

MIL-L-11734C
31 December 1969
SUPERSEDING
MIL-L-11734B
10 April 1964

MILITARY SPECIFICATION

LUBRICATING OIL, SYNTHETIC
(FOR MECHANICAL TIME FUZES)

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

1. SCOPE

1.1 This specification covers a synthetic lubricating oil intended for use in mechanical time fuzes at ambient temperatures from -65° to +125°F (-54° to +52°C).

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- QQ-C-576 - Copper Flat Products with Slit, Slit and Edge Rolled, Sheared Sawed, or Machined Edges (Plate, Bar, Sheet, and Strip)
- QQ-S-624 - Steel Bar, Alloy, Hot Rolled and Cold finished (General Purpose)

STANDARDS

FEDERAL

- Fed. Test Method Std. No. 791 - Lubricants, Liquid Fuels and Related Products, Methods of Testing

MILITARY

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

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity, or as directed by the contracting officer.)

FEC 1150

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS TEST METHODS

- D 97 - Pour Point
- D 270 - Sampling Petroleum and Petroleum Products
- D 445 - Viscosity of Transparent and Opaque Liquids (Kinematic and Dynamic Viscosities)
- D 664 - Neutralization Number by Potentiometric Titration
- D 972 - Evaporation Loss of Lubricating Greases and Oils

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

Technical society specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

3. REQUIREMENTS

3.1 Composition. The lubricating oil shall conform to the composition specified in table I.

Table I. Composition of lubricating oil

Constituents	Percent (by weight)
D1-(2-ethylhexyl) sebacate ^{1/}	32.3 ± 0.5
D1-(2-ethylhexyl) azelate ^{1/}	60.2 ± 1.0
Phenyl-alpha-napthylamine ^{1/}	0.5 ± 0.1
Barium petroleum sulfonate (100 percent active) ^{2/}	1.0 ± 0.25

^{1/} Composition shall be certified in accordance with 4.c.1.1

^{2/} Based on an average molecular weight of petroleum sulfonic acid of 490.
The test for this constituent shall be performed in accordance with 4.c.1.2.

3.2 Viscosity. The kinematic viscosity of the oil shall be as follows.

- (a) 12.5 centistokes at 100°F (37.8°C)
- (b) 15,000 centistokes, maximum, at -70°F (-56.7°C)

The viscosity at 100°F shall be determined in accordance with 4.6.2.1.
The viscosity at -70°F shall be determined in accordance with 4.6.2.2.

3.3 Pour point. The pour point shall not exceed -80°F (-53°C) when the oil is tested in accordance with 4.6.3.

3.4 Evaporation loss. The evaporation loss at 210°F (99°C) shall not exceed 1.2 percent by weight when the oil is tested in accordance with 4.6.4.

3.5 Low temperature stability. The oil shall show no gelling or separation of solid and liquid phases after testing it in accordance with 4.6.5. The presence of a dense cloud in the oil which does not settle out but which disappears on warming to 77°F (25°C) shall not be cause for rejection.

3.6 Oxidation stability. After performance of the oxidation stability test in accordance with 4.6.6, the requirements specified in 3.6.1 through 3.6.4 shall be met.

3.6.1 Effect on steel and copper. No pitting, etching, or other corrosion shall be evident when the steel and copper test specimens are examined in accordance with 4.6.6.3.

3.6.2 Appearance. No gumming or separation of insoluble materials shall be apparent when the oil is examined in accordance with 4.6.6.4.

3.6.3 Neutralization number change. The acid or base number of the oxidized oil shall not be more than 0.2 units higher than that of the unoxidized oil. The test shall be performed in accordance with 4.6.6.5.

3.6.4 Viscosity change. The viscosity at 100°F (37.8°C) of the oxidized oil shall not differ by more than ± 5.0 percent from the initial viscosity at 100°F (of the unoxidized oil). The test shall be performed in accordance with 4.6.6.6.

3.6.5 Acid number of volatile substances. The acid number of volatile substances formed during oxidation of the oil shall not exceed 0.15 (i.e., 0.15 milligrams of KOH per gram of oil), when the oil is tested in accordance with 4.6.6.7.

3.7 Corrosivity. After performance of the test specified in 4.6.7, the lubricated areas of at least two of the three discs shall show no evidence of pitting, etching, or corrosion. If the third disc reveals corrosion, there shall be no more than three rust spots within the area covered by the brass lip.

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3.8 Rust inhibition. When tested in accordance with 4.6.8, the oil shall demonstrate satisfactory rust-inhibiting characteristics. The oil shall be considered to have failed to meet this requirement if either of the following conditions develop on three of the four test specimens

- (a) One rust spot larger than one millimeter in diameter that forms during the first 24 hours of the 48-hour test period.
- (b) Three rust spots, none larger than one millimeter in diameter, that form during the first 24 hours and increase in size during the second 24 hours of the 48-hour period.

