

INCH-POUND

MIL-L-7808K  
 20 July 1994  


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 SUPERSEDING  
 MIL-L-7808J  
 11 May 1982

## MILITARY SPECIFICATION

### LUBRICATING OIL, AIRCRAFT TURBINE ENGINE, SYNTHETIC BASE

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 two grades of aircraft turbine engine lubricating oil.

**1.2 Classification.** The lubricating oil shall be furnished in the following grades, as specified:

<u>Grade</u>	<u>NATO Symbol</u>
3	0-148
4	0-163

Grade 3 is normally used in most applications and will be supplied when requisitioned, unless otherwise specified. Grade 4 should be specified when higher viscosity or greater thermal stability is needed.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents

**2.1.1 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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENOSD, 2335 Seventh Street, Suite 6, Wright-Patterson AFB OH 45433-7809, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 9150

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## SPECIFICATIONS

## FEDERAL

QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
QQ-S-698	Steel, Sheet and Strip, Low Carbon

## MILITARY

MIL-C-8188	Corrosion-Preventive Oil, Gas Turbine Engine, Aircraft Synthetic Base
MIL-S-13282	Silver and Silver Alloys
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number 0-156
MIL-L-27502	Lubricating Oil, Aircraft Turbine Engine, Ester Base

## STANDARDS

## FEDERAL

FED-STD-313	Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
FED-STD-791	Lubricants, Liquid Fuels, and Related Products; Methods of Testing

## MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-290	Packaging of Petroleum and Related Products

## TECHNICAL ORDERS

TO 33A6-7-24-11
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(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Building 4D, 700 Robbins Avenue, Philadelphia PA 19111-5094.)

**2.1.2 Other Government documents.** The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

## CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1200	Hazard Communication Standard
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**2.2 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 documents cited in the solicitation (see 6.2).

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## SOCIETY OF AUTOMOTIVE ENGINEERS, INC.

## AEROSPACE MATERIAL SPECIFICATIONS

AMS 3217/1A	Test Slabs, Acrylonitrile Butadiene (NBR-H) High Acrylonitrile
AMS 3217/4A	Test Slabs, Fluoroelastomer (FKM)
AMS 3217/5A	Test Slabs, Fluorosilicone (FVMQ)
AMS 4616	Silicon Bronze Bars, Rods, Forgings, and Tubing 92Cu – 3.2Si – 2.8Zn – 1.5Fe Stress Relieved
AMS 4908	Titanium Alloy Sheet and Strip – 8Mn Annealed, 110,000 psi (760 MPa) Yield Strength
AMS 5544	Alloy, Corrosion and Heat Resistant, Sheet, Strip, and Plate 57Ni – 19.5Cr – 13.5Co – 4.2Mo – 3.0Ti – 1.4Al – 0.05Zr – 0.006B, Consumable Electrode or Vacuum Induction Melted, Annealed
AMS 6490	Steel Bars, Forgings and Tubing 4.0Cr – 4.2Mo – 1.0V – (0.77–0.85C), Premium Aircraft Quality for Bearing Applications, Consumable Electrode Vacuum Melted

(Requests for copies of AMS publications should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Dr, Warrendale PA 15096–0001.)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM B152	Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM D92	Flash and Fire Points by Cleveland Open Cup, (AASHTO No. T48), Standard Test Method for
ASTM D235	Standard Specification for Mineral Spirits (Petroleum Spirits)
ASTM D445	Kinematic Viscosity of Transparent and Opaque Liquids (And the Calculation of Dynamic Viscosity) Standard Test Method for
ASTM D664	Acid Number of Petroleum Products by Potentiometric Titration (British Standard 4457), Standard Test Method for
ASTM D972	Evaporation Loss of Lubricating Greases and Oils, Standard Test Method for
ASTM D1947	Load-Carrying Capacity of Petroleum Oil and Synthetic Fluid Gear Lubricants, Standard Test Method for
ASTM D2273	Trace Sediment in Lubricating Oils, Standard Test Method for
ASTM D2532	Viscosity and Viscosity Change After Standing at Low Temperature of Aircraft Turbine Lubricants, Standard Test Method for
ASTM D2603	Sonic Shear Stability of Polymer-Containing Oils, Standard Test Method for
ASTM D2934	Rubber Seals – Compatibility With Service Fluids, Standard Test Method for
ASTM D4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D4177	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products
ASTM D4636	Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and Other Highly Refined Oils, Standard Test Method for
ASTM D5182	Standard Test Method for Evaluating the Scuffing (Scoring) Load Capacity of Oils
ASTM E1	ASTM Thermometers, Standard Specification for

(Requests for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103–1187.)

(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.)

