MIL-L-46150
15 April 1971
SUPERSEDING
RIAPD-688A
1 March 1968

MILITARY SPECIFICATION

LUBRICANT, WEAPONS, SEMI-FLUID (HIGH LOAD-CARRYING CAPACITY)

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

1. SCOPE

1.1 This specification covers one grade of semi-fluid lubricant which provides a low coefficient of friction and high load-carrying capacity (see 6.1).

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 the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL
- L-P-403 - Plastic Molding Material, Polytetrafluoroethylene (TFE-Fluorocarbon)
- P-D-680 - Dry Cleaning Solvent
- TT-N-95 - Naphtha, Aliphatic
- VV-L-800 - Lubricating Oil, General Purpose, Preservative (Water Displacing, Low Temperature)

MILITARY
- MIL-L-46000 - Lubricating Oil, Semi-Fluid (Automatic Weapons)

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

FSC 9150

QUALIFIED PRODUCTS LISTS

QPL-46000 - Qualified Products List of Products Qualified Under Military Specification MIL-L-46000 Lubricating Oil Semi-Fluid (Automatic Weapons)

DRAWINGS AND PARTS LISTS

Drawing and Parts List for Electric Drive Assembly Part No. 65C9761 (15 April 1965)
Drawing and Parts List for Electric Drive Assembly: Part No. 11686350 (10 August 1965)

(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.)

(Copies of the drawings and parts lists referenced above can be obtained from Hq., U. S. Army Weapons Command, ATTN: AMSWE-RET-ML, Rock Island, Illinois 61201.)

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 (ASTM) TEST METHODS

D 128 - Analysis of Lubricating Grease
D 130 - Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
D 270 - Sampling Petroleum and Petroleum Products
D 942 - Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method
D 972 - Evaporation Loss of Lubricating Greases and Oils
D 1092 - Apparent Viscosity of Lubricating Greases
D 1261 - Effect of Grease on Copper
D 1457 - TFE-Fluorocarbon Resin Molding and Extrusion Materials
D 1478 - Low-Temperature Torque of Ball Bearing Greases
D 1743 - Rust Preventive Properties of Lubricating Greases
D 2266 - Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)
D 2596 - Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)

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

Specifications and standards of technical societies are generally available for reference from libraries. They are also distributed among using Federal agencies.

3. REQUIREMENTS

3.1 Material. The semi-fluid lubricant shall consist of 75 ± 1 percent by weight of lubricating oil and 25 ± 1 percent by weight of polytetrafluoroethylene (PTFE) molding material. The lubricating oil shall meet all the requirements of MIL-L-46000 and shall be listed, or approved for listing on the qualified products list of that specification (QPL-46000). The PTFE molding material shall conform to the requirements of L-P-403, type IV, class 1 (see 6.4a).

3.2 Qualification. Semi-fluid lubricants furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.5.1 and 6.3).

3.3 Physical and chemical requirements. The semi-fluid lubricant shall conform to the requirements of table I and of 3.3 2 through 3.4. The polytetrafluoroethylene molding powder shall conform to the requirements of 3.3.1.

Table I. Physical and chemical requirements for the finished lubricant (see 4.6)

Properties	Requirements
Evaporation loss at 300°F (149°C) in 8 hours, max, percent	3.0
Rust prevention. ASTM rating, max	1
Oxidation stability at 300°F (149°C) 6-hour pressure drop, max	
Psi	10.0
Kg per sq cm	0 7
Torque at -65°F (-54°C), max, g-cm	
Starting	800
Running	600
Apparent viscosity at -65°F (-54°C), max. poises	
At 25 sec^{-1}	1200
At 100 sec^{-1}	800
Wear prevention at 250°F (121°C): scar diameter, max, mm	0.50
Extreme pressure properties· Load Wear Index, min, kg	70.0
Kinetic coefficient of friction, max	0.13

3.3.1 Melting point of polytetrafluoroethylene (PTFE). The melting point of the PTFE molding material used in formulating the lubricant shall be 621° ± 18°F (327° ± 10°C) when it is tested in accordance with 4.6 (table II)

3.3.2 Reaction of lubricant with copper. When the finished lubricant is tested in accordance with 4.6 (table II), the following requirements shall be met.

