

MIL-L-9236B(USAF)

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Superseding

MIL-L-9236A(USAF)

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## MILITARY SPECIFICATION

### LUBRICATING OIL, AIRCRAFT TURBINE ENGINE, 400°F

#### 1. SCOPE

1.1 SCOPE.- This specification covers one grade of aircraft gas turbine lubricating oil.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification:

#### SPECIFICATIONS

##### Military

|             |  |
|-------------|--|
| MIL-E-5009  | Engines, Aircraft, Turbojet, Qualification Tests for                         |
| MIL-L-7808  | Lubricating Oil, Aircraft Turbine Engine, Synthetic Base                     |
| MIL-L-25336 | Lubricating Oil, Aircraft Turbine Engine, High Film Strength, Synthetic Base |
| MIL-R-25897 | Rubber, High Temperature, Fluid Resistant                                    |

#### STANDARDS

##### Federal

|                                      |  |
|--------------------------------------|--|
| Federal Test Method Standard No. 791 | Lubricants, Liquid Fuels, and Related Products; Methods of Testing |
|--------------------------------------|--|

##### Military

|             |  |
|-------------|--|
| MIL-STD-290 | Packaging, Packing and Marking of Petroleum and Related Products |
|-------------|--|

FSC 9150

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## PUBLICATIONS

## Air Force-Navy Aeronautical Bulletin

No. 164

Lubricants, Hydraulic Fluids and  
Corrosion Inhibitors for Aircraft,  
Qualifying Procedure for

(Copies of documents required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 OTHER PUBLICATIONS.- The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

## American Society for Testing Materials Publication

## ASTM Standards on Petroleum Products and Lubricants

(Copies of ASTM publications may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.)

## 3. REQUIREMENTS

3.1 QUALIFICATION.- The aircraft turbine engine lubricating oil furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein.

3.1.1 REQUALIFICATION.- Requalification may be required in the event any change in quantity (of ingredients in the formulation), quality, composition, source of any of the ingredients or point of blending is made.

3.2 MATERIALS.- The composition of the lubricating oil is not limited. Additives to impart oxidation stability, corrosion-preventive properties and anti-wear properties are permitted.

3.3 PROPERTIES.- The properties of the lubricating oil shall conform to the following:

TABLE I

## Properties

|   |        |
|---|--------|
| Viscosity, Centistokes at 400°F (204.5°C), Min. | 1.0    |
| Viscosity, Centistokes at 100°F (37.8°C)        | Report |
| Flash Point, °F Min.                            | 425    |
| Pour Point, °F Min.                             | -75    |
| Spontaneous Ignition Temperature, °F Min.       | 750    |

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3.3.1 VISCOSITY, STABILITY.- The viscosity determination shall be conducted at -65°F. The two determinations under the 3-hour test shall not differ by more than 6.0 percent of the lowest value and both shall be below 21,000 centistokes. All determinations made under the 72-hour test shall be below 24,000 centistokes.

3.4 EVAPORATION.- The evaporation loss of the lubricating oil shall not exceed 15 percent by weight when tested at 400°F for 6-1/2 hours.

## 3.5 GEAR TESTS

3.5.1 LOAD-CARRYING ABILITY AT 165°F.- The gears, when run in accordance with Method 6508-T of Federal Test Method Standard No. 791, shall conform to the following:

a. Qualification Test Requirement: Eight determinations shall be made, the reported average of which shall be a minimum of 56 percent of the reference oil "B" rating.

b. Acceptance Test Requirement: A minimum number of determinations shall be made, as listed below, to satisfactorily pass the acceptance requirement. The reported result shall include all determinations and the averages obtained.

| <u>Number of<br/>Determinations</u> | <u>Relative Rating<br/>Percent (Min.)</u> |
|-------------------------------------|---|
| 2                                   | 63  |
| 4                                   | 60  |
| 6                                   | 58  |
| 8                                   | 56  |

3.5.2 LOAD-CARRYING ABILITY AT 400°F.- The gears shall be run with the lubricating oil at 10,000 plus or minus 100 RPM for 10 minutes at each prescribed load, with an oil inlet temperature to the gears of 400 plus or minus 10°F (204.5°C). The load-carrying ability at 400°F shall be reported as that load at which 22.5 percent of the working tooth area is scuffed.