**2.3 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.

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### 3. REQUIREMENTS

**3.1 Qualification.** The lubricating oil furnished under this specification shall be a product that is authorized by the Qualifying Activity for listing on the applicable Qualified Products List (QPL) at the time of award of contract (see 4.4 and 6.3).

**3.1.1 Material Safety Data Sheets.** When applying for qualification, the manufacturer shall submit to the Qualifying Activity (see 6.4) Material Safety Data Sheets (MSDS) prepared in accordance with *Hazard Communication Standard, 29 CFR 1910.1200*.

**3.2 Composition.** The composition of this lubricating oil is not limited except that organometallic compounds of titanium and silicone antifoam agents are prohibited. If the lubricating oil contains a tricresyl phosphate additive, not more than 1 percent of the tricresyl phosphate additive shall be ortho isomer.

**3.2.1 Materials.** The manufacturer shall certify that no carcinogenic or potentially carcinogenic constituents are present in any lubricating oil furnished under this specification as defined in the *Hazard Communication Standard, 29 CFR 1910.1200*. The engine lubricating oil shall have no adverse effect on the health of personnel when used for its intended purpose.

**3.2.2 Ozone depleting chemicals.** The following tests currently require the use of ozone depleting chemicals (ODCs). An acceptable substitute for each has been identified for each test.

<u>ASTM Test Method</u>	<u>ODC Substance</u>	<u>Acceptable Substitutes</u>
<i>ASTM D4636</i> Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and Other Highly Refined Oils	Trichlorotrifluoroethane 1,1,1- Trichloroethane	n – Heptane
<u>Federal Test Method</u>		
<i>FTM 3214</i> Foaming Characteristics of Aircraft Turbine Lubricating Oils (Dynamic Foam Test)	Trichlorotrifluoroethane	n – Heptane
<i>FTM 3403</i> Compatibility of Turbine Lubricating Oils	1,1,1- Trichloroethane	n – Heptane
<i>FTM 5305</i> Corrosiveness of Lubricants at 232°C (450°F)	1,1,1- Trichloroethane	<i>ASTM D235, Type IV</i>
<i>FTM 5307</i> Corrosiveness and Oxidation Stability of Aircraft Turbine Engine Lubricants	Trichlorotrifluoroethane (Freon)	n – Heptane

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**3.2.3 Trace element content.** The trace element content shall be determined as specified in 4.6.2 and shall not exceed the following:

<u>Element</u>	<u>Content Limit (ppm, max)</u>	
	<u>Grade 3</u>	<u>Grade 4</u>
Aluminum (Al)	2	2
Iron (Fe)	2	2
Chromium (Cr)	2	2
Silver (Ag)	1	1
Copper (Cu)	1	1
Tin (Sn)	<sup>1</sup> 11	<sup>1</sup> 11
Magnesium (Mg)	2	2
Nickel (Ni)	2	2
Titanium (Ti)	1	1
Silicon (Si)	2	2

<sup>1</sup> When determined in accordance with 4.6.2, tin (Sn) content appears approximately 7 ppm above actual concentration. When other spectrometers and methods are used, the maximum tin (Sn) content shall be 4 ppm.

**3.3 Physical and chemical properties.** The following properties of the lubricating oil shall conform to the requirements specified in 4.6.1:

- a. Particulate contaminant
- b. Neutralization number (T.A.N.)
- c. Viscosity
- d. Flash point
- e. Evaporation loss.

### 3.4 Performance characteristics

**3.4.1 Lubricating oil characteristics.** The following characteristics of the lubricating oil shall conform when tested in accordance with 4.6.1 to the requirements specified in tables I and II.

- a. Foaming characteristics
- b. Deposition
- c. Lead corrosion
- d. Corrosion at 232°C (450°F)
- e. Corrosion and oxidation stability.

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**3.4.1.1 Elastomer compatibility.** The elastomer compatibility characteristics of the lubricating oil shall be determined as specified in 4.6.3. Deterioration of the standard elastomer stocks shall not exceed limits specified therein.

**3.4.1.2 Bearing deposition.** Bearing deposition of the lubricating oil shall be determined in accordance with FTMS 3450 and reported as specified in 4.6.4. Results of the determinations shall comply with the following:

	<u>Grade 3</u>	<u>Grade 4</u>
Deposit rating	60 max	45 max
Filter deposit weight, g	2.0 max	1.0 max
Oil consumption, ml	1440 max	960 max
Viscosity at 40°C, % change	-5 to +25	-5 to +15
Acid number change, mg KOH/g	1.0 max	1.0 max
Metal specimen weight change, mg/cm <sup>2</sup>	±0.2 max	±0.2 max

**3.4.1.3 Gear load-carrying capacity.** The gear load-carrying capacity of the lubricating oil shall be determined and conform to the requirements specified in 4.6.5.

