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**MIL-PRF-7024F**  
**20 January 2012**

**SUPERSEDING**  
**MIL-PRF-7024E**  
**1 October 1997**

## **PERFORMANCE SPECIFICATION**

### **CALIBRATING FLUIDS, AIRCRAFT FUEL SYSTEM COMPONENTS**



Comments, suggestions, or questions on this document should be addressed to AFPA/PTPT, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB OH 45433-7632 or e-mailed to [AFPET.AFTT@wpafb.af.mil](mailto:AFPET.AFTT@wpafb.af.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

AMSC N/A

FSC 6850

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This specification is approved for use by 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, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

### 2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-25017      Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble

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

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### ASTM INTERNATIONAL

|           |   |
|-----------|---|
| ASTM D56  | Standard Test Method for Flash Point by Tag Closed Cup Tester (DoD Adopted)                                 |
| ASTM D86  | Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure (DoD Adopted)           |
| ASTM D130 | Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip 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 Gum Content in Fuels by Jet Evaporation (DoD Adopted)                              |

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|            |   |
|------------|---|
| ASTM D445  | Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity) (DoD Adopted)                                   |
| ASTM D873  | Standard Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method) (DoD adopted)   |
| ASTM D1093 | Standard Test Method for Acidity of Hydrocarbon Liquids and Their Distillation Residues (DoD adopted)   |
| ASTM D1298 | Standard Test Method 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 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 D3227 | Standard Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method) (DoD Adopted)                     |
| ASTM D3242 | Standard Test Method for Acidity in Aviation Turbine Fuel (DoD Adopted)   |
| ASTM D3606 | Standard Test Method for Determination of Benzene and Toluene in Finished Motor and Aviation Gasoline by Gas Chromatography (DoD adopted)                                 |
| ASTM D4052 | Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter (DoD Adopted)   |
| ASTM D4057 | Standard Practice for Manual Sampling of Petroleum and Petroleum Products (DoD Adopted)   |
| ASTM D4952 | Standard Test Method for Qualitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test) (DoD Adopted)   |
| ASTM D5191 | Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method) (DoD adopted)   |
| ASTM D5452 | Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration (DoD Adopted)   |
| ASTM D5972 | Standard Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method) (DoD Adopted)   |
| ASTM D6045 | Standard Test Method for Color of Petroleum Products by the Automatic Tristimulus Method  |
| ASTM E29   | Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications (DoD Adopted)  |

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

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2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. 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 homogeneous, visually free from water, sediment, or suspended matter and shall be clear and bright at the ambient temperature or at 21° Celsius (70° Fahrenheit), whichever is higher.

3.3 Additives – corrosion inhibitor. If so specified by the procuring activity, a corrosion inhibitor conforming to MIL-PRF-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 antioxidant additive shall be blended into the type II calibrating fluid in total concentration of not less than 12.0 milligrams of active ingredient per liter (4.2 pounds of inhibitor, not including weight of solvents, per 1000 barrels of fluid) nor more than 24.0 milligrams of active ingredient per liter (8.4 pounds per 1000 barrels), in order to prevent the formation of gums and peroxides. The following antioxidant formulations or combinations thereof 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 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

3.5 Workmanship. The finished calibrating fluid shall be homogeneous, 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 the toxic properties of benzene.

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**TABLE I. Chemical and physical requirements and test methods.**