3.5.3 GEAR FATIGUE AT 400°F.- The gears, when run with the lubricating oil at 10,000 plus or minus 100 RPM and an oil inlet temperature to the gears of 400 plus or minus 10°F (204.5°C) shall be subjected to a series of test cycles until the limit of fatigue pitting is observed. A minimum of 10 determinations shall be made. Report the individual determinations and the averages.

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3.6 SWELLING OF SYNTHETIC RUBBERS.- Swelling of synthetic rubber conforming to Specification MIL-R-25897 at 400°F for 72 hours by the test lubricating oil shall be within the limits established below:

| Rubber      | Percent Swell |        |
|-------------|---------------|--------|
|             | (Min.)        | (Max.) |
| MIL-R-25897 | 12            | 25     |

3.7 FOAMING CHARACTERISTICS.- The lubricating oil shall not exceed the following values for the indicated sequence:

- a. Sequence 1 100 ml maximum foam immediately following the bubbling period and complete foam collapse within 5 minutes.
- b. Sequence 2 25 ml maximum foam immediately following the bubbling period and complete foam collapse within 3 minutes.
- c. Sequence 3 100 ml maximum foam immediately following the bubbling period and complete foam collapse within 5 minutes.

3.8 DEPOSITION NUMBER.- When tested in the Wright Air Development Division deposition tester, the average deposition number for the lubricating oil shall be reported. Four runs shall be made for qualification and two runs for acceptance. The average acceptance deposition number shall not exceed the average qualification deposition number by more than 1.0.

3.9 COMPATIBILITY.- The lubricating oil shall be miscible with each of the lubricating oils approved under this specification and under Specifications MIL-L-7808 and MIL-L-25336. At the end of the test period, the mixtures shall not be turbid, shall not separate nor have a precipitation number greater than 0.005 ml/200 ml of oil.

3.10 BEARING STABILIZATION TEMPERATURE.- The oil shall not cause the bearing temperature to stabilize over 500°F when tested in the ERDGO bearing test rig. The time required to reach the stabilization temperature shall not exceed 60 minutes.

3.11 BEARING TEST.- The oil shall operate satisfactorily in the Wright Air Development Division bearing test rig for at least 50 hours. During this time the oil shall show no deleterious changes nor excessive deposits.

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3.12 100-HOUR ENGINE ENDURANCE TEST.- The lubricating oil shall perform as well as or better than the reference oil qualified under this specification when the engine is inspected after the 100-hour engine test.

3.12.1 USED OIL CONTROL.- The right is reserved to subject any sample removed from the engine test to all the tests of this specification. Additional tests which are considered necessary to assure the serviceability of the material may be run, upon mutual agreement between the manufacturer and the procuring activity. Significant changes in physical or chemical properties, or both, as a result of engine operation may be cause for rejection. The increase in viscosity at 100°F of the lubricating oil at the end of the 100-hour engine test shall not exceed 75 percent.

3.13 STORAGE STABILITY.- Initially, approval shall be granted upon the successful completion of all the other specification tests. However, after 12 months of storage in the dark at room temperature of 75 plus or minus 5°F (24.5 plus or minus 3°C), the oil shall show no signs of separation and shall meet all the requirements of this specification except the engine test. Failure to pass this storage stability test shall be cause for withdrawal of approval.

3.14 WORKMANSHIP.- The finished lubricating oil shall be transparent, uniform in appearance and shall be free from sediment, cloudiness, suspended matter or other adulterations when examined visually by reflected light, both before and after centrifuging. The precipitation number shall not exceed 0.005 ml/200 ml of oil.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.1.1 CLASSIFICATION OF TESTS.- The inspection and testing of lubricating oil shall be classified as follows:

- a. Qualification Tests.
- b. Acceptance Tests.

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4.2 GENERAL

4.2.1 BULK LOT.- An indefinite quantity of a homogeneous mixture of material manufactured as one batch at one time and place shall be considered a bulk lot.

4.2.2 PACKAGED LOT.- A homogeneous mixture of material from a single bulk lot filled in an indefinite number of 55-gallon drums or smaller containers shall be considered a packaged lot.

4.2.3 SAMPLING.- Each bulk or packaged lot of material sampled for product inspection shall be in accordance with Method 8001 of Federal Test Method Standard No. 791.

