METRIC

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1 April 1999
SUPERSEDING
MIL-T-83133D
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DETAIL SPECIFICATION

TURBINE FUELS, AVIATION, KEROSENE TYPES, NATO F-34 (JP-8), NATO F-35, AND JP-8+100

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 kerosene type aviation turbine fuel, NATO F-34 (JP-8) , NATO F-35, and JP-8+100. 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*).

NATO Code No./Grade	Description
F-35	Kerosene type turbine fuel which will contain a static dissipator additive, may contain antioxidant, corrosion inhibitor/lubricity improver, and metal deactivator but will not contain fuel system icing inhibitor.
F-34 (JP-8)	Kerosene type turbine fuel which will contain a static dissipator additive, corrosion inhibitor/lubricity improver, and fuel system icing inhibitor, and may contain antioxidant and metal deactivator.
JP-8+100	F-34 (JP-8) type kerosene turbine fuel which contains thermal stability improver additive as described in *Para 3.3.6.*

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 45433-7107, 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 *sections 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-DTL-5624 - Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8 ST

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)

STANDARDS

DEPARTMENT OF DEFENSE

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

QUALIFIED PRODUCTS LIST

QPL-25017 - Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Department of Defense Single Stock Point, 700 Robbins Avenue, Building 4D, 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 which are DoD adopted are those listed in the issue of DoDISS specified 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 D129 - Standard Test Methods for Sulfur in Petroleum Products (General Bomb Method)

ASTM D130	- Standard Test Methods 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 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 Methods 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 Florescent Indicator Adsorption (DoD Adopted)
ASTM D1322	- Standard Test Method for Smoke Point of Kerosene Aviation Turbine Fuels (DoD Adopted)
ASTM D1840	- Standard Test Method for Naphthalene Hydrocarbons in Aviation Turbine Fuels by Ultraviolet Spectrophotometry (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 Method for Electrical Conductivity of Aviation and Distillate Fuels Containing a Static Dissipater 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 Oxidation 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 Procedures) (DoD Adopted)
ASTM D3242	- Standard Test Method for Acidity in Aviation Turbine Fuel (DoD Adopted)
ASTM D3338	- Standard Test Method for Estimation of 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 Tested (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 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 (DoD Adopted)
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 D5453	- Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence
ASTM D5901	- 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 the Test Data to Determine Conformance with the 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 specifications or specification sheets), 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 fuel supplied under this specification shall be refined hydrocarbon distillate fuel oils containing 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 those listed in *table I*.

3.3 Additives. The type and amount of each additive used shall be made available when requested by procurement activity or user. (see *6.2.e*).

3.3.1 Antioxidants. Immediately after processing and before the fuel is exposed to the atmosphere (i.e., during rundown into feed/batch tankage), add an approved antioxidant (see *3.3.1.1*) in order to prevent the formation of gums and peroxides after manufacture. The concentration of antioxidant to be added shall be:

a. 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) to all JP-8 fuel that contains blending stocks that have been hydrogen treated.

b. At the option of the supplier, not more than 24.0 mg of active ingredient per liter of fuel (8.4 lb/1000 barrels) may be added to JP-8 fuels that do not contain hydrogen treated blending stocks.

3.3.1.1 Antioxidant 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'-disalycylidene-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-8 unless the supplier has obtained written consent from the Procuring Activity and user.

3.3.3 Static dissipater additive. An additive shall be blended into the 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 of the additive shall be determined by agreement between the purchasing authority and the supplier. The following electrical conductivity additive is approved: Stadis 450 marketed by Octel America, Inc., Newark, DE 19702.

3.3.4 Corrosion inhibitor. A corrosion inhibitor conforming to *MIL-PRF-25017* shall be blended into the F-34 (JP-8) grade fuel by the contractor. The corrosion inhibitor additive is optional for F-35. 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*. The contractor or transporting agency, or both, shall maintain and upon request shall make available to the Government evidence that the corrosion inhibitors used are equal in every respect to the qualification products listed in *QPL-25017*. The point of injection of the corrosion inhibitor shall be determined by agreement between the purchasing authority and the supplier.

TABLE I. Chemical and physical requirements and test methods.

