for D86) Loss, vol %, max (for D86)	 Report Report 100, min 125, min Report 270, max 1.5 1.5	 Report 205 (186), max Report Report Report 300 (330), max 1.5 1.5	D86[1/,2/] or D2887
Flash point, °C, min	-------	60[4/]	D56, D93[1/], or D3828
Density, at 15°C kg/L, min (API max) kg/L, max (API min)	 0.751 (57.0) 0.802 (45.0)	 0.788 (48.0) 0.845 (36.0)	 D1298 or D4052[1/]
Vapor pressure, at 37.8°C (100°F), kPa minimum maximum	 14 21	 ------- -------	D323, D4953, D5190, or D5191[1/,5/]
Freezing point, °C, max	-58	-46	D2386[1/] or D5972[6/]
Viscosity, at -20°C, max, mm^2/s	-------	8.5	D445
Heating value, Heat of combustion, MJ/kg, min	42.8	42.6	D3338, D4809[1/], or D4529
Calculated Cetane Index [7/]	-------	Report	D976 or D4737

TABLE I. Chemical and physical requirements and test methods – Continued.

REQUIREMENTS	GRADE JP-4	GRADE JP-5	TEST METHOD ASTM STANDARDS
Hydrogen content, mass percent, min	13.5	13.4	D3701[8/]
Smoke point, mm, min	20.0	19.0	D1322
Copper strip corrosion, 2 hr at 100°C (212°F), max	1	1	D130
Thermal stability: Change in pres. drop, mm of Hg, max Tube deposit code, less than	 25 3[10/]	 25 3[10/]	D3241[9/]
Existent gum, mg/100 mL, max	7.0	7.0	D381[11/]
Particulate matter, mg/L, max	1.0	1.0	D2276 or D5452[1/,12/]
Filtration time, minutes, max	10	15[13/]	[12/]
Water reaction interface rating, max	lb	-------	D1094
Micro Separometer rating, min	[14/]	[14/]	D3948
Fuel system icing inhibitor volume percent min volume percent max	 0.10 0.15	 0.10 0.15	D5006[15/]
Fuel electrical conductivity, pS/m Allowable range	150 to 600[16/]	------	D2624

1/ Referee Test Method.

2/ A condenser temperature of 0 to 4 °C (32 to 40 °F) shall be used for the distillation of JP-5 fuel. For JP-4, group 3 test conditions shall be used.

3/ ASTM D2887 may be used for JP-5 fuel only.

4/ ASTM D3828 may give results up to 1.7 °C below the ASTM D93 results. ASTM D56 may give results up to 1 °C below the ASTM D93 results.

5/ When using ASTM D5191 for vapor pressure determination of JP-4, the quality control checks, section 10, shall be performed each day using two control samples as the reference pure materials. The first control sample shall have a vapor pressure between 7 and 14 kPa and the second control sample shall have a vapor pressure between 21 and 23 kPa.

6/ ASTM D5972 may be used for freezing point determination of JP-5 only.

7/ Mid-boiling temperatures shall be obtained by either ASTM D86 or ASTM D2887 to perform the Cetane Index calculation. If ASTM D86 values are used, they shall be corrected to standard barometric pressure.

8/ ASTM D3343 or ASTM D3701 may be used to measure hydrogen content of JP-4, but when measuring hydrogen content of JP-5, only ASTM D3701 shall be used.

9/ See 4.3.2.1 for ASTM D3241 test conditions and procedures.

10/ If the visual rating of the heater tube shows Peacock (P) or Abnormal (A) type deposits, the fuel sample is not acceptable.

11/ If air is used instead of steam while performing ASTM D381, it shall be recorded. In case of a failure with air, the sample shall be retested using steam.

12/ A minimum sample size of 3.79 liters (1 gallon) shall be filtered. Filtration time shall be determined in accordance with the procedure in Appendix A of this specification. The procedure in Appendix A may also be used for the determination of particulate matter as an alternate to ASTM D2276 or ASTM D5452.

13/ The flow reducer ring of Appendix A of this specification, A.3.c, is not required for JP-5.

14/ The minimum microseparometer rating using a Micro-Separometer (MSEP) shall be as specified in table II.