**3.4.1.4 Compatibility.** When tested as specified in 4.6.6, the lubricating oil shall be mixable with selected referee lubricating oils qualified under this specification, *MIL-C-8188*, *MIL-L-23699*, and *MIL-L-27502*, without turbidity. The volume of sediment for mixtures which involve oils covered under this specification, *MIL-L-23699*, and *MIL-L-27502* shall not exceed 0.005 ml per 200 ml of oil. The volume of sediment for mixtures which involve oils covered under *MIL-C-8188* shall not exceed 0.05 ml per 200 ml of oil.

**3.4.1.4.1 Intermixing.** When the lubricating oil is mixed with equal parts of selected referee lubricating oils, the mixture shall conform with all the requirements herein except in 3.4.1.4 (compatibility), 3.4.1.5 (engine endurance), and 3.4.1.6 (storage stability).

**3.4.1.5 Engine endurance.** The lubricating oil shall be engine tested as specified in 4.6.7 to determine its acceptability for turbine engine use.

#### **3.4.1.6 Storage stability**

**3.4.1.6.1 Accelerated storage stability.** The lubricating oil shall be tested as specified in 4.6.8.1 and shall not exceed lead corrosion values of 40 g/m<sup>2</sup> after a 48-hour period and 230 g/m<sup>2</sup> after a 168-hour period.

**3.4.1.6.2 Extended storage stability.** The lubricating oil shall be evaluated after storage as specified in 4.6.8.2 to determine conformance with the specified requirements except 3.4.1.4, 3.4.1.4.1, 3.4.1.5, and 3.4.1.6.1. The lubricating oil shall pass all these requirements except that the lead corrosion requirement stated in table I shall not exceed 230 g/m<sup>2</sup>.

**3.5 Workmanship.** The finished lubricating oil shall be transparent and uniform in appearance, and free from cloudiness, suspended matter, or other adulterations when examined visually by transmitted light.

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## 4. QUALITY ASSURANCE PROVISIONS

**4.1 Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

**4.2 Classification of inspections.** The inspection requirements, specified herein, shall be classified as:

- a. Qualification inspection (4.4)
- b. Quality conformance inspection (4.5).

### 4.3 Testing requirements

**4.3.1 Material inspection.** Inspections shall be in accordance with *FED-STD-791*, method 9601.

#### 4.3.2 Inspection lots

**4.3.2.1 Bulk lot.** A bulk lot is defined as an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single, isolated container or manufactured by a single plant run (not to exceed 24 hours), through the same processing equipment, with no change in ingredient material.

**4.3.2.2 Packaged lot.** A packaged lot is defined as an indefinite number of 208-liter (55-gallon) drums or smaller unit packages of identical size and type offered for acceptance and filled with a homogeneous mixture of material from one isolated container or filled with a homogeneous mixture of material manufactured by a single plant run (not to exceed 24 hours), through the same processing equipment, with no change in ingredient material.

### 4.4 Qualification inspection

#### 4.4.1 Original formulation lubricating oil qualification sample

**4.4.1.1 Original formulation qualification tests.** A bulk lot of the original formulation lubricating oil shall be subjected to the qualification tests specified under 4.6.

**4.4.1.1.1 Original formulation data for engine endurance test.** Complete formulation data shall be furnished to the Qualifying Activity before the engine endurance test is conducted. This data shall include chemical composition (I.U.P.A.C. nomenclature and structural diagrams of each ingredient), the percentages of each ingredient, the manufacturer and trade name of each ingredient, and the purity of each ingredient. Formulation data will be respected as highly proprietary information.

#### 4.4.1.2 Original formulation manufacturer submittals

**4.4.1.2.1 Original formulation qualification letter of request.** The manufacturer shall forward a letter to the activity responsible for qualification (see 6.3) before the test sample is supplied. The letter shall contain the following:

- a. Request for authorization to submit test sample for qualification.
- b. Identification of the manufacturing site of the specific batch of test sample to be submitted.
- c. Certified test report that contains data on the specific batch of test sample to be submitted showing results of the tests specified herein except trace element content, compatibility, engine endurance, and extended storage stability which shall be conducted by the activity responsible for qualification (see 6.3).
- d. Verification that the composition of the test sample complies with the requirements of 3.2.

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**4.4.1.2.2 Original formulation qualification test samples.** Qualification test samples shall be identified as required and submitted to the activity responsible for qualification (see 6.3). The qualification test sample shall consist of 45.4 liters (12 gallons) packaged in hermetically sealed, 0.95-liter (1-quart) containers and 380 liters (100 gallons) packaged in 208-liter (55-gallon) drum containers. In addition, 19 liters (5 gallons) of the base oil blend (without additives), 0.95 liter (1 quart) of each base stock blend ingredient (without additives), and a minimum of 100 grams (3.5 ounces) of each additive ingredient used in the manufacture of the qualification test sample shall be submitted prior to qualification. Each lubricant ingredient submitted shall be from the same bulk lot used in preparation of the qualification test sample.