3.3.2.1 Effect on lubricant. The lubricant shall not decompose nor show evidence of green or brown discoloration.

3.3.2.2 Effect on copper. The copper strip shall show no evidence of etching or pitting nor shall the discoloration be greater than 1b of the ASTM copper strip corrosion standard (ASTM D 130).

3.3.3 Polytetrafluoroethylene content. The lubricant shall contain 25 ± 1 percent by weight of polytetrafluoroethylene. The test shall be performed in accordance with 4.6.2.

3.3.4 Machine-gun performance. The lubricant shall permit satisfactory operation of the 7.62 mm, GAU-2B/A machine gun without undue wear, galling, or other deleterious effects when tested in accordance with 4.6.3.

3.3.5 Storage stability. The film accumulated through separation of fluid and solid matter shall not exceed 10 mm in thickness when the lubricant is tested as specified in 4.6.4.

3.4 Workmanship. The ingredients of this lubricant shall be thoroughly mixed and processed through homogenizing equipment. The lubricant shall be free from water, dirt, foreign matter, and lumps or inhomogeneous structures when examined visually.

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 mixture of lubricant 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 mixture of lubricant from a single, isolated container; or filled with a homogeneous mixture of lubricant 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 tests in accordance with ASTM method D 270.

4.4 Inspection. Conduct 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 having one or more defects or under the required fill. If the number of defective or underfilled containers exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, reject the lot represented by the sample.

4.5 Classification of tests. Tests are classified as follows:

a. Qualification tests
b. Quality conformance tests

4.5.1 Qualification tests. Qualification tests consist of tests for all of the requirements specified in section 3.

4.5.2 Quality conformance tests. Quality conformance tests consist of tests for the following requirements (see table I):

Evaporation loss	(D 972)
Rust prevention	(D 1743)
Torque at -65°F (54°C)	(D 1478)
Wear prevention	(D 2266)

4.6 Test methods. Perform tests in accordance with the applicable test methods specified in table II and in 4.6.1, 4.6.2, 4.6.3, and 4.6.4.

Table II. Test methods

Test	ASTM Test Method No.
Evaporation loss 1/	D 972
Rust prevention	D 1743
Oxidation stability 2/	D 942
Torque at -65°F (-54°C)	D 1478
Apparent viscosity 3/	D 1092
Wear prevention 4/	D 2266
Extreme pressure properties, Load Wear Index 5/	D 2596
Melting point of polytetrafluoroethylene	D 1457
Reaction of lubricant with copper	D 1261

1/ Perform the evaporation test at 300° ± 2°F (149° ± 1°C) for 8 hours ± 5 minutes.
2/ Perform the oxidation stability test at 300° ± 2°F (149 ± 1°C).
3/ Perform the apparent viscosity test at -65° ± 0.5°F (-54° ± 0.3°C).
4/ Perform the wear prevention test at 250° ± 2°F (121° ± 1°C).
5/ See 6.4c.

4.6.1 Kinetic coefficient of friction. Determine the kinetic coefficient of friction on a "Cincinnati" Stick-Slip Lubricant Testing Machine (see 6.4b) or on an equivalent machine approved by the qualifying activity (see 6.3). Use Meehanite, Type GE, cast-iron friction blocks having a surface finish of 200 microinches, r.m.s. (see 6.4b). Wash the Meehanite blocks in petroleum naphtha meeting the requirements of TT-N-95 and dry with clean, dry, compressed air. Mount the blocks in their respective locations on the tester. Separate the blocks slightly and place a liberal amount of the lubricant between the blocks. Spread the lubricant over the surface of the blocks with a spatula. Operate the tester at a speed of 120 inches per minute under a load of 20 pounds for three minutes to establish a uniform bearing surface. At the end of the three-minute stabilizing period, change the tester speed to 3/4 inch of travel per minute. By means of the dial indicator, determine the displacements in both directions under loads of 20 pounds, 40 pounds, 60 pounds, and 80 pounds, respectively. Calculate the kinetic coefficients of friction (μ) by the formula.

$$\mu = \frac{\text{Total deflection}}{8 \times \text{load}}$$

Where:

Total deflection is the sum of the indicator readings in both directions of travel

Load is the force in pounds applied to the test blocks

Take an average of the coefficients of friction obtained under the four different test loads and report the average as the coefficient of friction of the lubricant.

