INCH-POUND
MIL-PRF-7024E
1 Oct 1997
Superseding
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30 August 1990

PERFORMANCE SPECIFICATION
CALIBRATING FLUIDS, AIRCRAFT FUEL SYSTEM COMPONENTS

This specification has been approved for all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for three types of calibrating fluid used in the calibration of aircraft fuel system components.

1.2 Classification. The fluids will be of the following types as specified (6.2):

Type I - Normal Heptane
Type II - Special Run Stoddard Solvent
Type III - High Flash Point Fluid

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 those identified as 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 the requirements of the specified documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government Documents.

2.2.1 Specifications, Standards, and Handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those 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-I-25017 Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to SA-ALC/SFSP, 1014 Billy Mitchell Blvd./Ste 1, Kelly AFB TX 78241-5603, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6850

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 the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the non-Government documents which are current on the date of the solicitation.

American Society for Testing and Materials (ASTM)

ASTM D 56 - Test Method for Flash Point by Tag Closed Tester (DoD adopted)

ASTM D 86 - Method for Distillation of Petroleum Products (DoD adopted)

ASTM D 130 - Methods for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test (DoD adopted)

ASTM D 156 - Test Method for Saybolt Color of Petroleum products (Saybolt Chronometer Method) (DoD adopted)

ASTM D 323 - Test Method for Vapor Pressure of Petroleum Products (Reid Method) (DoD adopted)

ASTM D 381 - Test Method for Existent Gum in Fuels by Jet Evaporation (DoD adopted)

ASTM D 445 - Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity) (DoD adopted)

ASTM D 873 - Test Method for Oxidation Stability of Aviation Fuel (Potential Residue Method) (DoD adopted)

ASTM D 1093 - Test Method for Acidity of Distillation Residues or Hydrocarbon Liquids (DoD adopted)

ASTM D 1298 - Test Method for Density, Relative Density, (Specific Gravity), or API Gravity of Crude Petroleum Petroleum Products by Hydrometer Method (DoD adopted)

ASTM D 1319 - Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption (DoD Adopted)

ASTM D 2276 - Test Method for Particulate Contaminant in Aviation Turbine Fuels (DoD adopted)

ASTM D 2386 - Test Method for Freezing Point of Aviation Fuels (DoD adopted)

ASTM D 3227 - Test Method for Mercaptan Sulfur in Gasoline, Kerosene, Aviation Turbine, and Distillate Fuels (Potentiometric Method) (DoD adopted)

ASTM D 3242 - Test Method for Total Acidity in Aviation Turbine Fuel (DoD adopted)

ASTM D 3606 - Test Method for Determination of Benzene and Toluene in Finished Motor and Aviation Gasoline by Gas Chromatography

ASTM D 4052 - Test Method for Density and Relative Density of Liquids by Digital Density Meter (DoD adopted)

ASTM D 4057 - Practice for Manual Sampling of Petroleum and Petroleum Products (DoD adopted)

ASTM D 4952 - Test Method for Quantitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test)

ASTM D 5972 - Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)

ASTM E 29 - Recommended Practice for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values (DoD adopted)

(Application for copies of ASTM documents should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959).

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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.

TABLE I. Chemical and Physical Requirements and Test Methods.

REQUIREMENTS	Type I	Type II	Type III	ASTM Test Method
Specific Gravity, 15.6°C/15.6°C (60°F/60°F)	0.699 ±0.002	0.770 ±0.005	0.780 ±0.005	D 1298 D 4052
Color, Saybolt, Lighter Than	+25		+25	D 156
Viscosity, Centistokes at 0°C (32°F)	0.785 ±0.01			D 445
25°C (77°F)		1.17 ±0.05		
37.8°C (100°F)	0.54 ±0.01		2.47 ±0.10	
Vapor Pressure at 37.8°C (100°F), kPa (psi) Max	13.8 (2.0)			D 323
Existent Gum, mg/100ml Max	2.0	5.0		D 381 1/
Potential Gum, mg/100ml Max	5.0			D 873 2/
Distillation: Initial BP °C (°F) Min		149(300)	216(420)	D 86
Recovered 10% °C (°F)			3/	
Recovered 50% °C (°F)			221-232 (430-450)	
Recovered 90% °C (°F)			3/	

TABLE I. Chemical and Physical Requirements and Test Methods(cont).