**4.4.2 Reblend lubricating oil qualification sample.** A reblend lubricating oil is a qualified, original formulation lubricating oil as specified in 4.4.1 in which one or more ingredients have been blended by a manufacturer other than the manufacturer of the original formulation.

**4.4.2.1 Reblend qualification tests.** A bulk lot of the reblend lubricating oil shall be subjected to the qualification tests specified under 4.6. The engine endurance test requirement may be waived if test results demonstrate equivalence of reblend oil to original formulation oil.

**4.4.2.2 Reblend manufacturer submittals**

**4.4.2.2.1 Reblend qualification letter of request.** The manufacturer shall forward a letter to the activity responsible for qualification before the test sample is supplied (see 6.3). The letter shall contain the following:

- a. Request for authorization to submit test sample for qualification.
- b. Identification of the product (by QPL reference number) for which reblend approval is requested.
- c. Proof that authorization to reblend the product has been granted by the manufacturer of the original formulation lubrication oil.
- d. Identification of the blending site of the specific bulk lot of test sample to be submitted and the source and percentage of each ingredient blended.
- e. Certified test report that contains data on the specific bulk lot of test samples to be submitted showing results of the test specified herein except trace element content, compatibility, engine endurance, and extended storage stability, which shall be conducted by the activity responsible for qualification (see 6.3).
- f. Suggested manufacturer's designation for the reblend product.

**4.4.2.2.2 Reblend qualification test samples.** Qualification test samples shall be identified as required and submitted to the activity responsible for qualification (see 6.3). The qualification test sample shall consist of 45.4 liters (12 gallons) packaged in hermetically sealed, 1-quart containers and 380 liters (100 gallons) packaged in 208-liter (55-gallon) drum containers. In addition, 19 liters (5 gallons) of the base oil blend and a minimum of 100 grams (3.5 ounces) of each additive ingredient used in the blending of the qualification test sample shall be submitted prior to qualification. Each lubricant ingredient submitted shall be from the same bulk lot used in the preparation of the qualification test sample.

**4.4.3 Rebrand lubricating oil qualification sample.** A rebrand lubricating oil is a qualified, fully-formulated oil as specified in 4.4.1 and 4.4.2, which is packaged by a supplier other than the manufacturer of the fully-formulated oil.

**4.4.3.1 Rebrand supplier submittals**

**4.4.3.1.1 Rebrand qualification letter of request.** The supplier shall forward a letter to the activity responsible for qualification (see 6.3). The letter shall contain the following:

- a. Identification of the product (by QPL reference number) for which rebrand approval is requested
- b. Proof that authorization to rebrand the product has been granted by the supplier of the product
- c. Identification of the rebranding site in which the product is to be packaged
- d. Suggested supplier's designation for the rebrand product.



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**4.4.4 Tentative approval.** Tentative approval for listing on the applicable Qualified Products List shall be granted pending successful completion of the extended storage stability tests. At any period of time up to three years maximum, failure to pass the extended storage stability requirements of 3.4.1.6.2 shall be cause for withdrawal of approval.

**4.4.5 Requalification.** Before any change is made in the quality, composition, source of ingredients, or source of supply of the lubricating oil, the supplier must request the Qualifying Activity (see 6.3) determine if requalification is required.

**4.4.6 Certification of qualification.** Each manufacturer listed on the Qualified Products List for at least two years shall be requested to forward to the responsible activity certification signed by a responsible official of management attesting that the listed product is still available from the listed plant, can be produced under the same conditions as originally qualified, and meets the requirements of the specification.

#### 4.5 Quality conformance inspection

##### 4.5.1 Sampling tests for verification of product quality

**4.5.1.1 Bulk lot random sample.** A bulk lot of oil shall be sampled at random in accordance with *ASTM D4057* or *ASTM D4177* and must be subjected to and comply with all the requirements of section 3 except the following:

###### Grade 3

- a. 72-hour viscosity stability
- b. Dynamic foam
- c. FVMQ and QVI elastomer compatibility
- d. 96-hour corrosion and oxidation stability at 175°C (347°F), alternate procedure 1
- e. 96-hour corrosion and oxidation stability at 200°C (392°F), standard procedure
- f. Bearing deposition
- g. Compatibility
- h. Engine endurance
- i. Extended storage

###### Grade 4

- a. Viscosity at 205°C (401°F)
- b. 72-hour viscosity stability
- c. Dynamic foam
- d. FVMQ and QVI elastomer compatibility
- e. 96-hour corrosion and oxidation stability at 200°C (392°F), alternate procedure 1
- f. 40-hour corrosion and oxidation stability at 220°C (428°F), standard procedure
- g. Bearing deposition
- h. Compatibility
- i. Engine endurance
- j. Extended storage

The gear load-carrying capacity test shall be performed on the first lot provided under each contract awarded.

