INCH-POUND

MIL-PRF-7808L
2 May 1997
SUPERSEDING
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PERFORMANCE 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 will be furnished in the following grades, as specified:

Grade	NATO Symbol
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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENSI, 2530 Loop Road W, Wright-Patterson AFB OH 45433-7101, 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**

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, 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 will be 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

FEDERAL

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

DEPARTMENT OF DEFENSE

MIL-C-8188	Corrosion-Preventive Oil, Gas Turbine Engine, Aircraft Synthetic Base
MIL-S-13282	Silver and Silver Alloys
MIL-PRF-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 Sheets, Preparation and Submission of
FED-STD-791	Lubricants, Liquid Fuels, and Related Products; Methods of Testing

MILITARY

MIL-STD-290	Packaging of Petroleum and Related Products

TECHNICAL ORDERS

TO 33A6-7-24-11	Operations and Maintenance Instructions for Fluid Analysis Spectrometer, Type A/E35U-3A

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service, 700 Robbins Avenue, Bldg 4D, Philadelphia PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications 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)

DEPARTMENT OF LABOR

29 CFR 1910.1200	Occupational Safety and Health Standards - Hazard Communications

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington DC 20402.)

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 documents cited in the solicitation (see *6.2*).

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AEROSPACE MATERIAL SPECIFICATIONS (AMS)

AMS 3217	Test Slabs, Acrylonitrile Butadiene (NBR-H) High Acrylonitrile Fluoroelastomer (FKM), and Fluorosilicone (FVMQ) (DoD adopted)
AMS 4616	Silicon Bronze Bars, Rods, Forgings, and Tubing 92Cu - 3.2Si - 2.8Zn-1.5Fe (DoD adopted)
AMS 4908	Titanium Alloy Sheet and Strip - 8Mn Annealed, 110,000 psi (760 MPa) Yield Strength (DoD adopted)
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 (DoD adopted)
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 (DoD adopted)

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale PA 15096-0001; telephone (412) 776-4841.)

AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

ASQC- Z1.4	Sampling Procedures and Tables for Inspection by Attributes (DoD adopted)

(Application for copies should be addressed to the American Society for Quality Control, PO Box 3005, 611 East Wisconsin Avenue, Milwaukee WI 53201-4606.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B152	Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar (DoD adopted)
ASTM D92	Standard Test Method for Flash and Fire Points by Cleveland Open Cup, (AASHTO No. T48) (DoD-adopted)
ASTM D235	Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent) (DoD adopted)
ASTM D445	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (And the Calculation of Dynamic Viscosity) (DoD adopted)
ASTM D664	Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration (British Standard 4457) (DoD adopted)
ASTM D972	Standard Test Method for Evaporation Loss of Lubricating Greases and Oils (DoD adopted)
ASTM D1947	Standard Test Method for Load-Carrying Capacity of Petroleum Oil and Synthetic Fluid Gear Lubricants (DoD adopted)
ASTM D2273	Standard Test Method for Trace Sediment in Lubricating Oils (DoD adopted)
ASTM D2532	Standard Test Method for Viscosity and Viscosity Change After Standing at Low Temperature of Aircraft Turbine Lubricants (DoD adopted)
ASTM D2603	Standard Test Method for Sonic Shear Stability of Polymer-Containing Oils
ASTM D4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ASTM D4177	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products (DoD adopted)
ASTM D4636	Standard Test Method for Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and Other Highly Refined Oils
ASTM D5182	Standard Test Method for Evaluating the Scuffing (Scoring) Load Capacity of Oils
ASTM E1	Standard Specification for ASTM Thermometers (Method 9501 - Federal Test Method Standard 791) (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.)

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.

3. REQUIREMENTS

3.1 Qualification. The lubricating oils furnished under this specification shall be products that are authorized by the Qualifying Activity for listing on the applicable Qualified Products List (QPL) before contract award (see *4.2* and *6.3*).