Property	Min	Max	Test Methods ASTM Standards
Color, Saybolt		1/	*D156* 2/ *or D6045*
Total Acid number, mg KOH/gm		0.015	*D3242*
Aromatics, vol percent		25.0	*D1319*
Sulfur, total, mass percent		0.30	*D129, D1266, D2622, D3120, D4294* 2/ *or D5453*
Sulfur Mercaptan, mass percent OR		0.002	*D3227*
Doctor Test		negative	*D4952*
Distillation Temperature, °C 3/			*D86* 2/*, D2887*
(D2887 limits given in parentheses)			
Initial boiling point		1/	
10 percent recovered		205 (186)	
20 percent recovered		1/	
50 percent recovered		1/	
90 percent recovered		1/	
End point		300(330)	
Residue, vol percent		1.5	
Loss, vol percent		1.5	
Flash point, °C	38	4/	*D56, D93* 2/ *or D3828* 4/
Density or Gravity			
Density, kg/L at 15° C OR	0.775	0.840	*D1298 or D4052* 2/
Gravity, API at 60°F	37.0	51.0	*D1298*
Freezing point, °C		-47	*D 2386* 2/*, D 5901 or D5972*
Viscosity, at -20°C, mm^2/s		8.0	*D445*
Net heat of combustion, MJ/kg	42.8		*D3338* 5/ *or D4809* 2/
Hydrogen content, mass percent	13.4		*D3701* 2/*, D3343*
Smoke point, mm, OR	25.0		*D1322*
Smoke point, mm, AND	19.0		*D1322*
Naphthalene, vol percent		3.0	*D1840*
Calculated Cetane Index		1/	*D976* 6/
Copper strip corrosion, 2hr at			
100°C (212°F)		No. 1	*D130*
Thermal stability			*D3241* 7/
change in pressure drop, mm Hg		25	
heater tube deposit, visual rating		<3 12/	
Existent gum, mg/100 ml		7.0	*D381*
Particulate matter, mg/L		1.0	*D2276* 8/ *or D5452* 2/
Filtration time, minutes		15	8/
Water reaction interface rating		1 b	*D1094*
Water separation index	9/		*D3948*
Fuel system icing inhibitor, vol %	0.10	0.15	*D5006* 10/
Fuel electrical conductivity, ps/m	11/	11/	*D2624*

1/ To be reported - not limited.

2/ Referee Test Method.

3/ A condenser temperature of 0° to 4° C (32° to 40°F) shall be used for the distillation by *ASTM D86*.

4/ *ASTM D56* may give results up to 1° C (2° F) below the *ASTM D93* results. *ASTM D3828* may give results up to 1.7° C (3° F) below the *ASTM D93* results. Method IP170 is also permitted.

5/ When the fuel distillation test is performed using *ASTM D2887*, the average distillation temperature, for use in *ASTM D3338* shall be calculated as follow:

$$V = (10\% + 50\% + 95\%)/3$$

6/ Mid-boiling temperature may be obtained by either *ASTM D86* or *ASTM D2887* to perform the cetane index calculation. *ASTM D86* values should be corrected to standard barometric pressure.

7/ See *4.5.3* for *ASTM D3241* test conditions and test limitations.

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

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

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

*Even though the presence or absence 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.

10/ Test shall be performed in accordance with *ASTM D5006* using the DiEGME scale of the refractometer.

11/ The conductivity must be between 150 and 450 pS/m for F-34 (JP-8) and between 50 and 450 pS/m for F-35, at ambient temperature or 29.4°C (85°F), whichever is lower, unless otherwise directed by the procuring activity. In the case of JP-8+100, JP-8 with the thermal stability improver additive (see *3.3.6*), the conductivity limit must be between 150 to 700 pS/m at ambient temperature or 29.4°C (85°F), whichever is lower, unless otherwise directed by the procuring activity.

12/ Peacock or Abnormal color deposits result in a failure.

3.3.5 Fuel system icing inhibitor. The use of a fuel system icing inhibitor shall be mandatory for NATO F-34 (JP-8) and shall conform to *MIL-DTL-85470*. The point of injection of the additive for NATO F-34 (JP-8) shall be determined by agreement between the Purchasing Authority and the supplier. The fuel system icing inhibitor is not to be added to NATO F-35 unless so directed by the Purchasing Authority.

