METRIC
MIL-L-23699E
25 August 1994
Superseding
MIL-L-23699D
9 October 1990

MILITARY SPECIFICATION

LUBRICATING OIL, AIRCRAFT TURBINE ENGINE, SYNTHETIC BASE, NATO CODE NUMBER O-156

This specification is approved for use by all Departments and Agencies of the Department of Defense

1 SCOPE

* 1.1 Scope. This specification covers two classes of gas turbine engine lubricating oils, primarily used for aircraft engines, which have a nominal viscosity of 5 centiStokes at 100°C and are made with neopentyl polyol ester base stocks. This oil is identified by NATO Code Number O-156.

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

Classification	Type of Oil
STD	Standard (Non-Corrosion Inhibiting)
C/I	Corrosion Inhibiting

2 APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications, standards, and manual 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: Naval Air Systems Command, AIR-5362, 1421 Jefferson Davis Highway, Arlington, VA 22243-5360, by using the 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

Military

MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-T-9046	Titanium and Titanium Alloy, Sheet, Strip, and Plate

STANDARDS

Federal

FED-STD-313	Material Safety Data Sheets, Preparation and Submission of
FED-STD-595	Colors Used in Government Procurement
FED-STD-791	Lubricant, Liquid Fuel, and Related Products; Methods of Testing

Military

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

TECHNICAL MANUALS

Navy

NAVAIR 17-15BF-62	Fluid Analysis Spectrometer, Type A/E35U-3, Operation Instructions and Maintenance Instructions

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS

D 92	Flash and Fire Points by Cleveland Open Cup, Test for
D 97	Pour Point of Petroleum Oils, Test for
D 445	Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity), Test Method for
D 664	Neutralization Number by Potentiometric Titration, Test for
D 892	Foaming Characteristics of Lubricating Oils

D 972 Evaporation Loss of Lubricating Greases and Oils, Test for
D 2532 Viscosity and Viscosity Change After Standing at Low Temperature of Aircraft Turbine Lubricants, Test for
D 2603 Sonic Shear Stability of Polymer-Containing Oils, Test for
D 4057 Manual Sampling of Petroleum and Petroleum Products
D 4177 Automatic Sampling of Petroleum and Petroleum Products

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z129.1 American National Standard for the Precautionary Labeling of Hazardous Industrial Chemicals.

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

(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.)

SOCIETY OF AUTOMOTIVE ENGINEERS

AEROSPACE MATERIAL SPECIFICATIONS

AMS 3217/1 Test Slabs, Acrylonitrile butadiene (NBR-H)
AMS 3217/4 Test Slabs, Fluoroelastomer (FKM)

AEROSPACE RECOMMENDED PRACTICE

* ARP 4249 Bearing Corrosion Test Method

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

2.3 Order of Precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification The lubricating oil furnished under this specification shall be a product which is qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.3)

3.1.1 Requalification. Requalification shall be required in the event 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 activity responsible for qualification (see 6.3). The laboratory test report specified in 4.3.2 shall be forwarded to the activity responsible for qualification with each reformulation request.

* 3.2 Materials The composition of the lubricating oil is not limited, except that materials containing barium or organic compounds of titanium are prohibited and the basestock shall be a neopentyl polyol ester material. Recycled basestocks are permitted, however, each batch must be fully tested in accordance with the qualification requirements of this specification If a tricresyl phosphate (TCP) additive is used, the TCP additive shall not contain more than one (1) percent of the ortho isomer of tricresyl phosphate.

3 2 1 Acid components. The acid components of the finished oil shall be determined in mole-percent on the qualification test sample using the method number 3500 of FED-STD-791. The manufacturer may then select a range of 10 mole-percent for each acid component to bracket the values on the qualification sample by the qualifying laboratory. The acid components of production lots of oil submitted for quality conformance inspection shall fall within the stated desired range for each acid This requirement applies only to the major acid components (10 mole-percent or greater) Minor acid components shall not exceed 10 mole-percent in production lots. Failure to meet this requirement shall be cause for rejection of the lot

3 3 Chemical and physical requirements. The finished lubricating oil shall conform to the requirements specified in Table I.