4.2.4 INSPECTION

4.2.4.1 INSPECTION OF MATERIAL.- Inspection shall be in accordance with Method 9601 of Federal Test Method Standard No. 791.

4.3 QUALIFICATION TESTS

4.3.1 SAMPLING INSTRUCTIONS.- The qualification test samples shall consist of 200 gallons of finished lubricating oil, selected as specified in 4.2.3, from a single lot. Samples shall be identified as required by the authorizing letter and forwarded to the Wright Air Development Division, Attn: WCLPFO, Wright-Patterson Air Force Base, Ohio.

4.3.1.1 Qualification test samples shall be accompanied by a certified test report containing laboratory test data from a commercial testing laboratory, certified by the activity responsible for qualification, showing the results of all tests required by the specification except the load-carrying ability test at 400°F, the gear fatigue test at 400°F, the bearing stabilization temperature test, the bearing test and the 100-hour engine endurance test, and including general information as to the chemical type or trade name of the ingredients used, identifying major or minor constituents, location of manufacture of individual ingredients and location of formulation facilities.

4.3.2 TESTS.- The qualification tests shall consist of all the tests of this specification as described in 4.5.

4.4 ACCEPTANCE TESTS.- Acceptance tests shall consist of all the tests of this specification as described under 4.5 except the spontaneous ignition temperature test, the 72-hour viscosity

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stability test, the load-carrying ability test at 400°F, the gear fatigue test at 400°F, the compatibility test, the bearing stabilization temperature test, the bearing test and the 100-hour engine endurance test.

4.4.1 SAMPLING.- Samples shall consist of a sample from a single lot selected as specified in 4.2.3. The size of this sample shall be determined by the Government inspector or the procuring activity or both.

4.4.2 REJECTION AND RETEST.- Lubricating oils which have been rejected may be reworked and replaced 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 oils rejected after retest shall not be resubmitted without the specific approval of the procuring activity. Consistent failure of material to pass the aforementioned acceptance tests shall be cause for removal from the Qualified Products List.

#### 4.5 TEST METHODS

4.5.1 CHEMICAL AND PHYSICAL TESTS.- Unless otherwise specified, the following tests shall be made in accordance with the test methods described in Federal Test Method Standard No. 791.

TABLE II  
TEST METHODS<sup>1</sup>

| Requirements                                    | Fed. Test Method Std. No. 791 | ASTM Standards <sup>2</sup> |
|---|-------------------------------|-----------------------------|
| Kinematic viscosity at 400, 210 and 100°F       | 305                           | D445                        |
| Flash point                                     | 1103                          | D92                         |
| Pour point                                      | 201                           | D97                         |
| Spontaneous ignition temperature                | 1152                          | ---                         |
| Viscosity and viscosity stability test at -65°F | 307-T                         | ---                         |
| Evaporation test <sup>3</sup>                   | 351                           | D972                        |
| Load-carrying ability at 165°F                  | 6508-T                        | ---                         |
| Load-carrying ability at 400°F                  | 6511-T                        | ---                         |
| Gear Fatigue at 400°F <sup>4</sup>              | 6509-T                        | ---                         |

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TABLE II (Continued)

TEST METHODS<sup>1</sup>

| Requirements  | Fed. Test Method Std. No. 791 | ASTM Standards <sup>2</sup> |
|---|-------------------------------|-----------------------------|
| Swelling synthetic rubber test <sup>5</sup>           | 3604-T                        | ---                         |
| Foaming test  | 3212-T                        | ---                         |
| Deposition test                                       | 5003-T                        | ---                         |
| Compatibility test <sup>6</sup>                       | 3403-T                        | ---                         |
| 100-hour engine endurance test <sup>7</sup>           | ---                           | ---                         |
| Precipitation number of lubricating oils <sup>8</sup> | 3101                          | D91                         |
| Neutralization number <sup>9</sup>                    | 5106                          | ---                         |

## Footnotes:

1. At the time of qualification, the right is reserved to subject the lubricating oil to such additional tests as are considered necessary to assure the serviceability of the material.
2. Reference the American Society for Testing Materials Standard on Petroleum Products and Lubricants.
3. Use a test temperature of 400 plus or minus 1°F for 6-1/2 hours. The test is set up at room temperature and timing of the test shall start when the test coil is immersed in the 400°F bath.
4. A minimum of 10 determinations shall be made.
5. Use rubber conforming to Specification MIL-R-25897 only. Run the test at 400 plus or minus 2°F for 72 hours.
6. Centrifuging shall be in accordance with Method 3103 of Federal Test Method Standard No. 791, except dilution shall not be used. Representative lubricating oils used in the test shall consist of lubricating oils qualified under Specifications MIL-L-7808 and MIL-L-25336.
7. Engine, model and type as specified by Wright Air Development Division, qualified in accordance with Specification MIL-E-5009, shall be used.