4.6.2 Polytetrafluoroethylene content. Remove the insoluble matter in the lubricant in accordance with the procedure for "Insolubles" in method I of ASTM D 128. Consider all such insoluble matter to be polytetrafluoroethylene.

4.6.3 Machine-gun performance Test the lubricant for performance in the 7.62 mm, GAU-2B/A machine gun with two electric drive assemblies, to permit the weapon to be operated at a high rate of fire and a low rate of fire. If a failure occurs during any part of the test sequence, discontinue the test and consider the lubricant to have failed the performance requirement.

4.6.3.1 High rate of fire. Use an Electric Drive Assembly, Part No. 65C9761, to provide a firing rate of 6000 rounds per minute. Design details for this drive assembly are contained in Drawing No 65C9761 and Engineering Parts List No. 65C9761 (see 2.1).

a. Ambient temperature. Disassemble the gun and clean it of all traces of lubricant and dirt by washing it with dry cleaning solvent conforming to P-D-680. Do not use a chlorinated solvent. Do not disassemble, clean, or relubricate the sealed, grease-lubricated bearing. During disassembly of the gun, rotate the bearing, examine it for flat surfaces and replace it if defective. Remove the solvent completely from all surfaces of the gun, using a water-free air jet if necessary. Coat the gun components, except the barrels, with the test lubricant. Burnish the lubricant into the surfaces of the components. Coat the barrels lightly, both in the bores and on the external surfaces, with lubricating oil conforming to VV-L-800. Reassemble the gun, making sure that the threaded bolts are tightened to a measured degree with a torque wrench. Lubricate these bolts with the test lubricant to ensure that the torque indicates tightening rather than friction caused by roughness of the threads. Fire two components of five 100-round bursts at an ambient temperature of 40° to 100°F (4° ± 38°C), allowing three minutes of cooling between complements. During the test, accelerate the firing rate to a minimum of 6000 rounds per minute within 0.4 seconds After completing the test, examine the gun for the presence of dry areas, carbon, uneven wearing, galling, or other undesirable conditions.

b. Low temperature After satisfactory completion of the ambient temperature test, disassemble, clean, relubricate and soak the gun at -30°F (-34°C) for four hours Soak the ammunition at the same temperature. Position the feed belt for firing so that the first round can be fired without disturbing the coating Fire three 100-round bursts at an ambient temperature of -30°F (-34°C), allowing two hours of cooling between bursts During the test, accelerate the firing rate to a minimum of 4500 rounds per minute within 0 5 seconds After completing the test, examine the gun for the presence of dry areas, carbon, uneven wearing, galling, or other undesirable effects.

c High temperature After satisfactory completion of the low temperature test, clean, relubricate, and soak the gun at 260°F (127°C) for four hours. Do not soak the ammunition. Before firing, allow the ambient temperature to drop to a minimum of 180°F (82°C) Fire three 100-round bursts at the 180°F ambient temperature, allowing sufficient cooling to permit reloading During the test, accelerate the firing rate to a minimum of 6000 rounds per minute within 0.5 seconds After completing the test, examine the gun for the presence of dry areas, carbon, uneven wearing, galling, or other undesirable effects

4 6.3.2 Low rate of fire. Use an Flectric Drive Assembly, Part No. 11686350, to provide a firing rate of 200 rounds per minute. Design details for this drive assembly are contained in Drawing No. 11686350 and Engineering Parts List No 11686350 (see 2 1)

a Ambient temperature Use the procedure for the high rate of fire, ambient temperature test (4 6.3.1a) with the following exception: Accelerate the firing rate to a minimum of 2000 rounds per minute within 0 4 seconds. After completing the test, examine the gun for the presence of dry areas, carbon, uneven wearing, galling, or other undesirable effects.

