METRIC

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18 September 1998
SUPERSEDING
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22 November 1996

DETAIL SPECIFICATION

TURBINE FUEL, AVIATION, GRADES JP-4, JP-5, AND JP-5/JP-8 ST

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

1. SCOPE

1.1 Scope. This specification covers three grades of aviation turbine fuel NATO F-40 (JP-4), NATO F-44 (JP-5), and JP-5/JP-8 ST (see *6.1*). This specification was thoroughly reviewed as a part of acquisition reform. While most of the requirements were converted to performance terms, due to the military-unique nature of the product (see *6.1*) and the need for compatibility with deployed systems, it was determined that not all requirements could be converted. The issuance of this specification as "detail" is not intended to constrain technology advances in future systems.

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

Grade	NATO Code No.	Description
JP-4	F-40	Wide cut, gasoline type
JP-5	F-44	High flashpoint, kerosene type
JP-5/JP-8 ST		Special test fuel, high flashpoint, kerosene type, for engine development and qualification testing (see *6.1*).

1.3 References. Turbine fuels in accordance with this specification and generally referenced in other documents with grade not specified will be interpreted to also include turbine fuels in accordance with *MIL-T-83133*.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENSI, Bldg 560, 2530 Loop Rd, West, Wright-Patterson AFB OH 45433-7101, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A **FSC 9130**

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in *sections 3* and *4* 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 documents cited in *section 3* and *4* of this specification, whether or not they are listed.

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 listed in the issue of the *Department of Defense Index of Specifications and Standards* (*DoDISS*) and supplement thereto, cited in the solicitation (see *6.2*).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric)
MIL-I-85470	Inhibitor, Icing, Fuel System, High Flash, NATO Code Number S-1745 (Metric)

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-290	Packaging of Petroleum and Related Products

QUALIFIED PRODUCTS LIST

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Department of Defense Single Stock Point, Building 4D, 700 Robbins Avenue, Philadelphia PA 19111-5098.)

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 the documents that are DoD adopted are those listed in the issue of the *DoDISS* cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the *DoDISS* are the issues of the documents cited in the solicitation (see *6.2*).

AMERICAN SOCIETY FOR TESTING AND MATERIALS 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 (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 Kerosene Aviation Turbine Fuels (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 X-Ray Spectrometry (DoD Adopted)
ASTM D2624	Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels Containing a Static Dissipator Additive
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 (DoD Adopted)
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
ASTM D4529	Standard Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
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	Vapor Pressure of Petroleum Products (Mini Method) (DoD Adopted)
ASTM D5452	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
ASTM D5453	Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence
ASTM D590l	Standard Test Method for Freezing Point of Aviation Fuels (Automatic Optical Method)
ASTM D5972	Standard Test Method for the Freezing Point of Aviation Fuels (Automated 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)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959; (610) 832-9500.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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 feed stock 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 conform to the requirements listed in *section 3* and *tables I and II*, as applicable, when tested in accordance with the applicable test methods.

3.3 Additives. Information concerning the type and amount of each additive used shall be made available when requested by procuring activity or user.

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 and JP-5/JP-8 ST fuels; and to JP-4 fuels that contain blending stocks that have been hydrogen treated to prevent the formation of gums and peroxides after manufacture. JP-4 fuels that do 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, JP-5/JP-8 ST, 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 those JP-4 fuels not hydrogen treated, the supplier may add 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. A metal deactivator, N,N'-disalicylidene-1,2-propanediamine, may 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. Metal deactivator additive shall not be used in JP-4 or JP-5 unless the supplier has obtained written consent from the Procuring Activity and 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).

3.3.3 Corrosion inhibitor. A corrosion inhibitor that conforms to *MIL-PRF-25017* shall be blended into the JP-4, JP-5, and JP-5/JP-8 ST fuel by the supplier. The amount added shall be equal to or greater than the minimum effective concentration and shall not exceed the maximum allowable concentration listed in the latest revision of *QPL-25017*.

3.3.4 Fuel system icing inhibitor. The use of a fuel system icing inhibitor shall be mandatory. The icing inhibitor shall be in accordance with *MIL-I-85470*. The point of injection of the additive for JP-4, JP-5, and JP-5/JP-8 ST shall be determined by agreement between the Purchasing Authority and the supplier.