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**4.5.1.2 Particulate contamination.** Samples of filled and sealed 223–milliliter (7.5–ounce), 0.95–liter (1–quart), and 3.78–liter (1–gallon) containers, taken at periodic intervals as to be representative of each day’s production, must conform with the particulate contaminant requirement. The number of samples taken each day shall be in accordance with *MIL-STD-105* at Inspection Level S–2.

**4.5.2 Sampling for examination of filled containers.** Each packaged lot of containers shall be sampled in accordance with *MIL-STD-105*, Inspection Level I, and examined for leakage, fill, closure, and preparation for shipment (packaging, packing, marking) in compliance with *MIL-STD-290*.

**4.5.3 Rejection and retest.** Lubricating oils which have been rejected may be reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original sample shall be furnished the inspector. Lubricating oil rejected after retest shall not be resubmitted without the specific approval of the Procuring Activity. Failure of production lots to pass the quality conformance tests shall be cause for removal from the Qualified Products List.

**4.5.4 Reporting.** A copy of the quality conformance inspection report on each lot shall be forwarded to the Qualifying Activity (see 6.2.1 and 6.3).

**4.6 Methods of inspection.** Requirements contained herein shall not be subject to corrections for test method precision. If multiple determinations are made, results within the repeatability and reproducibility limits of precision may be averaged unless otherwise specified.

**4.6.1 Properties and performance characteristics determinations.** Properties and performance characteristics of the lubricating oil shall be determined in accordance with table I, table II, and 4.6.2 through 4.6.8.2.

**4.6.2 Trace metal content.** The trace metal content of the oil shall be determined with an atomic emission (A/E 35U–3 or FAS–2C) spectrometer. Using JOAP spectrometric calibration standards, the spectrometer shall be calibrated in accordance with paragraphs 4–32, 4–33, 4–46, and 4–47 of *Air Force Technical Order 33A6–7–24–11*. Immediately after standardizing the spectrometer, 5 determinations of the oil for trace metal content shall be performed. The average of the 5 determinations shall be reported. Samples which require trace metal content determinations may be sent with a request for analysis to: Technical Support Center, Joint Oil Analysis Program, 296 Farrar Road, Suite B, Pensacola FL 32508–5010.

**4.6.3 Elastomer compatibility test.** The elastomer compatibility test shall be conducted on standard elastomer stocks in accordance with the *FED-STD-791* test method indicated below. Deterioration of the standard elastomer stocks shall not exceed the following limits:

Standard Elastomer Stock	<i>FED-STD-791</i> Method	Test Time at Temp (Hr/°C)	Swell Percent Min–Max	Tensile Strength, % Change, Max	Elongation % Change, Max	Hardness Change, Max
NBR–H	3604	168/70	12–35			
FKM	3432	72/175	2–25	50	50	20
FVMQ	3432	72/150	2–25	50	50	20
QV I	3432	72/150	2–30	50	50	20.

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**4.6.3.1 Standard elastomer stocks.** Standard elastomer stocks NBR-H, FKM, and FVMQ shall conform to the formulation data and physical requirements provided in *AMS 3217/1A*, *AMS 3217/4A*, and *AMS 3217/5A*. The QV I standard silicone rubber shall conform to table 4 of *ASTM D2934* (see 6.6).

**4.6.4 Bearing deposition test.** To determine compliance with the requirements of 3.4.1.2, bearing test determinations shall be conducted in accordance with *FTMS 3450* and the following:

- a. Test-oil sump temperature shall be 177°C (350°F).
- b. Test bearing temperature shall be 260°C (500°F).
- c. Metal specimens shall be as follow:
  - (1) Aluminum (*QQ-A-250/4*, T3 or T4)
  - (2) Silver (*MIL-S-13282*, grade A)
  - (3) Bronze alloy (*AMS 4616*)
  - (4) Low-carbon steel (*QQ-S-698*, grade 1009, cold rolled, Temper 4 or 5)
  - (5) M-50 steel (*AMS 6490*)
  - (6) Waspaloy (*AMS 5544*)
  - (7) Titanium (*AMS 4908*).

**4.6.4.1 Reporting data.** Test results of all determinations shall be included in reporting data. The following shall also be reported or submitted: (a) bearing stabilization temperature, (b) major item deposit demerits, and (c) major item colored photographs.

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TABLE I. Physical and chemical properties and performance characteristics.