Final Boiling Point °C (°F)		210 (410) Max	232-246 (450-475)	
Recovery, Percent Min		98.5		
Range, 5 to 95% points °C (°F)	1.7 (3) 4/			
Residue, Volume %, Max			1.5	
Loss, Volume %, Max			1.5	
Flash Point,°C(°F),Min		38 (100)	79 (175)	D 56
Aromatics, Vol %, Max		20.0		D 1319
Benzene, Vol %, Max	0.01	0.01	0.01	D 3606
Olefins, Vol %, Max		5.0		D 1319
Particulate Matter, mg/l, Max		2.0		D 2276
Mercaptan Sulfur, %Wt, Max or Doctor Test		0.001 Sweet		D 3227 D 4952
Copper Corrosion, Max	No. 1	No. 1	No. 1	D 130
Total Acid Number, mg/l, Max		0.015		D 3242
Freezing Point,°C(°F), Max			-54 (-65)	D 2386 D 5972
Acidity, Distillation Residue, Max			Neutral	D 1093

1/ Air Jet Method
2/ 5-Hour Aging Period
3/ To Be Reported-Not Limited
4/ Must Include Temperature of 98°C(208°F)

3. REQUIREMENTS

3.1 Materials. The fluids shall consist completely of hydrocarbon compounds, except as otherwise specified herein.

3.2 Chemical and Physical Requirements. The product shall conform to the requirements as specified in Table I. Requirements in Table I are absolute and not subject to correction for tolerance of test methods. The finished calibrating fluid shall be homogenous, visually free from water, sediment, or suspended matter and shall be clear and bright at the ambient temperature or at 21 degrees Centigrade (70 degrees Fahrenheit), whichever is higher.

3.3 Additives - Corrosion Inhibitor. If so specified by the procuring activity, a corrosion inhibitor conforming to MIL-I-25017 shall be blended into the calibration fluid by the contractor. The amount added shall be equal to or greater than the minimum effective concentration listed in the latest revision of QPL-25017. The supplier may add any one of the corrosion inhibitors listed on the latest revision of QPL-25017. The supplier shall maintain documentation that the corrosion inhibitor used is an approved QPL-25017 product.

3.4 Additives-Antioxidants. If so specified by the procuring activity, an anti-oxidant additive shall be blended into the type II calibrating fluid in total concentration not less than 4.2 pounds of inhibitor (not including weight of solvents) per 1000 barrels of fluid nor more than 8.4 pounds per 1000 barrels, in order to prevent the formation of gums and peroxides. The following additives or additive blends are approved for use:

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-dimethylphenol
28 percent max tert-butyl-methylphenols and tert-butyl-dimethylphenols

f. 55 percent min 6-tert-butyl-2,4-dimethylphenol
45 percent max mixture of tert-butylphenols and di-tert-butylphenols

g. 60 to 80 percent 2,6-dialkylphenols
20 to 40 percent mixture of 2,3,6-trialkylphenols and 2,4,6-trialkylphenols

h. 35 percent min 2,6-di-tert-butyl-4-methylphenol
65 percent max mixture of methyl-, ethyl-, and dimethyl-tert-butylphenols

i. 60 percent min 2,4-di-tert-butylphenol
40 percent max mixture of tert-butylphenols

j. 30 percent min mixture of 2,3,6-trimethylphenol and 2,4,6-trimethylphenol
70 percent max mixture of dimethylphenols

k. 65 percent min mixture of 2,4,5-triisopropylphenol and 2,4,6 triisopropylphenol
35 percent max mixture of other isopropylphenols and biphenols

l. 55 percent min butylated ethyl phenols
45 percent max butylated methyl and dimethyl phenols

3.5 Workmanship. The finished calibrating fluid shall be homogenous, visually free from undissolved water, sediment, or suspended matter and shall be clear and bright at the ambient temperature or at 21°C (70°F), whichever is higher.

3.6 Toxicity. The finished calibrating fluid shall have no adverse effect on the health of personnel when used for its intended purpose. The fluid shall contain no components which produce noxious vapors in such concentrations that would cause physical irritation to personnel during use or formulation under conditions of adequate ventilation. Percent composition of benzene shall be less than 0.01% of the total volume of the calibrating fluid due to benzene's toxic properties.

3.7 Limiting Values. The following applies to all specified limits in this performance specification: For the purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specification limit according to the rounding-off method of ASTM Practice E 29 for using Significant Digits in Test Data to Determine Conformance with Specifications.

4. VERIFICATION

4.1 Classification of Inspection. The inspections shall be classified as quality conformance inspections.

4.2 Quality Conformance Inspection. Inspections of individual lots shall serve as a basis for acceptance and shall consist of all the examinations and tests specified in section 3. Use the chemical and physical requirements and applicable test methods as specified in Table I for conformance testing.