* 3.4 Bench performance tests (Table II)

* 3.4.1 Gear test (load carrying ability of lubricating oils).

a. Qualification inspection requirements: The oil shall be subjected to six determinations The average of these six determinations shall not be less than 102 percent of Hercolube A All six determinations shall be made on the same machine.

b The reference oil average rating used to obtain the relative ratings shall be reported.

3 4 2 Bearing test. After a 100 hour bearing test, the overall deposit demerit rating shall be less than 80 The weight of filter deposits shall not exceed 3 grams and the total oil consumption shall not exceed 2,000 mL The viscosity of the lubricating oil shall not have changed more than -5 to +30 percent from the original viscosity at 40°C (104°F) and the change in total acid number shall not exceed 2.0 mg KOH/g, during test and at the end of the 100-hour test period.

TABLE I
PHYSICAL, CHEMICAL AND PERFORMANCE TEST REQUIREMENTS

Requirements	STD and C/I Limits	Test Method	
		ASTM	FED-STD-791
Viscosity, cSt, @ -40°C (-40°F), Max.	13,000	D 2532	
Percent Change after 72 hours @ -40°C (-40°F), Max. 1/	±6		
Viscosity, cSt, * @ 100°C (212°F), Min. - Max.	4.90-5.40	D 445	
* @ 40°C (104°F), Min	24.5		
Flash Point, °C (°F), Min.	246 (475)	D 92	
Pour Point, °C (°F), Max.	-54 (-65)	D 97	
* Total Acid Number, Max 2/	1.00	D 664	
Evaporation Loss, Percent by Weight, 6 5 hours @ 204°C (400°F), Max 3/	10	D 972	
Foaming, Foam Volume, mL, Max 4/		D 892	
5 minutes aeration @ 24°C (75°F)	25		
1 minute settling @ 24°C (75°F)	none		
5 minutes aeration @ 93.5°C (200°F)	25		
1 minute settling @ 93.5°C (200°F)	none		
5 minutes aeration @ 24°C (75°F) (after test @ 93.5°C above)	25		
1 minute settling @ 24°C (75°F)	none		
Rubber Compatibility			3604 & 3433 5/
Rubber Swell, Percent Min - Percent Max			
AMS No. 3217/1 - 72 hours @ 70°C (158°F)	5-25		
AMS No. 3217/4 - 72 hours @ 204°C (400°F)	5-25		
Standard Silicone Rubber - 96 hours @ 121°C (250°F)	5-25		
Tensile Strength Loss, Percent Max.			
Standard Silicone Rubber - 96 hours @ 121°C (250°F)	30		

Notes
1/ The initial viscosity shall be determined 35 ± 1 minutes after the viscometer is placed in the bath maintained at -40°C ±1 05°C and again at 72 hours ±5 minutes after completion of initial viscosity
* 2/ Titrate to a pH 11 end point Report as mg KOH/g
3/ Use bath temperatures of 204°C ±1°C (400°F ±2°F) and 6-1/2 hour test period ASTM Standard E 1-67 Thermometer No 80F shall be used Air temperature shall be maintained at 204°C ±1°C (400°F ±2°F), using a preheater, if necessary
4/ Complete foam collapse is that point at which no more than a single row of bubbles remain around the cylinder wall and air inlet tube If this ring of bubbles around the cylinder wall contains segments having two or more layers of bubbles and the difference in height of the foam in the ring is not greater than 10 mL, complete foam collapse is to be that point at which a break occurs in the ring of bubbles without subsequent reforming of the ring
5/ AMS No 3217/1 and AMS No 3217/4 shall be tested in accordance with Method 3604 and Standard Silicone Rubber shall be tested in accordance with Method 3433