PROPERTIES	REQUIREMENTS		TEST METHODS <i>ASTM FED-STD-791</i>
	Grade 3	Grade 4	
Particulate contamination (3 micron filter)			<i>FTM 3013</i>
Contaminant, mg/liter	5.0 max	5.0 max	
Filtering time, min			
0.95 liter (1 quart)	30 max	30 max	
223 milliliter (7.5 ounce)	7.0 max		
Acid number (T.A.N.), mg KOH/g	0.30 max <sup>1</sup>	0.5 max <sup>1</sup>	<i>D664</i>
Viscosity at 205°C (401°F), cs		1.1 min	<i>D445</i>
Viscosity at 100°C (212°F), cs	3.0 min	4.0 min	<i>D445</i>
Viscosity at 40°C (104°F), cs	12.0 min	17.0 min	<i>D445</i>
Viscosity at -51°C (-60°F), cs			
at 35 minutes	17 × 10 <sup>3</sup> max	20 × 10 <sup>3</sup> max	<i>D2532</i>
at 3 hours	17 × 10 <sup>3</sup> max <sup>2</sup>	20 × 10 <sup>3</sup> max <sup>2</sup>	<i>D2532</i>
at 72 hours	17 × 10 <sup>3</sup> max	20 × 10 <sup>3</sup> max	<i>D2532</i>
Flash point, °C (°F)	210 (410) min	210 (410) min	<i>D92</i>
Evaporation loss, at 205°C (401°F), %	30 max <sup>3</sup>	15 max <sup>3</sup>	<i>D972</i>
Foaming characteristics (static)			<i>FTM 3213</i>
Foam volume, ml	100 max	100 max	
Foam collapse time, sec	60 max	60 max	
Foaming characteristics (dynamic)			<i>FTM 3214</i>
Foam vol, ml /			
Collapse time, sec			
80°C (176°F) at 1000 cc/min	100 max/60 max	100 max/60 max	
80°C (176°F) at 1500 cc/min	150 max/60 max	150 max/60 max	
80°C (176°F) at 2000 cc/min	200 max/60 max	200 max/60 max	
110°C (230°F) at 1000 cc/min	100 max/60 max	100 max/60 max	
110°C (230°F) at 1500 cc/min	150 max/60 max	150 max/60 max	
110°C (230°F) at 2000 cc/min	200 max/60 max	200 max/60 max	
Deposition test (WADC)			<i>FTM 5003</i>
Deposit rating	1.5 max	0.7 max	
Acid number change, mg KOH/g	20 max	20 max	
Viscosity at 40°C (104°F), % change	100 max	100 max	
Oil consumption, ml	100 max	100 max	
Lead corrosion, g/m <sup>2</sup>	9.3 max <sup>4</sup>	9.3 max <sup>4</sup>	<i>FTM 5321</i> <i>FTM 5305</i>
Corrosion test at 232°C (450°F)			
Silver, g/m <sup>2</sup>	±4.5 max <sup>4</sup>	±4.5 max <sup>4</sup>	
Bronze, g/m <sup>2</sup>	±4.5 max <sup>4,5</sup>	±4.5 max <sup>4,5</sup>	
Corrosion and oxidation stability	Table II	Table II	<i>D4636</i>
Thermal stability and corrosivity at 274°C (525°F)			<i>FTM 3411</i>
Viscosity change, % <sup>6</sup>		5.0 max	
Total acid number change, mg KOH/g		6.0 max	
Metal weight change, mg/cm <sup>2</sup>		4.0 max	
Shear stability, viscosity loss, %		4 max	<sup>7</sup> <i>D2603</i>

<sup>1</sup> Titrate to a pH 11 end point.<sup>2</sup> Result shall not differ from the 35-minute determination by more than 6.0 percent.<sup>3</sup> Use a 6 1/2-hour test period and a bath temperature of 205°C ±1°C (401°F ±2°F). *ASTM Standard E1-67* Thermometer No. 80-F shall be used. Air temperature shall be maintained at 205°C ±1°C (401°F ±4°F), using a preheater, if necessary.<sup>4</sup> Multiply mg/in<sup>2</sup> by 1.55 to convert to g/m<sup>2</sup>.<sup>5</sup> Silicon Bronze (*AMS 4616*) shall be used in lieu of copper (*ASTM B152*).<sup>6</sup> Compared with viscosity of new oil samples tested at 40.0°C (104°F).<sup>7</sup> Use an irradiation period of 30 minutes on a 30-ml (1-oz) oil sample at a power setting which causes 11.5 ±0.5 percent viscosity loss to a 30-ml (1-oz) sample of ASTM Reference Fluid A when irradiated for 5 minutes.

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TABLE II. Corrosion and oxidation stability.