TABLE II. Microseparometer rating

Product	Additives*	MSEP Rating, min
JP-4 and JP-5	Antioxidant (AO), Metal Deactivator (MDA)	90
JP-4 and JP-5	AO, MDA, and Fuel System Icing Inhibitor (FSII)	85
JP-4 and JP-5	AO, MDA, and Corrosion Inhibitor/Lubricity Improver (CI/LI)	80
JP-4 and JP-5	AO, MDA, CI/LI, and FSII	70

* Samples submitted for specification conformance testing shall contain the same additives present in the refinery batch. Regardless of which minimum the refiner elects to meet, the refiner shall report the MSEP rating on a laboratory hand blend of the fuel with all additives required by the specification.

15/ Tests shall be performed with ASTM D5006 using the DiEGME scale of the refractometer.

16/ The conductivity shall be in the range of 150 to 600 pS/m at ambient fuel temperature or 29.4°C, whichever is lower.

4. VERIFICATION

4.1 Conformance inspection. Conformance inspection shall consist of all examinations, inspections, and tests of this specification.

4.1.1 Inspection lot. For conformance inspection, individual lots shall be examined, inspected, and tested as specified herein to ensure individual lots meet all the requirements specified in section 3.

4.1.2 Sampling plans.

4.1.2.1 Sampling for conformance inspection. Each bulk or packaged lot (see 6.6) of material shall be sampled in accordance with ASTM D4057 and ASTM D4177 or both, except where individual test procedures contain specific sampling instructions.

4.1.2.1.1 Sample containers. Examine the sample container for conformance to ASTM D4306 recommended sample containers (see 6.5).

4.1.2.2 Sampling for examination of filled containers for delivery. A random sample of filled containers shall be selected from each lot. The samples shall be examined in accordance with 4.3.1.3.

4.2 Inspection conditions. The fuel shall meet limiting values in table I, using the specified test methods.

4.3 Methods of inspection.

4.3.1 Examination of product.

4.3.1.1 Visual inspection. Samples selected in accordance with 4.1.1 shall be visually examined for compliance with 3.4.

4.3.1.2 Examination of empty containers. Prior to filling, each empty unit container shall be visually inspected for cleanliness and for proper usage in accordance with ASTM D4057.

4.3.1.3 Examination of filled containers. Samples taken as specified in 4.1.2 shall be examined for conformance to MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, packing, and markings.

4.3.2 Chemical and physical tests. Tests to determine conformance to chemical and physical requirements shall be conducted in accordance with table I. Requirements contained in table I are not subject to corrections for test tolerances. If multiple determinations are made, results falling within any specified repeatability and reproducibility tolerances shall be averaged to determine conformance to table I. The following applies to all specified limits in this standard: For purposes of determining conformance with this specification, an observed value or a calculated value shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the rounding method of ASTM E29.

4.3.2.1 Thermal stability. The thermal stability test shall be conducted using ASTM D3241 (JFTOT). The heater tube shall be rated visually (see Annex A1 of ASTM D3241).

4.3.2.1.1 Test conditions.

a. Minimum heater tube temperature at maximum point: 260 °C
b. Fuel system pressure: 3.45 MPa (500 psig)
c. Fuel flow rate: 3.0 mL/minute
d. Test duration: 150 minutes

4.3.2.1.2 ASTM D3241 procedure.

a. Record the differential pressure in mm Hg at 150 minutes, or time to differential pressure of 25 mm Hg, whichever comes first.

b. Record the heater tube deposit code rating at the end of the test.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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 JP-4 and JP-5 fuels covered by this specification are intended for use in aircraft turbine engines. These fuels require military unique additives that are necessary in military weapon systems. This requirement is unique to military aircraft, engine designs, and missions. Additionally, JP-5 is a military unique fuel because it must have a flash point substantially higher than commercial aviation turbine fuels. It is stored in large quantities on aircraft carriers and other vessels. The flash point is for safety in these military unique applications.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification
b. Grade of fuel required (see 1.2)
c. Information concerning the type and amount of each additive used (see 3.3)
d. Location and injection method of the corrosion inhibitor/lubricity improver (see 3.3.3)
e. Location and injection method of the fuel system icing inhibitor (see 3.3.4)
f Location and injection method of the static dissipater for JP-4 only (see 3.3.5)
g. Quantity required and size containers desired
h. Packaging requirements (see 5.1)

6.3 Conversion of metric units. Units of measure have been converted to the International System of Units (SI) (Metric) in accordance with ASTM SI10. If test results are obtained in

units other than Metric or there is a requirement to report dual units, ASTM SI10 should be used to convert the units.

6.4 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.5 Sample containers. A number of jet fuel properties are very sensitive to trace contamination from sample containers.