TABLE I (Continued)
PHYSICAL, CHEMICAL AND PERFORMANCE TEST REQUIREMENTS

Requirements	STD and C/I Limits			Test Method FED-STD-791
Compatibility	Compatible			3403 6/
Turbidity	none			
Sediment, mg/L, Max.	10			
Storage Stability				
Low Temp , 6 weeks @ -18°C (0°F)	No crystallization, separation, or gelling			7/
Extended, after 12 months 9/ @ 24 ±5°C (75 ±10°F)	Meet all quality conformance tests			8/
Thermal Stability and Corrosivity @ 274°C (525°F)				3411
* Viscosity Change, Percent Max. 10/	5.0			
* Total Acid Number Change, Max. 2/	6 0			
Weight of Metal Change, mg/cm², Max	4.0			
Sediment				3010
Visual Undissolved Water	none			
Sediment through 1 2 μm filter, mg/L, Max.	10			
Total Ash, mg/L, Max 11/	1			
Corrosion and Oxidation Stability				5308 12/
72 hours @ Test Temperature, °C(°F)	175 (347)	204 (400)	218(425)	
* Viscosity, Percent Change 10/	-5 to +15	-5 to +25	Report	
* Total Acid Number Change, Max 2/	2.0	3 0	Report	
Metal Weight Change, mg/cm², Max.				
Steel	±0.2	±0.2	±0 2	
Silver (Ag)	±0.2	±0.2	±0 2	
Aluminum (Al)	±0.2	±0.2	±0.2	
Magnesium (Mg)	±0.2	±0.2	-	
Copper (Cu)	±0.4	±0 4	-	
Titanium (Ti)	-	-	±0 2	
Sludge Content, Filtered through 10 μm, mg/100 mL oil, Max.	50	50	50	

Note 6/ See paragraph 4 5 1 for test method details
7/ See paragraph 4 5 2 for test method
8/ See paragraph 4 5 3 for test method
9/ Tentative approval shall be given to products meeting all specification qualification tests Final approval shall be awarded upon sucessful completion of this test. Failure to pass this test shall be cause for withdrawl of approval
* 10/ Compared with viscosity of new oil samples tested at 40°C (104°F)
11/ If the total sediment does not exceed 1 mg/L, the ash content does not need to be determined
12/ See paragraph 4 5 4 for test method details

TABLE I (Continued)
PHYSICAL, CHEMICAL AND PERFORMANCE TEST REQUIREMENTS

Requirements	STD and C/I Limits	Test Method	
		ASTM	FED-STD-791
Trace Metal Content, ppm, Max.			13/
Aluminum (Al)	2		
Iron (Fe)	2		
Chromium (Cr)	2		
Silver (Ag)	1		
Copper (Cu)	1		
Tin (Sn)	11		
Magnesium (Mg)	2		
Nickel (Ni)	2		
Titanium (Ti)	2		
Silicon (Si)	10		
Lead (Pb)	Report		
Molybdenum (Mo)	Report		
Acid Assay	Report		3500 14/
Shear Stability, Viscosity Loss, % Max. @ 40 °C (104°F)	4	D 2603 15/	

Note 13/ See paragraph 4 5 6 for test method details
14/ Alternate methods may be used if acceptable to the qualifying activity, however, only Method 3500 of FED STD 791 shall be used for referee tests
15/ Use an irradiation period of 30 minutes on a 30 mL oil sample at a power setting which causes 11 5 ±0 5 percent viscosity loss to a 30 mL sample of ASTM Reference Fluid A when irradiated for five (5) minutes

TABLE II
BENCH TEST REQUIREMENTS

Requirements	Limits		Test Method	
	STD	C/I	FED-STD-791	SAE ARP
Gear Test (Load Carrying Capability of Lubricating Oils)	2/	2/	6508 1/	
Bearing Test, Type 1-½	3/	3/	3410	
Bearing Corrosion Test		4/		4249

Notes 1/ Only the Ryder gear machines having a Reference Oil average rating within the range of 2,100-2,600 lb/in after eight determinations are acceptable (See 6 2 2)
2/ Gear test limits are contained in paragraph 3 4 1
3/ Bearing test limits are contained in paragraph 3 4 2
4/ Bearing Corrosion Test limits are contained in paragraph 3 4 3