Test Conditions Using ASTM D4636		Post Test Oil Properties				Post Test Metal Specimen Weight Change, mg/cm <sup>2</sup>				
Duration	Temperature	Change in Viscosity at 40°C %	Change in Neutralization Number	Sludge Volume, ml	Weight Loss, %	Al	Ag	Bz	Fe	M-50
Grade 3:										
96 hrs	175°C (347°F)	-5 to +15	2.0 max	no visible sludge <sup>5</sup>	4.0 max	±.2	±.2	±.4	±.2	±.2
96 hrs	200°C (392°F)	-5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2
96 hrs	200°C (392°F)	-5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2
Grade 4:										
96 hrs	200°C (392°F)	-5 to +18	2.0 max	no visible sludge <sup>5</sup>	4.0 max	±.2	±.2	±.4	±.2	±.2
40 hrs	220°C (428°F)	-5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2
40 hrs	220°C (428°F)	-5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2

## Notes:

<sup>1</sup> Standard test procedure using intermediate sampling is required.<sup>2</sup> Alternate procedure 1 without intermediate sampling is required.<sup>3</sup> Qualification test only.<sup>4</sup> Qualification and quality conformance test.<sup>5</sup> If sludge is visible, it shall be determined not to exceed 0.2% max.

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**4.6.5 Gear load-carrying capacity test.** Gear load-carrying capacity test determinations shall be conducted as specified in either 4.6.5.1 or 4.6.5.2. The average of a minimum of two determinations by either test method shall be required to determine load-carrying capacity. Test results of all determinations shall be included in reporting data.

**4.6.5.1 Gear load-carrying capacity test requirement conducted in accordance with ASTM D1947.** Only Ryder gear machines with a reference oil "C" average rating within the range of 438 to 578 kN/m (2500 to 3300 lbf/in) are acceptable. The average percentage of the relative rating determinations shall be multiplied by the reference oil specified average of 508 kN/m (2900 lbf/in).

<u>Determinations</u>	Grades 3 and 4 Load-Carrying Capacity <u>Avg % Relative Rating × 508 kN/m (2900 lbf/in)</u>
2 min	385 kN/m (2200 lbf/in) min.

**4.6.5.2 Gear load-carrying capacity test requirement conducted in accordance with ASTM D5182 (modified).** The FZG test speed shall be 1750 rpm minimum rather than 1440 rpm minimum, and the failure criterion is reached when the summed total width of scuffing/scoring/adhesive wear damage from all 16 teeth is estimated to equal or exceed 2 gear teeth width (40 mm) rather than 1 gear tooth width (20 mm).

<u>Determinations</u>	Grades 3 and 4 Load-Carrying Capacity <u>Avg Maximum Standard Load Stage Prior to Failure</u>
2 min	load stage 5 min.

**4.6.6 Compatibility test.** The compatibility test to determine compliance with the requirements of 3.4.1.4 shall be conducted in accordance with *FED-STD-791*, method 3403, and the additional procedures specified herein.

**4.6.6.1 Turbidity inspection.** Upon completion of the 168-hour oven period, the test flasks shall be stored in the dark, at a room temperature of 25°C ±5°C (77°F ±9°F), for 21 days before visual inspection for turbidity and centrifuging. Centrifuge tubes with a small scale division of 0.005 ml or less shall be used. (DeLaval centrifuge tube, part 14209, or equivalent, is acceptable.)

**4.6.6.2 Sediment volume.** The volume of sediment shall be determined in accordance with *ASTM D2273*. The sediment shall be centrifuged from a 200 ml oil sample without the use of solvent.

**4.6.7 Engine endurance test.** The oil shall be subjected to an accelerated endurance test in a turbine or turboshaft engine, or both, for a period sufficient to determine its performance characteristics, as specified by the Qualifying Activity (see 6.3). Periodic oil samples shall be withdrawn and tested during, and upon completion of, the test. The condition of the periodically sampled used oil shall indicate no excessive changes in performance characteristics. A post-test condition of the engine shall indicate no excessive deposits, wear, corrosion, or other adverse conditions attributable to the test oil.

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**4.6.8 Storage stability tests**

**4.6.8.1 Accelerated storage stability test.** Two 1-gallon cans which each contain 1260 ml of the test oil shall be placed in an unvented oven maintained at  $110^{\circ}\text{C} \pm 1^{\circ}\text{C}$  ( $230^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ) throughout the test. A 500-ml sample shall be removed from each can after 48 and 168 hours of storage and the lead corrosion test specified in table I shall be performed on each sample. The cans shall be replaced in the oven after each sample removal without replenishment of the oil.

**4.6.8.2 Extended storage stability test.** Twelve gallons of the lubricating oil packaged in 1-quart containers shall be stored at an ambient temperature not lower than  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) and not greater than  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) for periods up to three years. After storage for the specified time, the lubricating oil shall be tested for the requirements specified in 3.4.1.6.2.