3.9 Workmanship. The constituent materials of the oil shall be thoroughly mixed to produce a clean, uniform product. The oil shall be free from visible suspended matter, grit, water, or other foreign matter.

4. QUALITY ASSURANCE PROVISIONS

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

4.2 Lot.

4.2.1 Bulk lot. An indefinite quantity of a homogeneous blend of lubricating oil, offered for acceptance in a single, isolated container, or manufactured in a single plant run (not exceeding 24 hours), through the same processing equipment, with no change in the ingredient materials.

4.2.2 Packaged lot. An indefinite number of unit containers of identical size and type, offered for acceptance, and filled with a homogeneous blend of lubricating oil from a single isolated container; or filled with a homogeneous blend of lubricating oil manufactured in a single plant run (not exceeding 24 hours), through the same processing equipment, with no change in the ingredient materials.

4.3 Sampling.

4.3.1 Sampling for examination of filled containers. Take a random sample of filled containers from each lot in accordance with MIL-STD-105, at inspection level II and acceptable quality level (AQL) - 2.5 percent defective.

4.3.2 Sampling for tests. Take samples for test in accordance with ASTM method D 270.

4.4 Inspection. Perform inspection in accordance with method 9601 of Fed. Test Method Std. No. 791.

4.4.1 Examination of filled containers. Examine samples taken in accordance with 4.3.1 for compliance with MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, packing, and marking requirements. Reject any container that has one or more defects or is under the required fill. Reject the lot represented by a sample if the number of defective or underfilled containers in the sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105.

4.5 Classification of tests. All tests are classified as quality conformance tests.

4.6 Test procedures.

4.6.1 Composition.

4.6.1.1 The supplier shall certify, in writing, that the following constituents of the oil are present in the percentages specified in table I:

D1-(2-ethylhexyl) sebacate
D1-(2-ethylhexyl) azelate
Phenyl-alpha-naphthylamine

4.6.1.2 Barium petroleum sulfonate. Weigh accurately approximately 30 grams of the oil in a tared Coors No. 4 porcelain crucible. Ash the oil cautiously. Add an excess of 50 percent sulfuric acid solution and heat the crucible under a hood until white sulfur trioxide fumes are no longer given off. Repeat the sulfuric acid treatment. Place the crucible and its contents in a 400-ml beaker, and add approximately 150 ml of distilled water. Heat to boiling and digest on a steam bath for 4 hours. Remove the crucible from the beaker, using platinum-tip tongs, and thoroughly wash the crucible with distilled water, collecting the washings in the beaker. Filter the beaker contents through an ashless, close-textured filter paper, washing the residue in the paper with three 50-ml portions of distilled water. Place the filter paper, with the residue, in the same crucible (fold paper into a small volume) and heat the crucible gently until the paper and the residue are dry. Ignite the residue to constant weight in a furnace set at approximately 1380°F (750°C). Calculate the percent by weight of barium petroleum sulfonate using 1117 as the molecular weight of the barium petroleum sulfonate.

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4.6.2 Viscosity.

4.6.2.1 At 100°F (37.8°C). Determine the viscosity of the oil at 100°F (37.8°C) in accordance with ASTM method D 445.

4.6.2.2 At -70°F (-56.7°C). Determine the viscosity of the oil at -70°F (-56.7°C) with a capillary pipette of the type prescribed in ASTM method D 445. Any suitable coolant bath, capable of maintaining a temperature of $-70^{\circ} \pm 0.3^{\circ}\text{F}$ ($-56.7 \pm 0.2^{\circ}\text{C}$), may be used in this test.

4.6.3 Pour point. Determine the pour point of the oil in accordance with ASTM method D 37.

4.6.4 Evaporation loss. Determine the evaporation loss of the oil in accordance with ASTM method D 97. Use a test temperature of 210°F (99°C).

4.6.5 Low-temperature stability. Pour approximately 40 ml of the oil into a 125-ml glass-stoppered Erlenmeyer flask. Place the stoppered flask in a refrigerator maintained at $-70^{\circ} \pm 1^{\circ}\text{F}$ ($-57^{\circ} \pm 1^{\circ}\text{C}$) for 72 hours. Examine the oil for conformance to 3.5.

4.6.6 Oxidation stability.

4.6.6.1 Preparation of test specimens. Prepare two metal-strip test specimens, one of electrolytic copper conforming to QQ-C-576, the other of FC 1020 carbon steel conforming to QQ-S-624. The strips shall measure approximately 3.75 by 1.0 by 0.025 inches (95 by 25 by 0.64 millimeters). Polish the strips with 1/0, 3/0 and 5/0 sandpaper successively, wash them with reagent-grade n-hexane while wiping them with absorbent cotton, and finally wash them in boiling, reagent-grade petroleum ether. Be careful not to handle the strips with bare hands or otherwise contaminate them after they are polished.