6.6 Definitions.

6.6.1 Bulk lot. A bulk lot consists of an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single isolated container or manufactured in a single plant run through the same processing equipment, with no change in ingredient material.

6.6.2 Packaged lot. A packaged lot consists of an indefinite number of 208-liter (55-gallon) drums or smaller unit packages of identical size and type, offered for acceptance, and filled from the isolated tank containing a homogeneous mixture of material, or filled with a homogeneous mixture of material run through the same processing equipment, with no change in ingredient material.

6.6.3 Homogeneous product. A homogeneous product is defined as a product where samples taken at various levels of the batch tank are tested for the defining homogeneous characteristics and all values obtained meet the repeatability precision requirements for that test method.

6.7 Subject term (key word) listing.

Antioxidant
Corrosion inhibitor
Icing inhibitor
Jet fuel
Static dissipator additive

6.8 International standardization agreements. This specification implements ASCC Air Std 15/6, Guide Specifications (Minimum Quality Standards) for Aviation Fuels: NATO F-34, F-35, F-40 and F-44; ASCC Air Std 15/9, Interchangeability Chart of Standardized Aviation Fuels, Lubricants and Associated Products; NATO STANAG 1135, Interchangeability of Fuels, Lubricants and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations; and NATO STANAG 3747, Guide Specifications (Minimum Quality Standards) for Aviation Turbine Fuels (F-34, F-35, F-40 and F-44). When amendment, revision, or cancellation of this specification is proposed, the preparing activity must coordinate the action with the U.S. National Point of Contact for the international standardization agreement, as identified in the ASSIST database at http://www.dodssp.daps.mil.

6.9 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.

APPENDIX A

METHODS FOR DETERMINATION OF
FILTRATION TIME AND TOTAL SOLIDS (PARTICULATE)

A.1 SCOPE

A.1.1 Scope. This method describes a procedure to determine singularly or simultaneously the filterability characteristics and solids contamination of jet fuel. The purpose is to detect and prevent contaminants in jet fuel, which can plug and cause rupture of ground filtration equipment, thereby affecting flight reliability/safety of aircraft. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 METHODS

A.2.1 Summary of methods. 3.79 liters (1 gallon) of jet fuel is filtered through a membrane filter in the laboratory. The time required to filter this volume is measured in minutes and solids content is determined gravimetrically.

A.3 APPARATUS

a. Membrane filter: White, plain 47-mm diameter, nominal pore size 0.8 micron. The membrane shall be approved by ASTM for use with ASTM D5452.

b. Filtration apparatus: Of the types shown in ASTM D5452, figure 2. It consists of a funnel and funnel base with a filter support such that a membrane filter can be securely locked or clamped between the sealing surfaces of the funnel and its base. The funnel and funnel base shall be of stainless steel or glass construction.

c. Insert ring: The insert ring shall only be used with JP-4 fuel. A 47-mm diameter paper flow reducer ring with dimensions to give a filtering area of 4.8 cm^2. (Millipore Corporation Part No. XX10 04710.)

d. Vacuum flask: A minimum of 4 liters.

e. Vacuum system: That develops in excess of 67.5 kPa (20 in. of mercury) vacuum.

f. Oven: Of the static type (without fan assisted circulation) controlling to 90 ± 5 °C.

g. Forceps: Flat-bladed with unserrated, nonpointed tips.

h. Solvent filtering dispenser: Containing a 0.45 micron maximum pore size filter in the delivery line.

i. Glass Petri dish: Approximately 125 mm in diameter with removable cover.

j. Analytical balance: Single or double pan, the precision standard deviation of which must be 0.07 mg or better.

A.4 PREPARATION

A.4.1 Preparation of apparatus and sample containers. All components of the filtration apparatus (except the vacuum flask), sample containers, and their caps must be cleaned as described in ASTM D5452. All metal parts of the filtration apparatus are to be electrically bonded and grounded, including the fuel sample container and the metal insert ring, if used. See ASTM D5452 for other safety precautions.

A.5 SAMPLING

A.5.1 Sample. Obtain a representative 3.79 liters (1 gallon) sample as directed in ASTM D5452. When sampling from a flowing stream is not possible, an all-level sample or an average sample in accordance with ASTM D4057 and/or ASTM D4177 shall be permitted. The 3.79-liter sample container shall be an interior epoxy-coated metal can, a brown glass bottle, or a clear glass bottle protected by suitable means from exposure to light.