3.2 Materials. The composition of this lubricating oil is not limited; however, organometallic compounds of titanium and silicone antifoam agents and known or suspected human carcinogens (as defined by the *Occupational Safety and Health Standards - Hazard Communications, 29 CFR 1910.1200*) 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. The engine lubricating oil shall have no adverse effect on the health of personnel when used for its intended purpose. Recycled basestocks are permitted; however, each batch must be fully tested in accordance with all qualification requirements of this specification. The manufacturer may be required to submit certification of conformance to this paragraph (see *6.2*).

3.2.1 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.

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

3.3 Chemical and physical requirements. All classifications of the finished lubricating oil shall conform to the requirements listed in *section 3* and *tables I, II,* and *III* when tested in accordance with the applicable test methods.

TABLE I. Chemical, physical, and performance requirements.

Characteristic	Requirement		Test Method	
	Grade 3	Grade 4	ASTM	FED-STD-791
Particulate contamination (3micron filter)				*FTM 3013*
Contaminant, mg/liter	5.0 max	5.0 max		
Filtering time, min				
0.95 liter (1 quart)	30 max	30 max		
223 mililiter (7.5 ounce)	7.0 max			
Acid number (T.A.N.), mg KOH/g	0.30 max[1/]	0.5 max[1/]	*D664*	
Viscosity at 205°C (401°F), cs		1.1 min	*D445*	
Viscosity at 100°C (212°F), cs	3.0 min	4.0 min	*D445*	
Viscosity at 40°C (104°F), cs	11.5 min	17.0 min	*D445*	
Viscosity at -51°C (-60°F), cs				
at 35 minutes	17×10^3 max	20×10^3 max	*D2532*	
at 3 hours	17×10^3 max[2/]	20×10^3 max[2/]	*D2532*	
at 72 hours	17×10^3 max	20×10^3 max	*D2532*	
Flash point, °C(°F)	210(410)min	210(410)min	*D92*	
Evaporation loss, at 205°C (401°F), %	30 max[3/]	15 max[3/]	*D972*	
Foaming (static)				*FTM 3213*
Foam volume, ml	100 max	100 max		
Foam collapse time, sec	60 max	60 max		
Foaming (dynamic)				*FTM 3214*
Foam volume, ml				
Collapse time, sec				
80°C (176°F) at 1000 cc/min	100/60 max	100/60 max		
80°C (176°F) at 1500 cc/min	150/60 max	150 /60 max		
80°C (176°F) at 2000 cc/min	200/60 max	200/60 max		
110°C (230°F) at 1000 cc/min	100/60 max	100/60 max		
110°C (230°F) at 1500 cc/min	150/60 max	150/60 max		
110°C (230°F) at 2000 cc/min	200/60 max	200/60 max		
Deposition test (WADC)				*FTM 5003*
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^2	9.3 max[4/]	9.3 max[4/]		*FTM 5321*
Corrosion test at 232°C (450°F)				*FTM 5305*[5/]
Silver, g/m^2	±4.5 max[4/]	±4.5 max[4/]		
Bronze, g/m^2	±4.5 max[4,6/]	±4.5 max[4,6/]		

TABLE I. Chemical, physical, and performance requirements. (cont)

Characteristic	Requirement		Test Method	
	Grade 3	Grade 4	ASTM	FED-STD-791
Thermal stability and corrosivity at 274°C (525°F)				*FTM 3411*
Viscosity change, % [7/]		5.0 max		
Total acid number change, mg KOH/g		6.0 max		
Metal weight change, mg/cm^2		4.0 max		
Shear stability, viscosity loss, %		4 max	*D2603* [8/]	
Trace metal content, ppm, maximum [9/]				
Aluminum (Al)	2	2		
Iron (Fe)	2	2		
Chromium (Cr)	2	2		
Silver (Ag)	1	1		
Copper (Cu)	1	1		
Tin (Sn)	11 [10/]	11 [10/]		
Magnesium (Mg)	2	2		
Nickel (Ni)	2	2		
Titanium (Ti)	1	1		
Silicon (Si)	2	2		
Compatibility				*FTM* 3403 [11/]
Turbidity	None	None		
Sediment, ml/200 ml oil, maximum				
MIL-PRF-7808	0.005	0.005		
MIL-PRF-23699	0.005	0.005		
MIL-C-8188	0.05	0.05		
Storage stability				
Low temperature, 6 weeks at -18°C (0°F) [12/]	no crystallization, separation or gelling			
Accelerated, 110°C ± 1°C (230°F ± 2°F) [13/]				
Lead corrosion, g/m^2				
after 48 hours	40			
after 168 hours	230			
Extended, after 3 years, ambient temperature	meet conformance inspection (see *4.3*) [14/]			