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 determined by agreement between the Purchasing Authority and the supplier. The following static dissipator additive is approved: Stadis 450®, marketed by Octel America, Newark, DE 19702. Static dissipator additive is not permitted in JP-5 to be used by the Navy unless the supplier or Procuring Activity has obtained written consent 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 (70°F) and shall contain no more than 1.0 mg/L of particulate matter as required 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*[11] *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	0.002	0.002	*D3227*
Doctor test	Negative	Negative	*D4952*
Sulfur, total, mass percent, max	0.40	0.40	*D1266, D2622, D3120, D4294*[11] *or D5453*
Distillation temperature, °C (*D2887* tests in parentheses)[15]			*D86*[1,11] *or D2887*
Initial boiling point	Report	Report	
10 percent recovered, temp	Report	206 (185)°C, max	
20 percent recovered, temp	100°C, min	Report	
50 percent recovered, temp	125°C, min	Report	
90 percent recovered, temp	Report	Report	
End point, max temp	270°C, max	300 (330)°C, max	
Residue, vol %, max (for *D86*)	1.5	1.5	
Loss, vol %, max (for *D86*)	1.5	1.5	
Flash point, °C, min		60[14]	*D56, D93*[11]*, or D3828*
Density, at 15°C			*D1298 or*
kg/L, min (API max)	0.751 (57.0)	0.788 (48.0)	*D4052*[11]
kg/L, max (API min)	0.802 (45.0)	0.845 (36.0)	
Vapor pressure, at 37.8°C (100°F), kPa			*D323, D4953,*
minimum	14		*D5190, or*
maximum	21		*D5191*[11,12]
Freezing point, °C, max	-58	-46	*D2386*[11]*, D5901, or D5972*[2]
Viscosity, at -20°C, max, mm^2/s		8.5	*D445*
Heating value, Heat of combustion, MJ/kg,	42.8	42.6	*D3338, D4809*[11]*, or D4529*

TABLE I. Chemical and physical requirements and test methods (continued)

Requirements	Grade JP-4	Grade JP-5	Test Method ASTM Standards
Calculated Cetane Index		Report	*D976*[3]
Hydrogen content, mass percent, min	13.5	13.4	*D3701*[4]
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	25	25	*D3241*[5]
Tube deposit code, less than	3	3	
Existent gum, mg/100 mL, max	7.0	7.0	*D381*[13]
Particulate matter, mg/L, max	1.0	1.0	*D2276 or D5452*[6, 11]
Filtration time, minutes, max	10	15[7]	[6]
Water reaction			
Interface rating, max	lb	lb	*D1094*[6]
Microseparometer rating, min	[8]	[8]	*D3948*
Fuel system icing inhibitor			*D5006*
volume percent min	0.10	0.15	[9]
volume percent max	0.15	0.20	[9]
Fuel electrical conductivity, pS/m			
allowable range	150 to 600[10]		*D2624*

1 A condenser temperature of 0° to 4°C (32° to 40°F) shall be used for the distillation of JP-5 and JP-5/JP-8 ST fuels. For JP-4, group 3 test conditions shall be used.

2 *ASTM D5972* may be used for freeze point determination of JP-5 only.

3 *Mid-boiling temperatures may be obtained by either D86 or D2887 to perform the Cetane Indexcalculation.* If D86 values are used, they should be corrected to standard barometric pressure.

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

5 See 4.4.2.1 for ASTM D3241 test conditions and test limits.

6 A minimum sample size of 3.79 liters (1 gallon) shall be filtered. Filtration time will be determined inaccordance with the procedure in appendix A. The procedure in appendix A may also be used for the determination of particulate matter as an alternate to ASTM D2276 or ASTM D5452.