A.6 PROCEDURE

A.6.1 Test procedure.

a. Membrane filters shall be removed from the package and placed in an oven for a minimum of 15 minutes at 90 °C. After preheating, but prior to weighing, the membrane filters shall be stored in a desiccator.

b. Each membrane filter shall be weighed. A filter weighing in excess of 90 mg shall not be used in the test.

c. The insert ring shall be centered on the filter base. One membrane filter shall be placed directly over the insert ring. The top funnel shall be locked into place.

d. Immediately prior to filtering the fuel, shake the sample to obtain a homogenous mix and ensure that fuel temperature does not exceed 30 °C. Clean the exterior or top portion of the sample container to ensure no contaminants are introduced. Any free water present in the fuel sample will invalidate the filtration time results by giving an excessive filtration time rating.

e. With the vacuum off, pour approximately 200 mL of fuel into the funnel.

f. Turn vacuum on and record starting time. Continue filtration of the 3.79 liter sample, periodically shaking the sample container to maintain a homogenous mix. Record the vacuum in kPa (in. of mercury) 1 minute after start and again immediately prior to completion of filtration. Throughout filtration, maintain a sufficient quantity of fuel in the funnel so the membrane filter is always covered.

g. Record the filtration time in minutes expressed to the nearest whole number. If filtration of the 3.79 liters is not completed within 30 minutes, the test will be stopped and the volume of the fuel filtered will be measured. In these cases, record filtration time as “greater than 30 minutes” and the total volume of fuel filtered.

h. Record the vacuum in kPa (in. of mercury) as determined from the average of the two readings taken in A.6.1.f.

i. After recording the filtration time, shut off the vacuum and rinse the sample container with approximately 100 mL of filtered petroleum ether and dispense into the filtration funnel. Turn on the vacuum and filter the 100 mL rinse. Turn off the vacuum and wash the inside of the funnel with approximately 50 mL of filtered petroleum ether. Turn on vacuum and filter. Repeat the funnel rinse with another 50 mL of petroleum ether but allow the rinse to soak the filter for approximately 30 seconds before turning on the vacuum to filter the rinse. With the vacuum on, carefully remove the top funnel and rinse the periphery of the membrane filter by directing a gentle stream of petroleum ether from the solvent dispenser from the edge of the membrane toward the center, taking care not to wash contaminants off the filter. Maintain vacuum after final rinse for a few seconds to remove the excess petroleum ether from the filter.

j. Using forceps, carefully remove the membrane filter from the filter base and place in a clean Petri dish. Dry in the oven at 90 °C for 15 minutes with the cover on the Petri dish slightly ajar. Place dish in a dessicator and allow to cool for a minimum of 15 minutes. If more than one sample is processed, cooling time will have to be increased. Reweigh the filter.

k. Record the total solids content in mg/liter by using the following formula:

$$\frac{\text{Weight gain of filter in mg}}{3.785} = \text{mg/liter}$$

l. Should the sample exceed the 30-minute filtration time and a portion of the fuel is not filtered, the solids content in mg/liter will be reported as follows: Determine the volume of fuel filtered by subtracting the mL of fuel remaining from 3.785.

$$\frac{\text{Weight gain of filter in mgs}}{\text{mL of fuel filtered x } 0.001} = \text{mg/liter}$$

A.7 LIMIT

A.7.1 Test limits.

a. Filtration time:

(1) The maximum allowable filtration time shall be 10 minutes for grade JP-4 and 15 minutes for grade JP-5.

(2) The vacuum shall exceed 67.5 kPa (20 in. of mercury) throughout the test; i.e., the differential pressure across the filter should exceed 67.5 kPa (20 in. of mercury).

(3) The fuel temperature shall be between 18° and 30°C.

b. Total solids: Maximum allowable particulate matter is 1.0 mg/liter.

A.8 NOTES

A.8.1 If it is desired to determine the filtration time and not the total solids content, perform the test by omitting steps A.6.1.i, A.6.1.j, A.6.1.k, and A.6.1.l.

A.8.2 If it is desired to determine the total solids content and not the filtration time, use of the insert ring may be omitted. It is also permissible, but not required, to use a control filter for a specific analysis or a series of analyses. When this is accomplished, the procedures specified in ASTM D5452 apply.

CONCLUDING MATERIAL

Custodians:
Army - AT
Navy - AS
Air Force -11
DLA - PS

Review activities:
Army – AR, AV
Navy – SH
Air Force - 68

Preparing activity:
Navy - AS

(Project 9130-1074)

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 ASSIST Online database at http://www.dodssp.daps.mil.