1/ *Titrate to a pH 11 end point.*
2/ *Result shall not differ from the 35-minute determination by more than 6.0 percent.*
3/ *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.*
4/ *Multiply mg/in^2 by 1.55 to convert to g/m^2.*
5/ *In order to minimize vapors (see 4.4), Erlenmeyer flasks with proper ground joints (24/40) may be used with elbow adapters and tubing, capturing vapors in a liquid trap.*
6/ *Silicon Bronze (SAE-AMS 4616) shall be used in lieu of copper (ASTM B152).*
7/ *Compared with viscosity of new oil samples tested at 40.0°C (104°F).*
8/ *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.*
9/ *See paragraph 4.4.1 for test method details.*
10/ *When determined in accordance with 4.4.1, 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.*
11/ *See paragraph 4.4.3 for test method details.*
12/ *See paragraph 4.4.4 for test method details.*
13/ *See paragraph 4.4.5 for test method details.*
14/ *See paragraph 4.4.6 for test method details. Tentative approval will be given to products meeting qualification inspection (see 4.2), pending successful completion of the extended storage stability test. Failure to pass this test shall be cause for withdrawal of approval.*

TABLE II. Chemical, physical, and performance requirements: elastomer compatibility.

Standard Elastomer Stock	FED-STD 791 Method	Test Time at Temp (Hr/°C)	Swell Percent Min-Max	Tensile Strength, % Change, Max	Elongation Percent Change, Max	Hardness Change, Max
SAE-AMS 3217/1	*3604*	168/70	12-35			
SAE-AMS 3217/4	*3432*	72/175	2-25	50	50	20
SAE-AMS 3217/5	*3432*	72/150	2-25	50	50	20

3.4 Bench performance requirements. Bench performance requirements shall be as specified in *3.4.1* and *3.4.2*.

3.4.1 Bearing deposition. Bearing deposition of the lubricating oil shall be determined in accordance with *FED-STD-791, Method 3450*, and reported as specified in *4.4.2* Results of the determinations shall comply with the following:

	Grade 3	Grade 4
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^2	±0.2 max	±0.2 max

TABLE III. Chemical, physical and performance requirements: Corrosion and oxidation stability.

Test Conditions Using *ASTM D4636*		Post Test Oil Properties				Post Test Metal Specimen Weight Change, mg/cm^2, max						
Duration	**Temperature**	**Change in Viscosity at 40°C %**	**Change in Neutralization Number**	**Sludge Volume, ml**	**Weight Loss, %**	**Al**	**Ag**	**Bz**	**Fe**	**M–50**	**Mg**	**Ti**
Grade 3:												
96 hrs	175°C [2,3] (347°F)	–5 to +15	2.0 max	no visible sludge[5]	4.0 max	±.2	±.2	±.4	±.2	±.2	±.4	±.2
96 hrs	200°C [2,4] (392°F)	–5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2	±.4	±.2
96 hrs	200°C [1,3] (392°F)	–5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2	±.4	±.2
Grade 4:												
96 hrs	200°C [2,3] (392°F)	–5 to +18	2.0 max	no visible sludge[5]	4.0 max	±.2	±.2	±.4	±.2	±.2	±.4	±.2
40 hrs	220°C [2,4] (428°F)	–5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2	±.4	±.2
40 hrs	220°C [1,3] (428°F)	–5 to +25	4.0 max		4.0 max	±.2	±.2	±.4	±.2	±.2	±.4	±.2

[1] Standard test procedure using intermediate sampling is required.

[2] Alternate procedure 1 without intermediate sampling is required.