7 The flow reducer ring of appendix A, A.4.c, is not required for JP-5 and JP-5/JP-8 ST fuel.

8 The minimum microseparometer rating using a Micro-Separometer (MSEP) shall be as follows:

Product	Additives	MSEP Rating, min
JP-4, JP5, and JP-5/JP-8 ST	Antioxidant (AO)*, Metal Deactivator (MDA)*	90
JP-4, JP-5, and JP-5/JP-8 ST	AO*, MDA*, and Fuel System Icing Inhibitor (FSII)*	85
JP-4, JP-5, and JP-5/JP-8 ST	AO*, MDA*, and Corrosion Inhibitor/Lubricity Improver (CI/LI)	80
JP-4, JP-5, and JP-5/JP-8 ST	AO*, MDA*, CI/LI, and FSII	70

* Even though the presence or absence of this additive does not change these limits, 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.

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

10 The conductivity must be in the range of 150 to 600 pS/m at ambient fuel temperature or 29.4°C (85°F), whichever is lower.

11 Referee Test Method.

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

13 If air is used instead of steam while performing ASTM D381, it must be reported. In case of a failure with air, the sample must be retested using steam.

14 ASTM D3828 may give results up to 1.7°C (3°F) below the ASTM D93 results. ASTM D56 may give results up to 1°C (2°F) below the ASTM D93 results.

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

TABLE II. Chemical and physical requirements for JP-5/JP-8 ST.

Requirements	Minimum	Maximum	Test Method ASTM Standards
Aromatics, vol percent	23.0	27.0	*D1319*
Flash point, ^{o}C	60		*D56, D93, or D3828*
Density, at 15°C, kg/L (API)	0.815 (42.1)	0.845 (36.0)	*D1298* or *D4052*
Viscosity, @ -40^{o}C, mm^{2}/s	12		*D445*
Hydrogen content, wt percent	13.3	13.5	*D3701*
Smoke point, mm	18.0	21.0	*D1322*
NOTE: All other requirements of *table I* for grade JP-5 apply.			

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as quality conformance inspection (see *4.2*).

4.2 Conformance inspection. Test for the acceptance of individual lots shall consist of tests for all requirements specified in *section 3*. Quality conformance inspection shall include the test requirement herein.

4.2.1 Inspection lot. For acceptance purposes, individual lots shall be examined as specified herein and subjected to tests for all requirements cited in *section 3*.

4.2.2 Sampling plans.

4.2.2.1 Sampling for verification of product quality. Each bulk or packaged lot (see *6.6*) of material shall be sampled for verification of product quality in accordance with *ASTM D4057* and/or *ASTM D4177*, except where individual test procedures contain specific sampling instructions.

4.2.2.1.1 Sample containers. A number of jet fuel properties are very sensitive to trace contamination that can originate from sample containers. For recommended sample containers refer to *ASTM D4306*.

4.2.2.2 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 *4.4.1.3*.

4.3 Inspection conditions. The Fuel shall comply with the specified limiting values in *Table I* and *Table II*, using the cited test methods. The specified limiting values must not be changed. This precludes any allowance for test method precision and adding or subtracting digits. For purposes of determining conformance with the specified limiting values, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of digits used in expressing the specified limiting value, in accordance with the Rounding-Off Method of *ASTM E29*.

4.4 Methods of inspection.

4.4.1 Examination of product.

4.4.1.1 Visual inspection. Samples selected in accordance with *4.2.1* shall be visually examined for compliance with *3.4*.

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

4.4.1.3 Examination of filled containers. Samples, taken as specified in *4.2.2* shall be examined for conformance to *MIL-STD-290* with regard to fill, closure, sealing, leakage, packaging, packing, and markings. Any container having one or more defects under the required fill shall be rejected.

4.4.2 Chemical and physical tests. Tests to determine conformance to chemical and physical requirements (see *3.2*) shall be conducted in accordance with the applicable test methods listed in *tables I* and *II*, except for those specified herein.

4.4.2.1 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).

4.4.2.1.1 Test conditions.

a. Heater tube temperature at maximum point: 260 ^{o}C (500 ^{o}F)

b. Fuel system pressure: 3.45 MPa (500 pounds/square inch of gravity)

c. Fuel flow rate: 3.0 milliliter/minute

d. Test duration: 150 minutes

4.4.2.1.2 Acceptability criteria. The fuel sample is acceptable if all the following criteria are met:

a. The maximum visual rating of the heater tube deposits is less than a code 3 (Annex A1 of ASTM D3241).

b. The visual rating of the heater tube shows neither peacock-type deposit (code P) nor abnormal-type deposits (code A).

c. The maximum differential pressure across the test filter does not exceed 25 mm of mercury.

d. Remove the reservoir cover and pour into a measuring cylinder the fuel found above the piston only. If this measured fuel is less than 405 mls, reject the test because insufficient fuel has been pumped for a normal 150-minute test. It is suggested the cause of the insufficient flow be located before another test is run.