4.3 Lot Definitions.

a. Bulk Lot of Material. An indefinite quantity of a homogeneous mixture of material contained in one isolated tank or kettle which is greater than 55 gallons in size, or a quantity manufactured by a single plant run through the same processing equipment during one continuous operation not exceeding a 24-hour period.

b. Packaged Lot of Material. A container lot of material shall be defined as an indefinite number of 55-gallon drums or smaller unit containers of identical size and type, filled with a homogeneous mixture of material manufactured by a single plant run through the same processing equipment during one continuous operation not exceeding a 24 hour period.

4.4 Sample. Each sample shall be of sufficient size to conduct all the quality conformance tests as specified herein. Unless otherwise specified, the quality conformance tests shall be performed on each required sample.

4.5 Sampling. Sampling shall be in accordance with ASTM D 4057.

4.5.1 Drums. The number of drums selected for sampling from each lot shall be according to Table II. The calibrating fluid from each container sampled shall constitute a separate sample.

TABLE II. Sampling for test.

Number of containers in lot	Number of containers to be sampled
2-25	2
26-150	3
151-1200	5
1201-7000	8

4.2.2.1.4 Portable tanks, cargo tanks, and tank cars. Each portable tank, cargo tank, or tank car shall constitute a lot. Unless otherwise specified, the sample shall be composited into one sample when one-third portions are withdrawn from the bottom, center, and top thirds of the tank.

4.2.2.1.5 Other containers. Unless otherwise specified, other containers of 100 gallons or less water capacity shall be sampled according to 4.2.2.1.3. Containers greater than 100 gallons water capacity shall be sampled according to 4.2.2.1.4.

4.6 Government Requested Sample. When requested, a 1-gallon sample shall be forwarded to the laboratory designated by the procuring activity for testing as specified herein.

4.7 Rejection. Failure of any calibrating fluid sample to conform to any of the specification requirements shall be cause for rejection of the lot represented.

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, they will 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.)

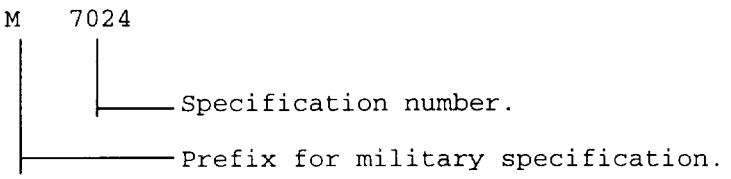
6.1 Intended Use. The fluids covered by this specification are intended for use in the calibration of aircraft fuel system components. Exercise caution to avoid prolonged contact with the skin and observe Occupational Safety and Health Administration (OSHA) guidelines.

Questions pertaining to the toxic effects should be referred to the appropriate departmental medical service.

6.2 Acquisition Requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification
b. Type
c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3)
d. Facility where Government requested test sample should be sent
e. Quantity required, and size and type of containers required
f. Packaging requirements (see 5.1)
g. Addition of corrosion inhibitor to the calibrating fluid
h. Addition of anti-oxidant additive to the calibrating fluid

6.3 Part or Identifying Number (PIN). The PIN number is created as shown below. It serves to identify a product during procurement and also in the Federal Supply System.



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

6.5 Subject Term (key word) Listing.

High Flash Point
Corrosion Inhibitor
Antioxidant

Custodians:
Army - AV
Navy - AS
Air Force - 68

Review Activities:
Army - EA, MD
Air Force - 11
DLA - GS

Preparing activity:
Air Force - 68

(Project 6850-1205)

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.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-7024E	**2. DOCUMENT DATE (YYMMDD)** 1 OCT 1997

3. DOCUMENT TITLE CALIBRATING FLUIDS, AIRCRAFT FUEL SYSTEM COMPONENTS

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON *(if applicable)*	**7.DATE SUBMITTED** (YYMMDD)

8. PREPARING ACTIVITY

a. NAME SA-ALC/SFSP	b. TELEPHONE *Include Area Code)* (1) Commercial (2) AUTOVON
c. ADDRESS *(Include Zip Code)* 1014 BILLY MITCHELL BLVD. STE. 1 KELLY AFB, TX 78241-5603	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** DEFENSE QUALITY AND STANDARDIZATION OFFICE 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22401-3466 Telephone (703) 756-2340 AUTOVON 289-2340