[3] Qualification test only.

[4] Qualification and quality conformance test.

[5] If sludge is visible, it shall be determined not to exceed 0.2% max.

3.4.2 Gear load-carrying capacity. The gear load-carrying capacity determinations shall be conducted as specified in either *3.4.2.1* or *3.4.2.2*. The average 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.

3.4.2.1 Gear load-carrying capacity 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).

Determinations	Grades 3 and 4 Load-Carrying Capacity Avg % Relative Rating _ 508 kN/m (2900 lbf/in)
2 minimum	385 kN/m (2200 lbf/in) minimum.

3.4.2.2 Gear load-carrying capacity 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).

Determinations	Grades 3 and 4 Load-Carrying Capacity Avg Maximum Standard Load Stage Prior to Failure
2 minimum	load stage 5 minimum.

3.5 Full-scale performance requirements.

3.5.1 Engine endurance. The oils shall be tested in a turboshaft engine in accordance with *4.4.7* to evaluate acceptability for turbine engine use. The post-test condition of the engine shall indicate no excessive deposits, wear, corrosion, or other adverse conditions attributable to the test oil.

3.6 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.

3.7 Material safety data sheets. Material safety data sheets shall be prepared and submitted in accordance with *FED-STD-313* (see *6.4*).

4. VERIFICATION

4.1 Classification of inspections. The inspection and testing of lubricating oils shall be classified as follows:

a. Qualification inspection (see *4.2*).

b. Conformance inspection (see *4.3*).

4.2 Qualification inspection. Qualification inspection shall consist of testing to all the requirements specified in *section 3* and *tables I, II,* and *III*. When required by the qualifying activity, additional evaluations (engine test) may be required on candidate formulations.

4.2.1 Qualification inspection sample. 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 basestock 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. Upon receiving authorization from WL/POSL, these samples shall be forwarded to WL/POSL, Bldg 490, 1790 Loop Road North, Wright-Patterson AFB OH 45433-7103. Each sample shall be plainly identified by a securely attached, durable label marked with the following information:

QUALIFICATION INSPECTION SAMPLE
LUBRICATING OIL, AIRCRAFT TURBINE ENGINE,
MIL-PRF-7808

Type of sample: (basestock, additive, or finished oil)

Classification of oil: (Grade 3 or Grade 4)

Name of manufacturer:

Product code number:

Batch number:

Date of manufacture:

Submitted by (name) on (date) for qualification inspection in accordance with *MIL-PRF-7808* under authorization of (reference authorization letter, see *6.3*).

4.2.2 Qualification inspection test report. 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. 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.

c. Complete formulation data, including chemical composition, 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.

d. Verification that the composition of the test sample complies with the requirements of *3.2*.

e. Identification of the manufacturing site of the specific batch of test sample to be submitted.

f. MSDS (see *3.7*) of the candidate product and for each of the additive components used in the formulation.

4.2.3 Requalification. Requalification shall be required when any change is made in source of manufacture, purity, or composition of the lubricating oil base stocks or additives. A minor change in the oil formulation may be made without requalification testing, but only after notification to, and approval by, the qualifying activity (see *6.3*). Each reformulation request shall include a certified test report (see *4.2.2*).

4.3 Conformance inspection. Conformance inspection of production lots shall consist of all the tests specified in *table IV*. Failure of production lots to pass any of the conformance tests shall be cause for rejection of the lot.

4.3.1 Sampling. Each bulk lot (see *6.7*) of material shall be sampled at random in accordance with *ASTM D4057* or *ASTM D4177* for the conformance inspection tests (see *4.3*).

4.3.2 Inspection. Inspections shall be conducted in accordance with *FED-STD-791, method 9601*, "Inspection Requirements."

4.3.2.1 Examination of filled containers. A random sample of filled containers from each lot (see *6.7*), taken in accordance with *ASQC-Z1.4*, shall be examined for conformance to *MIL-STD-290* with regard to fill, closure, sealing, leakage, packaging, packing, and markings. Reject any container having one or more defects or for being under the required fill. If the number of defective or underfilled containers exceeds the acceptance number for the appropriate sampling plan of *ASQC-Z1.4*, reject the lot represented by the sample.