3.3.6 Thermal stability improver additive. Due to logistical concern, personnel at the operating location shall request written approval from the cognizant activity to add a thermal stability improver additive to the fuel. If approval is given, the concentration of the additive and location of injection shall be specified by the cognizant service activity listed below. JP-8 fuel with an approved thermal stability improver additive at the required concentration shall be designated as JP-8+100. Thermal stability improver additive shall not be used in JP-8 without approval, in writing, from:

Cognizant Activity for the Navy and Marine Corps: Naval Air Systems Command, AIR-4.4.5, Bldg 2360 PSEF, 22229 Elmer Road, Patuxent River, MD 20670-1534.

Cognizant Activity for the Air Force and all other DoD agencies: AFRL/PRSF, Bldg 490, 1790 Loop Road N, WPAFB, OH 45433-7103.

Cognizant Activity for the Army: US Army Tank-automotive and Armaments Command, AMSTA-TR/210, Warren, MI 48397-5000.

3.3.6.1 Qualified additives. Qualified thermal stability improver additives are listed in *table II*.

TABLE II Qualified Thermal Stability Improver Additives

Additive Name	Qualification Reference	Manufacturer
SPEC AID 8Q462	AFRL/PRSF Ltr, 9 Dec 97	BetzDearborn 9669 Grogan Mill Road P.O. Box 4300 The Woodlands TX 77387
AeroShell Performance Additive 101	AFRL/PRSF Ltr, 13 Jan 98	Shell Aviation Ltd. Shell-Mex House Strand London WC2R 0ZA

3.3.7 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 visually free from undissolved water, sediment, or suspended matter and shall be clear and bright. 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*.

4. VERIFICATION

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

4.2 Conformance inspection. Test for 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*.

4.3 Inspection.

4.3.1 Inspection conditions. The fuel shall comply with the specified limiting values in *table 1*, 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 the 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 Sampling plans.

4.4.1 Sampling. Each bulk or packaged lot of material shall be sampled for verification of product quality in accordance with *ASTM D4057* or *ASTM D4177*, except where individuals test procedures contain specific sampling instructions.

4.4.2 Sampling for inspection of filled containers. A random sample of filled containers shall be selected from each lot and shall be subjected to the examination of filled containers as specified in *4.5.1.3*.

4.5 Methods of inspection.

4.5.1 Examination of product.

4.5.1.1 Visual inspection. Samples selected in accordance with *4.4.1* shall be visually examined for compliance with *3.4*.

4.5.1.2 Examination of empty containers. Before filled, each unit container shall be visually inspected for cleanliness and suitability in accordance with *ASTM D4057*.

4.5.1.3 Examination of filled containers. Samples taken as specified in *4.4.2* shall be examined for conformance to *MIL-STD-290* with regard to fill, closure, sealing, leakage, packaging, packing, and markings. Any container with one or more defects under the requited fill shall be rejected.

4.5.2 Chemical and physical tests. Tests to determine conformance to chemical and physical requirements shall be conducted in accordance with *table I*. The fuel shall pass all tests listed in *table I*. No additional testing shall be required. Requirements contained herein are not subject to corrections for test tolerances. If multiple determinations are made, results falling within any specified repeatability and reproducibility tolerances may be averaged. For rounding off of significant figures, *ASTM E29* shall apply to all tests required by this specification.

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

4.5.3.1 *ASTM D3241* test conditions

a. Heater tube temperature at maximum point: 260°C (500°F).

b. Fuel system pressure: 3.45 MPa (500 psig).

c. Fuel flow rate: 3.0 mL/min.

d. Test duration: 150 minutes.

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

a. The maximum differential pressure across the test filter does not exceed 25 millimeters of mercury.

b. The maximum visual rating of the heater tube deposits are less than a code 3, and visual rating of the heater tube shows neither peacock type deposits (code P) nor abnormal type deposits (code A).

c. 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 to locate the cause of the insufficient flow before running another test.

4.5.3.3 *ASTM D3241* reported data. The following data shall be reported:

a. Differential pressure in millimeter of mercury at 150 minutes, or time to differential pressure of 25 millimeters of mercury, whichever comes first.

b. Heater tube deposit visual code rating at the end of the test.

c. If a Mark 8A tube deposit rater (TDR) is available, the maximum SPUN TDR rating shall be reported.