* 3.4 3 Bearing Corrosion Test - (C/I Oils Only).

a. Qualification inspection requirements. The candidate oil must successfully pass three series of Bearing Corrosion Tests. The first series of tests shall be conducted on the candidate oil as received (new oil) and the second series shall be conducted on the post test filtrate from the 204° C (400° F) Corrosion and Oxidation Stability Test (stressed oil). The third series shall be run on the used oil from the turboshaft engine test. Each series of tests shall consist of two test chambers, each containing ten candidate specimens and four each of the pass and fail reference oils. A minimum of fifteen of the twenty candidate test specimens from each series shall be free of corrosion at the end of the test.

b. Quality conformance inspection requirements: Each production batch of the oil shall successfully pass one series of Bearing Corrosion Tests on the new oil. This series shall consist of two test chambers, each containing ten candidate specimens and four each of the pass and fail reference oils. A minimum of fifteen of the twenty candidate test specimens shall be free of corrosion at the end of the test Confirmation of the presence of the corrosion additive may be conducted using a quantitative laboratory analytical method of analysis approved by the qualifying activity. Confirmation of the specified additive package by such approved methods may be substituted for the Bearing Corrosion Test quality conformance test requirement

3.5 Full-scale performance tests.

3.5.1 Turboshaft engine test The oils shall be tested in a full-scale turboshaft engine in accordance with 4 5 5 to evaluate its serviceability and to ensure that engine components are not adversely affected. The post-test condition of the engine shall indicate no excessive deposits, wear or corrosion which are attributed to the test oil.

3.5.2 Service evaluation. At the discretion of the qualifying agency, additional engine and flight test evaluations may be required on candidate formulations which, in the opinion of the qualifying agency, represent unique or unusual formulations or manufacturing technology. The evaluation will be conducted by the qualifying activity or its designated representative and will consist of the following

a Model type tests A 150 hour, test cell operated, evaluation will be conducted on a minimum of two different models of aviation gas turbine engines used by the U.S Military.

b. Flight evaluation A 500 hour flight evaluation will be conducted in a Government owned aircraft having the same engine model as one used in the 150 hour model type test.

3.5.2.1 Evaluation criteria The rating criteria for both service evaluations will be reported as satisfactory or unsatisfactory. The satisfactory rating is contingent on the successful completion of the specified test duration without a lubricant related discrepancy and the satisfactory condition of the lubricant-wetted parts upon post-test engine disassembly and

inspection. The post-test condition of the candidate lubricant must be free of deleterious features.

3.6 Material safety data sheets. Material safety data sheets shall be prepared and submitted in accordance with FED-STD-313 and forwarded as specified in 4.3.2. The lubricating oil shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting activity (see 4.3.2 and 6.7).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsiblity for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) 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

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection and testing of lubricating oil shall be classified as follows:

a. Qualification inspection (4 3)

b. Quality conformance inspection (4.4)

4.3 Qualification inspection.

* 4.3.1 Qualification inspection sample. The qualification test sample shall consist of 208 liters (55 gallons) of finished lubricating oil and 19 liters (5 gallons) of the base oil without additives. A minimum of 100 grams of each additive ingredient used in the manufacture of the qualification test sample shall be submitted prior to qualification. Upon receiving authorization from the Naval Air Systems Command, AIR-53623C, (see 6.3), these samples shall be forwarded to the Naval Air Warfare Center Aircraft Division, (PE33), 1440 Parkway Ave., Trenton, NJ 08628. Each sample shall be plainly identified by a securely attached durable tag or label marked with the following information.

QUALIFICATION INSPECTION SAMPLE
LUBRICATING OIL, AIRCRAFT TURBINE ENGINE,
MIL-L-23699

Type of sample: *(basestock, additive, or finished oil)*
* Classification of Oil: (STD or C/I)
Name of manufacturer_____
Product code number_____
Batch number_____
Date of manufacture_____
Submitted by *(name)* on *(date)* for qualification inspection in accordance with MIL-L-23699 under authorization of *(reference authorizing letter, see 6.3)* .