4.3.3 Conformance inspection test report. A copy of the conformance inspection report on each lot of oil produced for US Government use shall be forwarded to the Aero Propulsion and Power Directorate, WL/POSL, Bldg 490, 1790 Loop Road North, Wright-Patterson AFB OH 45433-7103.

4.4..Test methods All tests shall be performed in accordance with *tables I, II, III,* and *IV*, and *4.4.1* through *4.4.7*.

4.4.1 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 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:

Department of Defense
Technical support Center
Joint Oil Analysis Program
ATTN: JOAP Lab
296 Farrar Road, Suite B
Pensacola FL 32508-5010

4.4.2 Bearing deposition. To determine compliance with the requirements of *3.4.*1, bearing test determinations shall be conducted in accordance with *FED-STD-791, Method 3450,* and the following: (a) test-oil temperature shall be 177 °C (350 °F), and (b) test bearing temperature shall be 260 °C (500 °F). Metal specimens shall be as follows: (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*), and (7) titanium (*AMS 4908*).

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

TABLE IV: Conformance tests.

Characteristic	Test Paragraph	Test Method *FED-STD-791*	Test Method ASTM
Elastomer compatibility (see *table II*) *SAE-AMS 3217/1*, */4*, and */5*	--	*FTM 3604* *FTM 3432*	--
Corrosion and oxidation stability (see *table III*) Grade 3: 96 hours at 200 °C (392 °F) Grade 4: 40 hours at 220 °C (428 °F)	--	--	*D4636*
Trace metal content, ppm, maximum (see *table I*)	*4.4.1*	--	--
Gear load-carrying capacity[1/]	*3.4.2*	--	--
Flash point, °C (°F) (see *table I*)	--	--	*D92*
Evaporation loss, at 205 °C (401 °F), % (see *table I*)	--	--	*D972*
Foaming (static), foam volume, ml, maximum (see *table I*)	--	*FTM 3213*	--
Deposition, WADC (see *table I*)	--	*FTM 5003*	--
Lead corrosion, g/m^2 (see *table I*)	--	*FTM 5321*	--
Corrosion test at 232 °C (450 °F) (see *table I*)	--	*FTM 5305*	--
Thermal stability and corrosivity at 274 °C (525 °F) (see *table I*)	--	*FTM 3411*	--
Shear stability, viscosity loss , % (see *table I*)	--	--	*D2603*
Particulate contamination, mg/liter(see *table I*)	--	*FTM 3013*	--
Acid number, mg KOH/g (see *table I*)	--	--	*D664*
Viscosity (see *table I*), cSt at 100 °C (212 °F) at 40 °C (104 °F) at -51 °C (-60 °F), 35 min, 3 hr	--	--	*D445* *D445* *D2532*

[1/] *Gear load-carrying capacity test shall be performed on the first production lot of each qualified lubricating oil supplied to the procuring activity*.

4.4.3 Compatibility. The compatibility test shall be performed in accordance with *FED-STD-791, Method 3403*. The lubricating oil shall be mixable with selected referee lubricating oils qualified under this specification, *MIL-C-8188*, and *MIL-PRF-23699*, without turbidity. 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.) 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. The volume of sediment for mixtures which involve oils covered under this specification, *MIL-PRF-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 of oil.

4.4.3.1 Intermixing. When the lubricating oil is mixed with equal parts of selected referee oils, the mixture shall conform with all the requirements specified in *3.3* and *3.4* except compatibility, storage stability, and engine endurance.

4.4.4 Low temperature storage. Three 1-quart cans of oil shall be stored in a cold chamber maintained at -18° ±2.5°C (0° ±5°F) for 6 weeks. At the end of the storage period the oil shall be visually inspected for evidence of crystallization, additive separation, and gelling.

4.4.5 Accelerated storage. Two 1-gallon cans which each contain 1260 ml of the test oil shall be placed in an unvented oven maintained at 110° ±1°C (230° ±2°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.