| REQUIREMENTS  | Type I                          | Type II          | Type III   | ASTM Method       |
|---|---------------------------------|------------------|--|-------------------|
| Specific Gravity, 15.6°C/15.6°C (60°F/60°F)   | 0.699<br>± 0.002                | 0.770<br>± 0.005 | 0.780<br>± 0.005   | D1298<br>D4052    |
| Color, Saybolt, Lighter Than  | +25                             |                  | +25  | D156<br>D6045     |
| Viscosity, mm <sup>2</sup> /s at<br>0°C (32°F)<br>25°C (77°F)<br>37.8°C (100°F)   | 0.785 ± 0.01<br><br>0.54 ± 0.01 | 1.17 ± 0.05      | 2.47 ± 0.10  | D445              |
| Vapor Pressure at 37.8°C (100°F),<br>kPa (psi) Max  | 13.8 (2.0)                      |                  |  | D323<br>D 5191    |
| Existent Gum, mg/100 mL Max   | 2.0                             | 5.0              |  | D381 <sup>1</sup> |
| Potential Gum, mg/100 mL Max  | 5.0                             |                  |  | D873 <sup>2</sup> |
| Distillation:<br>Initial BP °C (°F) min<br>Recovered 10% °C (°F)<br>Recovered 50% °C (°F)<br>Recovered 90% °C (°F)                    |                                 | 149 (300)        | 216 (420)<br>Note <sup>3</sup><br>221-232 (430-450)<br>Note <sup>3</sup> | D86               |
| 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) <sup>4</sup>            |                  |  |                   |
| Residue, Volume %, Max  |                                 |                  | 1.5  |                   |
| Loss, Volume %, Max   |                                 |                  | 1.5  |                   |
| Flash Point, °C (°F), Min   |                                 | 38 (100)         | 79 (175)   | D56               |
| Aromatics, Vol %, Max   |                                 | 20.0             |  | D1319             |
| Benzene, Vol %, Max   | 0.01                            | 0.01             | 0.01   | D3606             |
| Olefins, Vol %, Max   |                                 | 5.0              |  | D1319             |
| Particulate Matter, mg/L, Max   |                                 | 2.0              |  | D2276<br>D5452    |
| Mercaptan Sulfur, % Wt, Max or<br>Doctor Test   |                                 | 0.001<br>Sweet   |  | D3227<br>D4952    |
| Copper Corrosion, Max   | No. 1                           | No. 1            | No. 1  | D130              |
| Total Acid Number, mg KOH/g, Max  |                                 | 0.015            |  | D3242             |
| Freezing Point, °C (°F), Max  |                                 |                  | -54 (-65)  | D2386<br>D5972    |
| Acidity, Distillation Residue, Max  |                                 |                  | Neutral  | D1093             |
| Notes:<br>1. Air Jet Method<br>2. 5-Hour Aging Period<br>3. To Be Reported-Not Limited<br>4. Must Include Temperature of 98°C (208°F) |                                 |                  |  |                   |

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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 E29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

3.8 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

## 4. VERIFICATION

4.1 Classification of inspections. 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.

4.3.1 Bulk Lot of Material. An indefinite quantity of a homogeneous mixture of material contained in one isolated tank or kettle which is greater than 208 liters (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.

4.3.2 Packaged Lot of Material. As an indefinite number of 208 liter (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 D4057.

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                      | 1                                  |
| 26 – 150                    | 3                                  |
| 151 – 1200                  | 5                                  |
| 1201 – 7000                 | 7                                  |

4.5.2 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.

4.5.3 Other containers. Unless otherwise specified, other containers of 380 liters (100 gallons) or less water capacity shall be sampled according to 4.5.1. Containers greater than 380 liters (100 gallons) water capacity shall be sampled according to 4.5.2.

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4.6 Government requested sample. When requested, a 4 liter (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 or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

### 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The fluids covered by this specification are intended for use in the calibration of military 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 must specify the following:

- a. Title, number, and date of this specification.
- b. Type of fluid required (i.e., Type I, II, or III).
- c. Facility where Government requested test sample should be sent, if applicable.
- d. Quantity required, and size and type of containers required.
- e. Packaging requirements (see 5. 1).
- f. Addition of corrosion inhibitor to the calibrating fluid, if applicable.
- g. Addition of anti-oxidant additive to the calibrating fluid, if applicable.

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

6.4 Shelf-life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a materiel quality storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at the time of receipt by the Government. These and other requirements, if necessary, are in DoD 4140.27-M, *Shelf-life Management Manual*. The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website at: <https://www.shelflife.hq.dla.mil/>.

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### 6.5 Subject term (key word) listing.

High flash point  
Corrosion inhibitor  
Antioxidant  
Stoddard solvent

6.6 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.

### CONCLUDING MATERIAL

#### Custodians:

Army – AV  
Navy – AS  
Air Force – 68  
DLA – GS

#### Preparing activity:

Air Force – 68  
(Project 6850-2011-009)

#### Review activities:

Army – EA, MD  
Air Force – 11

Note: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information using the ASSIST Online database at <https://assist.daps.dla.mil>.