**5. PACKAGING**

**5.1 Packaging, packing, and marking.** Packaging, packing, and marking shall be in accordance with *MIL-STD-290*.

**5.2 Container markings.** In addition to the marking specified in *MIL-STD-290*, the following notes shall appear on each container:

DO NOT MIX WITH OILS OTHER THAN MIL-L-7808  
AND REVISIONS THERETO.

**WARNING**

MAY CONTAIN ADDITIVES WHICH ARE HARMFUL IF TAKEN  
INTERNALLY. DO NOT USE AS MEDICINAL OR FOOD PRODUCT.

The word, "WARNING" shall be the same size as the military symbol as specified in *MIL-STD-290*; the remainder of the marking shall be legible.

**5.2.1 Exterior shipping container markings.** In addition to the markings specified in *MIL-STD-290*, each exterior shipping container shall have the above warning statement stencilled or labelled on the top outer flap adjacent to the side of the carton on which the NATO symbol, military symbol, specification number, et cetera, appear.

**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 lubricating oil procurable to this specification is intended for use in specific models of aircraft turbine engines, helicopter transmissions, accessory and auxiliary equipment, auxiliary power units, and other types of equipment which require a synthetic base oil. Grade 3 is intended for normal use unless otherwise specified. Grade 4 is intended for applications which require higher viscosity and greater thermal stability.

**6.2 Acquisition requirements.** Acquisition documents must specify the following:

- a. Title, number, grade, and date of this specification. (If the grade is not specified, Grade 3 shall be issued.)
- b. Issue of *DoDISS* to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2).
- c. Type and size of containers required (see 5.1).
- d. Level of packaging and packing required (see 5.1).
- e. Quantity desired.

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**6.2.1 Consideration of data requirements.** The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where *DOD FAR Supplement 27.475-1* exempts the requirement for a DD Form 1423. Data specified in 4.5.4 will be listed directly on a DD Form 1423 incorporated into the contract.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.5.4			

The above DID's were those cleared as of the date of this specification. The current issue of *DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL)*, must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

**6.3 Qualification.** With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in *QPL-7808* whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Aero Propulsion & Power Directorate, ATTN: WL/POSL, Bldg 490, 1790 Loop Rd N, Wright-Patterson AFB OH 45433-7103, and information pertaining to qualification of products may be obtained from that activity.

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

**6.5 Supplemental information.** Supplemental information concerning qualification and procurement of this material is contained in the *Defense Standardization and Specification Program Document, SD-6*, entitled *Provisions Governing Qualification (Qualified Products List)*.

**6.6 Standard elastomer stocks.** Additional information relative to standard elastomer stocks may be obtained from the Materials Directorate, ATTN: WL/MLSE, Bldg 652, 2179 Twelfth St Ste 1, Wright-Patterson AFB OH 45433-7718.

#### **6.7 Subject term (key word) listing**

aircraft engine oil  
lubricant  
synthetic base lubricant  
synthetic base oil  
turbine engine lubricating oil

**6.8 International standardization agreements.** Certain provisions of this specification (1.2) are the subject of international standardization agreements (*ASCC Air Standard 15/9* and *STANAG 1135*). When amendment, revision, or cancellation of this specification is proposed that 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.



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**6.9 Changes from previous issue.** The margins of this specification are marked with vertical lines to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army – ME

Navy – AS

Air Force – 11

Preparing activity:

Air Force – 11

Review activities:

Army – AV, ME

Navy – SH

Air Force – 68

DLA – PS

(Project 9150–1107)

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# 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
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, not 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.

<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER <b>MIL-L-7808K</b>	2. DOCUMENT DATE (YYMMDD) <b>940720</b>
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3. DOCUMENT TITLE	<b>LUBRICATING OIL, AIRCRAFT TURBINE ENGINE, SYNTHETIC BASE</b>
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4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMIT-

a. NAME <i>(Last, First, Middle Initial)</i>	b. ORGANIZATION	
c. ADDRESS <i>(Include Zip Code)</i>	d. TELEPHONE <i>(Include Area Code)</i> (1) Commercial	7. DATE SUBMITTED (YYMMDD)
	(2) DSN <i>(If applicable)</i>	

8. PREPARING ACTIVITY

A. NAME ASC/ENOSD AF CODE 11	B. TELEPHONE <i>(Include Area Code)</i> (1) Commercial (513) 255-6281 (2) DSN <i>(If applicable)</i> 785-6281
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C. ADDRESS <i>(Include Zip Code)</i> 2335 SEVENTH STREET, SUITE 6 WRIGHT-PATTERSON AFB OH 45433-7809	<b>IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:</b> Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340
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