4.3.2 Test report. The manufacturer shall forward a certified test report to the activity responsible for qualification before the qualification test sample is supplied (see 6.3). The test report shall contain laboratory data showing the results of all tests required by this specification, with the exception of the tests for compatibility, low temperature storage, extended storage stability, sediment, bearing test, shear stability, and turboshaft engine test. The test report shall also include complete formulation data giving the chemical name of each ingredient using International Union of Pure and Applied Chemistry (I.U P A C) nomenclature, the percentage of each ingredient and the manufacturer and trade name of each ingredient The mole-percent of each acid of the base ester shall be given as determined by the method of 4.5. The manufacturer shall also submit material safety data sheets on the toxicity (see 3.6) of the candidate product and for each of the additive components used in the formulation

4.3.3 Qualification inspection tests The qualification tests shall consist of all the tests specified in 4 5.

4 4 Quality conformance inspection. Quality conformance inspection of individual lots shall include all of the tests of this specification except for the following.

a. 72-hour viscosity stability test at -40°C (-40°F)

b. 175°C (347°F) corrosion and oxidation stability test.

c. 218°C (425°F) corrosion and oxidation stability test.

d. Compatibility test

e. Low temperature storage test.

f Extended storage stability test

g. Full-scale performance tests

h. Rubber compatibility tests, AMS No.s 3217/1, 3217/4 and Silicone

i. Shear stability test.

j. Acid Assay test.

* k. The Ryder Gear Test.

* l. The Bearing Test, Type 1 -½ (see Table II) shall be performed on the first three full-scale production lots of each qualified lubricating oil supplied to the procuring activity. Additional requirements for performing the bearing test on production batches may be specified in the procurement contracts

* m. The Bearing Corrosion Test (see Table II) shall be performed on all production batches of C/I lubricant supplied except as noted in paragraph 3.4.3 b.

* Notes: (1) Failure of production lots to pass any of the quality conformance tests shall be cause for rejection of the lot.

(2) A sample of five (5) cases of 1 quart containers (120 cans) of material from the first production lot supplied to the procuring agency after qualification, and one (1) case of every production batch supplied to the procuring agency thereafter, shall be forwarded to the Naval Air Warfare Center Aircraft Division (PE33), 1440 Parkway Ave, Trenton, New Jersey 08628.

4.4.1 Lot Formation.

4 4.1.1 Bulk lot. A bulk lot is defined as an indefinite quantity of homogeneous mixture of material offered for acceptance in a single isolated container or manufactured by a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.4.1.2 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 manufactured by a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

4.4.2 Sampling.

4.4.2.1 Sampling for verification of product quality. Each bulk lot of material shall be sampled at random in accordance with ASTM Method D 4057 or D 4177 for verification of product quality via the performance of the quality conformance inspection tests discussed in 4.4.

4.4.2.2 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.

4.4.2.3 Sampling for examination of sedimentation of filled and sealed containers. Samples of filled and sealed 1-quart containers shall be taken at periodic intervals to be representative of each packaged lot. The number of samples taken each day shall be in accordance with MIL-STD-105 at Inspection Level S-2

4 4.3 Inspection

4.4.3 1 Inspection of material Inspection shall be in accordance with Method 9601 of FED-STD-791.

4.4.4 Test Report. A copy of the quality conformance inspection report on each lot of oil produced for U.S. Government use shall be forwarded to the Naval Air Warfare Center Aircraft Division (PE33), Box 7176, Trenton, NJ 08628

* 4.5 Test methods Qualification and quality conformance tests shall be performed in accordance with the applicable methods of Tables I and II and 4 5.1 through 4.5.6.