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 materiel 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 fuels covered by this specification are intended for use in aircraft turbine engines. JP-8 contains military unique additives that are required by military weapon systems. This requirement is unique to military aircraft and engine designs. When authorized, NATO F-34 (JP -8) may be used in ground - based turbine and diesel engines. NATO F-35 is intended for commercial aviation, but can be converted to NATO F-34 (JP-8) by the addition of the appropriate additives. A JP-5/JP-8 ST (special test) fuel, included in *MIL-DTL -5624*, is intended for use in the development and qualification testing of engines and aircraft designed to operate with JP-5 and JP-8.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, date of this specification, and grade (type) of fuel.

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

c. Quantity required and size containers desired.

d. Level of packaging and packing required (see *5.1*).

e. Location and injection method for addition of electrical conductivity additive, fuel system icing inhibitor and corrosion inhibitor, as required.

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 Definitions.

6.4.1 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.

6.4.2 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 an 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.

6.4.3 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.

6.5 Subject term (key word) listing

Antioxidants
Aviation fuel
Corrosion inhibitor
Fuel
F-34
F-35
Flash point
Freezing point
Hydrocarbon distillate fuel
Hydrogen content
Icing inhibitor
JP-8
JP-8+100
Jet A-1
Kerosene
Lubricity improver
Static dissipator
Thermal stability improver
Turbine

6.6 International agreements. Certain provisions of this specification are the subject of international standardization agreement *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 will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.7 Material Safety Data Sheet. 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*.

6.8 Test report. Test data required by *4.5* should be available for the procurement activity and user in the same order as listed in *table* I. The Inspection Data on Aviation Turbine Fuels form published in *ASTM D1655* should be used as a guide. Also, the type and amount of additives used should be reported

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 extensiveness of the changes.

Custodian:
Army - MR
Navy - AS
Air Force - 11
DLA – PS

Preparing Activity:
Air Force - 11

Project 9130-1067

Review Activities:
Army - AV, AR
Air Force – 68

International Interest:
(See *6.6*)

APPENDIX A

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

A.1 GENERAL

A.1.1 Scope. This method describes a procedure for determining singularly or simultaneously the filterability characteristics and solids contamination of jet fuel. The purpose is to detect and prevent contaminants in jet fuel that can plug and cause rupture of ground filtration equipment, thereby affecting flight reliability of aircraft.

A.2 APPLICABLE DOCUMENTS

AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS

ASTM D4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D4177	Standard Method for Automatic Sampling of Petroleum and Petroleum Products
ASTM D5452	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration

A.3 METHODS

A.3.1 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.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 of the funnel and its base. The funnel and funnel base shall be of stainless steel or glass construction.

c. Inset ring: A 47-mm diameter paper flow reducer ring with dimensions to give 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 inches of mercury) vacuum.

f. Oven: Of the static type (without fan assisted circulation) controlling to 90º ± 5º C (194º ± 9º F).

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

h. Solvent filtering dispenser: Containing a 1.2 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 Sampling. Obtain a representative 3.79 L (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 L (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 to 90º 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 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 homogeneous mix and assure that fuel temperature does not exceed 30º C (86º F). Clean the exterior or top portion of the sample container to ensure that 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 (inches 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 that 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 (inches of mercury) as determined from the average of the two readings taken in *A.7.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 the vacuum on and filter the 100 ml. Rinse. Turn vacuum off and wash the inside of the funnel with approximately 50 ml of filtered petroleum ether. Turn vacuum on 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 the vacuum on to filter the rinse. With 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 and place in a clean petri dish. Dry in the oven at 90º C (194º F) for 15 minutes with the cover on the petri dish slightly ajar. Place dish in a desiccator 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 figured 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 LIMITS

A.8.1 Test limits.

a. Filtration time:

(1) The maximum allowable filtration time shall be 15 minutes for Grade JP-8.

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

(3) The fuel temperature shall be between 18° and 30° C (64° and 86° F). If artificial heat (i.e., a hot water bath) is used to heat the sample, erroneously high filtration times may occur, but this approach is allowed.

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.6.i*, *A.6.j*, *A.6.k*, and *A.6.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.

. STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
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	MIL-DTL-83133E	**990401**

3. DOCUMENT TITLE

TURBINE FUELS, AVIATION, KEROSENE TYPES, NATO F-34 (JP-8), NATO F-35, AND JP-8+100

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

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