4.4.6 Extended storage. Twelve gallons of the lubricating oil packaged in 1-quart containers shall be stored at an ambient temperature not lower than -40°C (-40°F) and not greater than 60°C (140°F) for periods up to three years. After storage for the specified time, the lubricating oil shall be tested for the requirements specified in *3.3* and *3.4* except compatibility, accelerated storage stability, and engine endurance. The lead corrosion requirement stated in *table I* shall not exceed 230 g/m^2.

4.4.7 Engine endurance test. The oil shall be subjected to an accelerated endurance test in a turboshaft engine 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.

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 lubricating oil is intended for use in specific models of aircraft turbine engines, helicopter transmissions, accessory and 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 should specify the following:

a. Title, number, grade, and date of this specification, including any amendments. (If not specified, Grade 3 will 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* and *2.3*).

c. Type and size of containers required (see *5.1*).

d. Quantity desired.

e. Submittal of conformance test results (see *4.3.3*).

f. If certification of conformance to material prohibitions is required (see *3.2*).

6.2.1 Standard elastomers for compatibility tests. Standard elastomer stocks will conform to *SAE-AMS 3217/1*, *SAE-AMS 3217/4*, and *SAE-AMS 3217/5*.

6.3 Qualification. With respect to products which require 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 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 and Power Directorate, ATTN: WL/POSL, Bldg 490, 1790 Loop Road North, Wright-Patterson AFB OH 45433-7103, and information pertaining to qualification of products may be obtained from that activity. To initiate the qualification process, prospective suppliers will forward a written request for such action to the Aero Propulsion and Power Directorate at the above address. This letter will contain general information on the proposed candidate material. The Aero Propulsion and Power Directorate will respond, providing detailed instructions for the submission of product samples and test data.

6.3.1 Reblend lubricating oil qualification. A reblend lubricating oil is an original qualified lubricating oil as specified in *4.2*, in which one or more ingredients have been blended by a manufacturer other than the manufacturer of the original formulation. A bulk lot of the reblended oil will be subjected to the qualification tests (see *4.2*). The engine performance requirements (see *3.5.1*) may be waived, at the discretion of the qualifying activity, if other tests demonstrate equivalence to the original formulation. Reblend approvals may be initiated by the process described in *6.3*.

6.3.2 Rebrand lubricating oil qualification. A rebrand lubricating oil is a qualified, fully-formulated oil which has successfully passed all qualification tests (see *4.2*) and is manufactured by the original formulator at the original manufacturing site but which is packaged by a supplier other than the manufacturer of the fully-formulated oil. Rebrand approvals may be initiated by the process described in *6.3*.

6.3.3 Heat transfer properties. There is no qualification requirement listed in *section 3* for specific heat or thermal conductivity of potential products. The heat transfer properties of a given chemical class, such as polyol ester lubricants, are very consistent. Therefore, such a requirement is not warranted.

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 Subject term (key word) listing.

aircraft engine oil
synthetic ester lubricant
thermal stability
turbine engine lubricating oil
viscosity

6.6 International standardization agreements. Certain provisions of this specification 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 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 Definitions.

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.

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.

6.8 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. The changes are due to Acquisition Reform initiatives requiring Government specifications to be performance-based. These changes have no impact on the chemical, physical, or performance requirements with respect to the previous issue.

Custodians:
Air Force - 11
Army - CR4
Navy - AS

Review activities:
Air Force - 68
Army - AV
DLA - PS
Navy - SH

Preparing activity:
Air Force - 11

(Project 9150-1182)

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 waiver any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-7808L	2. DOCUMENT DATE (YYMMDD) 97/05/02

3. DOCUMENT TITLE
LUBRICATING OIL, AIRCRAFT TURBINE ENGINE, SYNTHETIC BASE

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)*	e. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE *(Include Area Code)*	
ASC/ENSI AF CODE 11	(1) Commercial (937) 255-0175	(2) AUTOVON 785-0175
c. ADDRESS *(Include Zip Code)* 2530 LOOP ROAD WEST WRIGHT-PATTERSON AFB OH 45433-7101	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	