b. Low temperature. Use the procedure for the high rate of fire, low temperature test (4 6.3 1b) with the following exception Accelerate the firing rate to a minimum of 1500 rounds per minute within 0 5 seconds After completing the test, examine the gun for the presence of dry areas, carbon, uneven wearing, galling, or other undesirable effects.

c. High temperature. Use the procedure for the high rate of fire, high temperature test (4.6.3 1c) with the following exception. Accelerate the firing rate to a minimum of 2000 rounds per minute within 0 5 seconds. After completing the test, examine the gun for the presence of dry areas, carbon, uneven wearing, galling, or other undesirable effects.

4.6.4 Storage stability. Mix the contents of the original container of the lubricant thoroughly to produce a uniform mixture Fill a 250-ml electrolytic beaker with lubricant to within one inch (25 mm) of the top. Smooth the surface of the lubricant with a spatula Seal the beaker tightly, and store it for six months at 77° ± 3°F (25° ± 2°C). At the end of this period examine the contents of the beaker for conformance to 3.3.4

5 PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking Unless otherwise specified in the contract or purchase order (see 6 2) and except as specified in 5.1.1, packaging, packing and marking shall be in accordance with MIL-STD-290.

5.1.1 In addition to the marking specified in MIL-STD-290 and such marking as may be specified in the contract or purchase order, all unit containers shall be marked as follows

a. WARNING! Do not use this lubricant in food-processing or food-handling equipment on surfaces that may contact food Do not allow the lubricant to contaminate foodstuffs

b. Shake or mix contents thoroughly before using.

6. NOTES

6.1 Intended use. The lubricant covered by this specification is intended for use in the 7.62 mm GAU-2B/A machine gun. It may also be used for other applications requiring an extreme-pressure lubricant with a low kinetic coefficient of friction and which is not readily removed by rapidly moving components The temperature range over which this lubricant may be used is -30° to +250°F (-34° to +121°C)

6.2 Ordering data. Procurement documents should specify the following:

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

6.3 Qualification With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they proposed 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 Hq., U S. Army Weapons Command, ATTN AMSWE-RET-ML, Rock Island, Illinois 61201, and information pertaining to qualification of products may be obtained from that activity

6.4 Equipment availability. Materials and equipment cited in this specification can be obtained from the following sources·

a. Polytetrafluorethylene (PTFE) molding material meeting the requirements of L-P-403, type IV› class 1 can be obtained from the Plastics Department, E I. du Pont de Nemours & Co , Inc , Wilmington, Delaware 19898

b. The Cincinnati Stick-Slip Lubricant Testing Machine and the Meehanite test blocks can be obtained from the Laboratory Equipment Corporation, Mooresville, Indiana 46158.

c. Four-Ball Extreme-Pressure Lubricant testers can be obtained from Precision Scientific Co (Catalog No 75015) and Roxana Machine Works (EP Tester)

6.5 Major changes The following changes are the major points of difference between this specification and the superseded document, RIAPD-688A

a. Full military coordination was effected

b. Requirements for the following properties were added

Evaporation loss
Rust prevention
Oxidation stability
Torque at -65°F (-54°C)
Apparent viscosity at -65°F (-54°C)
Wear prevention
Performance
Storage stability

Custodians
Army - MR
Navy - YD
Air Force - 68

Preparing activity:
Army - MR

Project No. 9150-0236

Review activities·
Army - WC, MU, MD, AV
Navy - AS, SA
Air Force - 11, 68

User activities:
Navy - MC

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5 PROBLEM AREAS

a. Paragraph Number and Wording

b Recommended Wording

c Reason/Rationale for Recommendation

6 REMARKS

7a NAME OF SUBMITTER *(Last, First, MI)* – Optional	b WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
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