* 4.5.1 Compatibility. The compatibility test shall be performed in accordance with Method 3403 of FED-STD-791 with the following additional procedure· Petroleum ether with a boiling range of 30 to 60°C, n-Heptane, or Hexane shall be used in place of 1,1,1-Trichloroethane (O-T-620). Upon completion of the 168-hour oven period, the test flasks shall be stored in the dark at room temperature 24°C ±5°C (75°F ±10°F) for 21 days before visual inspection for turbidity. Sediment shall be determined in accordance with 4.5. If the amount of sediment collected after the exposure period is greater than the limit specified in Table I additional testing may be performed on the mixture to determine that its performance meets the requirements of this specification The additional testing may include all of the tests described in this specification Referee lubricating oils shall consist of selected oils qualified under this specification, MIL-L-7808 and DOD-L-85734

4.5 2 Low temperature storage. Three one quart samples of oil shall be stored in a cold chamber maintained at -18°C ±2.5°C (0°F ±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.

4.5.3 Extended storage stability Five (5) cases of quart containers (120 cans) from the first production batch of the tentatively qualified oil (original qualification, reblend or rebrand) shall be stored at room temperature 24°C ±5°C (75°F ±10°F), for a 12-month period. At the end of one 12-month storage period, the samples shall be examined for conformance to all quality conformance test requirements.

* 4.5 4 Corrosion and oxidation stability. The corrosion and oxidation stability test shall be performed in accordance with Method No. 5308 FED-STD-791 with the following modifications: Three separate tests, each conducted at a different specified temperature and each of 72 hour duration, shall be performed at bath temperatures of 175°C (347°F), 204°C (400°F), and 218°C (425°F) maintained within ±2.5°C (±5°F). A suitable liquid medium or fluidized sand bath heating apparatus may be used in lieu of an aluminum block heater An electrolytic grade silver test square shall be substituted for the cadmium plated steel square. In the 218°C test, substitute titanium conforming to MIL-T-9046, Type I, Composition C, for copper and magnesium. Stainless steel or nickel-chrome wire may be used to tie the metal coupons together at all test conditions. The weight loss for titanium shall be reported as the average of the two squares. Condenser water temperature shall be maintained at 18°C ±2.5°C (65° ±5°F). The total acid number shall be determined in accordance with ASTM Method D 664. The post-test sludge content shall be determined as follows Decant oil from the test tube through a preweighted

10-micron teflon filter (Mitec LCWP 047-00 or equivalent) and measure filtrate volume. Set filtrate aside for viscosity and acid number tests. Remove all sludge from test equipment with rubber policeman, wash equipment and filtered sludge with petroleum ether, oven dry sludge sample, and weigh and compute sludge weight per 100 mL of oil. Do not add the petroleum ether washings to the oil filtrate used for viscosity and acid number. Petroleum ether with a boiling range of 30 to 60 °C, n-Heptane, or Hexane shall be used in place of 1,1,1-Trichloroethane (O-T-620).

4.5.5 Turboshaft engine. The oil shall be subjected to an accelerated endurance test in a turboshaft engine for a period sufficient to determine its performance characteristics. Engine components shall be inspected for defects upon completion of the endurance test run. Any defects found in the components of the engine which are serviced by the oil shall be cause for disqualification. Engine test conditions and test period shall be specified by the activity responsible for qualification (see 6.3).

4.5.6 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 Joint Oil Analysis Program spectrometric calibration standards, the spectrometer shall be standardized in accordance with paragraphs 4-32, 4-33, 4-46 and 4-47 of NAVAIR 17-15BF-62. Immediately after standardizing the spectrometer, five (5) determinations of the oil for trace metal content shall be performed The average of the five determinations shall be reported. Samples requiring trace metal content determinations may be sent to.

* Department of Defense
Technical Support Center
Joint Oil Analysis Program
Attn NOAP Lab
296 Farrar Road, Suite B
Pensacola, FL 32508-5010

5. PACKAGING

5 1 Preservation and packing. The lubricating oil shall be preserved and packed in accordance with MIL-STD-290 except the color of the can shall be green approximating No. 14110 and the lettering shall be yellow, approximating No. 13655, of FED-STD-595. The type and size of the containers and the level of preservation and packing shall be as specified by the acquiring activity.