4.6.6.2 Procedure. Pour 150 ml of the oil into a glass tube (approximately 60 cm long by 4.5 cm O.D.) fitted with an air inlet tube and a reflux condenser. Connect the copper and steel strips with copper wire and suspend them on glass hooks sealed in the air inlet tube. Immerse the strips completely in the oil. Place the tube assembly in an oil bath maintained at $212^{\circ} \pm 0.9^{\circ}\text{F}$ ($100^{\circ} \pm 0.5^{\circ}\text{C}$). Pass air through two towers containing soda lime and glass wool and then through the oil at a rate of 5 ± 0.2 liters per hour. Pass the gases escaping from the reflux condenser into a trap containing 50 ml of 0.1N potassium hydroxide solution diluted to 150 ml with distilled water. Run the test for 160 hours, then remove the tube from the bath and disassemble it. Wash the strips with reagent-grade n-hexane followed by reagent-grade acetone.

4.6.6.3 Effect on steel and copper. Examine the test specimens for pitting, etching, or other corrosion.

4.6.6.4 Appearance. Examine the oxidized oil for separation of insoluble materials or gumming.

4.6.6.5 Neutralization number change. Determine the acid or base numbers of the unoxidized and oxidized oil in accordance with ASTM method D 664 and compare the values obtained.

4.6.6.6 Viscosity change. Determine the viscosities of the unoxidized and oxidized oil at 100°F (37.8°C) in accordance with ASTM method D 445 and compare the values obtained.

4.6.6.7 Acid number of volatile substances. Determine the acid number of the volatile substances formed during the oxidation of the oil by back titration of the solution in the potassium hydroxide trap. Add to the solution a known amount of 0.1N sulfuric acid solution, approximately 10 percent by volume in excess of the amount of potassium hydroxide solution in the trap. Boil the solution for five minutes under a reflux condenser. Titrate the solution with standard 0.1N potassium hydroxide solution using phenolphthalein indicator.

4.6.7 Corrosivity. Determine the corrosivity of the oil in accordance with method 5322 of Fed. Test Method Std. No. 791.

4.6.8 Rust inhibition.

4.6.8.1 Preparation of test specimens. Prepare four test specimens 100 mm long by 10 mm in diameter, of hot-rolled FS 1020 carbon steel conforming to QQ-S-624. Polish the specimens successively with 1/0, 3/0 and 5/0 sandpaper, wash them in reagent-grade n-hexane while wiping them with absorbent cotton, and finally wash them in low-boiling reagent-grade petroleum ether. Soak the specimens in the test oil for 20 minutes and allow them to drain for four hours in a dust-free atmosphere.

4.6.8.2 Procedure. Place the specimens in a humidity cabinet in which temperature and humidity are controlled cyclically. The test cycle shall be eight hours long, consisting of two consecutive four-hour periods as follows:

- (a) 110° ± 5°F (43° ± 3°C) at 60 ± 2 percent relative humidity
- (b) 130° ± 5°F (54° ± 3°C) at 95 ± 2 percent relative humidity

The total test period shall be 48 hours long, consisting of six consecutive eight-hour test cycles as specified above. Examine the specimens at the end of 24 hours and 48 hours.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking. Unless otherwise specified in the contract or purchase order (see 6.1) and except as specified below, packaging, packing, and marking shall be in accordance with MIL-STD-290. When level A packing is required, the oil shall be furnished in containers specified by the procuring activity (see 6.1).

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5.1.1 Additional marking. Each container shall be marked as follows:

WARNING

Do not use this oil in food-processing or food-handling machinery on surfaces that may contact food. Do not allow the oil to contaminate foodstuffs.

6. NOTES

6.1 Ordering data. Procurement documents should specify the following information:

- (a) Title, number, and date of this specification.
- (b) Quantity of lubricating oil required.
- (c) Type and size of container required (see 5.1).
- (d) Level of packaging and level of packing required (see 5.1).
- (e) Special marking of shipping containers, if required (see 5.1).

Custodians:

Army - MR
Navy - OS
Air Force - 66

Preparing activity:

Army - MR

Project No. 9150-0169

Review activities:

Army - MU, MD, WC
Navy - OS
Air Force - 68
DSA - PS

User activities:

Army - ME, MI

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau N. 119 R004
<u>INSTRUCTIONS</u>		
This sheet is to be filled out by personnel either Government or contractor involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner and send to preparing activity.		
SPECIFICATION MIL-L-11734C, Lubricating Oil, synthetic (For Mechanical Time Fuzes)		
ORGANIZATION		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1 HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A GIVE PARAGRAPH NUMBER AND WORDING		
B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2 COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3 IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF YES IN WHAT WAY?		
4 REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers attach to form and place both in an envelope addressed to preparing activity.)		
SUBMITTED BY (Printed or typed name and activity)		DATE

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REPLACES NAVSHIPS FORM 4863 WHICH IS OBSOLETE

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