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## Footnotes (Continu 1)

8. When using Method 3103 to determine the presence of suspended matter required under Workmanship, 3.14, no diluents shall be used.

9. Titration end point shall be at pH 11.

4.5.2 BEARING STABILIZATION TEMPERATURE TEST.- The oil shall be tested in the ERDCG bearing test rig under the following conditions:

|                 |             |
|-----------------|-------------|
| Bearing size    | 100 mm      |
| Bearing speed   | 10,000 RPM  |
| Oil temperature | 400°F       |
| Oil flow        | 100 ml/min. |
| Air flow        | 0           |
| Test duration   | 60 min.     |

The temperature of the bearing shall be recorded at 5-minute intervals and if, at the end of 60 minutes, the temperature of the bearing has not stabilized within 5°F, the oil shall be considered to have failed the test. Any malfunctions of the bearing attributed to the oil shall be cause for failure of the oil.

4.5.3 BEARING TEST.- The oil shall be subjected to operation in the Wright Air Development Division bearing test rig under the following conditions:

|                                |             |
|--------------------------------|-------------|
| Oil tank temperature           | 425°F       |
| Bearing outer race temperature | 525°F       |
| Bearing speed                  | 8,180 RPM   |
| Bearing size                   | 127 mm      |
| Bearing radial load            | 500 pounds  |
| Air flow                       | 1.47 cfm    |
| Oil flow                       | 600 cc/min. |
| Oil capacity                   | 2 gallons   |
| Filter                         | 100 mesh    |

The test shall continue to failure or 100 hours, whichever occurs first. Every 5 hours, a 50 cc sample of the test oil shall be withdrawn and the following determinations made on each sample:

- a. Viscosity at 100°F.
- b. Neutralization number.

Upon completion of the test running, the rig shall be disassembled and inspected for deposits, corrosion, bearing wear, or other evidence of malfunction.

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## 5. PREPARATION FOR DELIVERY

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

5.2 ADDITIONAL MARKING.- In addition to the markings specified in Standard MIL-STD-290, the following note shall appear on each container:

"THIS LUBRICATING OIL IS NOT INTERCHANGEABLE AND SHALL NOT BE MIXED WITH ANY OTHER AIRCRAFT ENGINE OIL."

5.3 The oil shall be filtered through a suitable filter assembly rated at 10 microns or finer, situated as close to the container filling equipment as is feasible.

5.4 Specifically, 1-quart and 1-gallon metal containers, as provided by Standard MIL-STD-290, shall be inspected visually just prior to filling for loose solder, dirt, fibers, lint, metal particles, seaming compound or other foreign contaminants. The bottom seam shall show no extruded seaming compound and there shall be no seaming compound on the body immediately adjacent to the side seam. Visible seaming compound, evenly distributed and forming a very fine edge at the point of contact of the seam with the body, shall not be cause for rejection. If a soldered side seam is used in the fabrication of the can, residual soldering flux shall not be present on the inside seam of the containers. After filling, containers shall be inspected for marking, fill, closure and leakage.

## 6. NOTES

6.1 INTENDED USE.- The gas turbine lubricating oil covered in this specification is intended for use in specific models of aircraft gas turbine engines.

6.2 ORDERING DATA.- Requisitions, contracts and orders shall specify the following:

- a. Title, number and date of this specification.
- b. Type and size of containers required. (See 5.1)
- c. Level of packaging and packing required. (See 5.1)

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6.3 QUALIFICATION.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List 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 Wright Air Development Division, Wright-Patterson Air Force Base, Ohio, and information pertaining to qualification of products may be obtained from that activity.

6.4 The procedure for securing qualification tests and other details concerning qualification and procurement of this material are contained in the QPL Summary and ANA Bulletin No. 164.

NOTICE: When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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