5.2 Marking. All unit, intermediate, and shipping containers shall be marked in accordance with MIL-STD-290. All unit and intermediate packs of toxic and hazardous chemicals and materials shall also be labeled in accordance with the applicable laws, statutes, regulations or ordinances, including Federal, State, and Municipal requirements. In addition, unit or intermediate containers, including unit containers that serve as shipping containers, such as pails and drums, shall be marked with the applicable precautionary information detailed in ANSI Z129.1. In addition to these markings, the following note shall appear on each container:

DO NOT MIX WITH OILS OTHER THAN MIL-L-23699
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 military symbols specified in MIL-STD-290. The remainder of the marking shall be legible.

6. NOTES

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

* 6.1 Intended use. These gas turbine lubricating oils are intended for use in gas turbine engines and gear boxes which propel air, sea, and ground mobility equipment. These oils are designed for operation within the approximate bulk oil temperature range of -40° to 204°C (-40° to 400°F). The C/I oil is intended for applications where corrosion inhibition is desired.

6.2 Ordering data Procurement documents should specify

* a Title, number, Class (C/I or STD), and date of this specification.

b Type and size of container required (see 5.1).

c. Level of packaging and packing required (see 5.1).

d. Quantity desired.

e. Any additional instructions for performing the bearing test (see 4.4).

f. Submittal of test results (see 4.4.4)

6.2.1 Standard elastomers for compatibility tests. Standard elastomer stocks AMS 3217/1 and AMS 3217/4 shall conform to the formulation data and physical property requirements provided in the Society of Automotive Engineers, Aerospace Materials Specification No. 3217.

* 6 2.2 Source for standard reference oil. Standard reference oil may be obtained from the Naval Air Warfare Center Aircraft Division, Code PE33, P.O. Box 7176, Trenton New Jersey 08628.

6.3 Qualification With respect to products requiring qualification, awards shall be made only for the products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List, QPL-23699, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, 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 orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Attention: AIR-53623C, 1421

Jefferson Davis Highway, Arlington, VA 22243-5360, and information pertaining to qualification of products may be obtained from that activity. To initiate the qualification process, prospective suppliers shall forward a written request for such action to the Naval Air Systems Command at the above address. This letter shall contain general information on the proposed candidate material. The Naval Air Systems Command will respond in writing with a formal "letter of authorization" providing detailed instructions for the submission of product samples and test data

* 6.4 Subject Term (Key Word) listing.

Turbine Engine Lubricating Oil
Lubricant
Synthetic Base Lubricant
Synthetic Base Oil
Corrosion Inhibition

6.5 International standardization agreement. Certain provisions of this specification are the subject of an international standardization agreement with NATO (STANAG 1135). When amendment, revision, or cancellation of this specification is proposed which shall affect or violate the international agreement concerned, the preparing activity shall take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

6.6 Changes from previous issue. The margins of this specification are marked with asterisks 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 whatever 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

6.7 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 paragraph 4 of FED-STD-313.

CONCLUDING MATERIAL

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

Review Activities:
Army - AV
Navy - SH
Air Force - 68
DLA - GS

User activities.
Army - AR

Preparing activity:
Navy - AS
(Project No 9150-1134)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8 In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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

I RECOMMEND A CHANGE:	1 DOCUMENT NUMBER MIL-L-23699E	2 DOCUMENT DATE (YYMMDD) 940825

3 DOCUMENT TITLE
LUBRICATING OIL, AIRCRAFT TURBINE ENGINE, SYNTHETIC BASE, NATO CODE O-156

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

5 REASON FOR RECOMMENDATION

6. SUBMITTER

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

8 PREPARING ACTIVITY

a NAME Naval Air Systems Command AIR-53623C	b TELEPHONE *(Include Area Code)* (1) Commercial 703-604-3290 x7856	(2) AUTOVON 664-3290
c. ADDRESS *(Include Zip Code)* 1421 Jefferson Davis Highway Arlington, VA 22243-5360	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	