4.4.2.1.3 *ASTM D3241* reported data.

a. Report the differential pressure in millimeters of mercury at 150 minutes, or time to differential pressure of 25 mm of mercury, whichever comes first.

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

c. If a Mark 8A Tube deposit rater is available, the maximum SPUN TDR rating shall be reported for information purposes.

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 personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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. The JP-5/JP-8 ST (special test) fuel is a worst-case kerosene-type aviation turbine fuel in terms of fuel effects on engine starting, altitude relight, combustor durability, and exhaust smoke emissions. This fuel is intended for use in the development, testing, and qualification of engine components, engines, and aircraft. When authorized, the JP-5/JP-8 ST fuel may also be used for qualification testing of ground-based turbine engines.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification

b. Issue of *DoDISS* to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see *2*)

c. Grade of fuel required (see *1.2*)

d. Quantity required and size containers desired

e. Level of packaging and packing required

f. Location and injection method for addition of fuel system icing inhibitor (JP-4, JP-5, and JP-5/JP-8 ST and electrical conductivity additive (JP-4 only)).

6.3 Conversion of metric units. Units of measure have been converted to the International System of Units (SI) (Metric) in accordance with *ASTM SI 10*. If test results are obtained in units other than Metric or there is a requirement to report dual units, *ASTM SI 10* should be used to convert the units.

6.4 Inspection. Inspection should be performed in accordance with *method 9601* of *FED-STD-791*.

6.5 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*.

6.6 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
special test fuel
static dissipater additive

6.8 International standardization agreements. Certain provisions of this specification are the subject of international standardization agreements *ASCC Air Std 15/6*, *ASCC Air Std 15/9*, NATO *STANAG 1135*, and NATO *STANAG 3747*. When amendment, revision, or cancellation of this specification is proposed which affects or violates the international agreement concerned, the Preparing Activity will take appropriate reconciliation action through international standardization channels including the departmental standardization office, if required.

6.9 Changes from previous issue. Marginal notations are used in this revision to identify changes with respect to the previous issue.

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

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

Preparing activity:
Air Force - 11

(Project 9130-1068)

International Interest:
(See *6.8*)

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 APPLICABLE DOCUMENTS

AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS

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 D5452	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration

A.3 METHODS

A.3.1 Summery 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.4 APPARATUS

a. Membrane filter: White, plain 47-mm diameter, nominal pore size 0.8 micron. The membrane must 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 (194° ± 9°F).

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.5 PREPARATION

A.5.1 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 *Paragraph 8* of *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.6 SAMPLING

A.6.1 Sample. Obtain a representative 3.79 liters (1 gallon) sample as directed in *Paragraph 9* of *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-liters (1-gallon) 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.7 PROCEDURE

A.7.1 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 will 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 assure that fuel temperature does not exceed 30°C (86°F). Clean the exterior or top portion of the sample container to insure 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 liters (1 gallon) 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. Report the filtration time in minutes expressed to the nearest whole number. If filtration of the 3.79 liters (1 gallon) is not completed within 30 minutes, the test will be stopped and the volume of the fuel filtered will be measured. In these cases, report filtration time as “>30 minutes” and the total volume of fuel filtered.

h. Report the vacuum in kPa (in. of mercury) as determined from the average of the two readings taken in *A.7.1.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 (194°F) 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. Report the total solids content in mg/liter by using the following formula:

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

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 filtered 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.8 LIMIT

A.8.1 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 should 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 (64° and 86°F).

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

A.9 NOTES

A.9.1 If it is desired to determine the filtration time and not the total solids content, perform the test by omitting steps *A.7.1.i, A.7.1.j, A.7.1.k, and A.7.1.l.*

A.9.2 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.

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