

METRIC

MIL-PRF-85336B  
10 September 1998  
SUPERSEDING  
DOD-L-85336A  
5 March 1985

## PERFORMANCE SPECIFICATION

### LUBRICANT, ALL-WEATHER (AUTOMATIC WEAPONS)

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

#### 1. SCOPE

1.1 Scope. This specification covers an all-weather semi-fluid, rotary gun lubricant, resistant to corrosive marine and low temperature environments.

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

##### 2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications and standards 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: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100, 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

#### DEPARTMENT OF DEFENSE

- MIL-P-25732 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Services at 275 °F (135 °C).

### STANDARDS

#### FEDERAL

- FED-STD-791 - Lubricants, Liquid Fuels, and Related Products; Method of Testing.

(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

#### AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

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

(Application for copies should be addressed to the American Society for Quality Control, P.O. Box 3005, 611 East Wisconsin Avenue, Milwaukee, WI 53201-4604.)

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM-D130 - Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test, Standard Test Method for. (DoD adopted)
- ASTM-D471 - Rubber Property – Effect of Liquids, Standard Test Method for. (DoD adopted)
- ASTM-D942 - Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method, Standard Test Method for. (DoD adopted)

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- ASTM-D971 - Interfacial Tension of Oil Against Water by the Ring Method, Standard Test Method for. (DoD adopted)
- ASTM-D972 - Evaporation Loss of Lubricating Greases and Oils, Standard Test Method for. (DoD adopted)
- ASTM-D2266 - Wear Preventive characteristics of Lubricating Grease, (Four-Ball Method), Standard Test Method for. (DoD adopted)
- ASTM-D2625 - Endurance (Wear) Life and Load-Carrying Capacity of Solid Film Lubricants (Falex Pin and Vee Method), Standard Test Method for. (DoD adopted)
- ASTM-D2670 - Measuring Wear Properties of Fluid Lubricants (Falex Pin and Vee Method), Standard Test Method for. (DoD adopted)
- ASTM-D4057 - Manual Sampling of Petroleum and Petroleum Products, Standard Practice for. (DoD adopted)
- ASTM-D4177 - Automatic Sampling of Petroleum and Petroleum Products, Standard Practice for. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

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

### 3. REQUIREMENTS

3.1. Qualification. The lubricant furnished under this specification shall be a product that is authorized by the qualifying activity for listing on the applicable qualified product list before contract award (see 4.2 and 6.3).

3.2 Composition. The semi-fluid lubricant shall consist of a mixture of esters and silicone fluids thickened with a thickening agent (see 6.5), and shall conform to all of the requirements of this specification (see 6.6).

#### 3.3 Material.

3.3.1 Thickener purity. The thickener infusion surface tension shall be not less than  $38 \times 10^{-3}$  N/m when tested in accordance with 4.5.3.

3.4 Physical properties. The physical properties of the finished lubricant shall in accordance with table I.

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TABLE I. Physical properties.

Property	Limits	Test
Apparent viscosity, Pa-s at 25 °C at -55 °C, maximum	7.5-15.0 70	4.5.4
Evaporation, percent mass loss, maximum	6	Table III
Oxidation stability, drop in oxygen pressure after 100 hours. at 99 °C, kPa (psi), maximum	20 (2.9)	Table III
Copper corrosion	<u>1/</u>	Table III
Rust prevention	<u>2/</u>	4.5.5
Rubber compatibility, difference in percent mass change, maximum <u>3/</u>	3	4.5.6
Emulsification resistance, mL water separation, minimum <u>4/</u>	5	4.5.7
Wear prevention, average wear scar, diameter, mm, maximum	1.10	Table III
Load carrying capacity, N minimum <u>5/</u>	11,100	4.5.8
Storage stability after 168 hours at 50 °C oil separation, depth of oil, mm, maximum apparent viscosity, Pa-s at 25 °C <u>6/</u> at -55 °C, maximum	2 7.5-15.0 70	4.5.9.1 4.5.9.2 4.5.9.2
Machine gun performance	<u>7/</u>	4.5.10

1/ The copper plates (see 6.4) shall show no brown or black stains. Slight darkening or a slight green stain in the lubricant is acceptable.

2/ At least three of the four exposed panels shall be free of any visible rust.

3/ The change in mass of the O-ring caused by the lubricant shall be with respect to that produced by the reference fluid.

4/ The water shall form a continuous layer.

5/ In at least three of four tests.

6/ Apparent viscosity after storage shall be performed on original apparent viscosity test sample.

7/ There shall be no signs of damage.

3.5 Coating appearance. The lubricant shall form a uniform homogeneous coating and shall be free of lumps, visible dirt, grit, water, or other foreign matter.

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## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 Qualification inspection. The qualification sample of 4.2.1 shall be tested in accordance with table II to verify the physical properties of table I.

TABLE II. Qualification inspection.

Inspection	Requirement Paragraph	Test Paragraph
Thickener purity	3.3.1	4.5.3
Apparent viscosity	3.4	4.5.4
Evaporation	3.4	4.5.2
Oxidation stability	3.4	4.5.2
Copper corrosion	3.4	4.5.2
Rust prevention	3.4	4.5.5
Rubber compatibility	3.4	4.5.6
Emulsification resistance	3.4	4.5.7
Wear prevention	3.4	4.5.2
Load carrying capacity	3.4	4.5.8
Storage stability		
Oil separation	3.4	4.5.9.1
Apparent viscosity	3.4	4.5.9.2
Machine gun performance	3.4	4.5.10
Coating appearance	3.5	4.5.11

4.2.1 Qualification inspection sample. The qualification inspection sample shall consist of a minimum of three four-liter containers of lubricant and 0.1 kg of thickener used in the formulation.

4.3 Conformance inspection. Conformance inspection shall consist of testing the sample (see 4.3.1.2.) and examination of the filled containers (see 4.3.1.1) for conformance with packaging (see 5.1) and all the requirements specified in section 3, except thickener purity and machine gun performance. The lot shall be unacceptable if the sample fails to comply with any of the requirements for conformance inspections.

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4.3.1 Sampling.

4.3.1.1 Filled containers. A random sampling of filled unit containers and a random sample of shipping containers fully prepared for delivery shall be selected from each lot of lubricant in accordance with ASQC-Z1.4, Inspection Level II.

4.3.1.2 Test samples. A random two-liter sample for testing shall be selected from each lot in accordance with ASTM-D4057 or ASTM-D4177.

4.4 Inspection methods. Inspection methods shall be in accordance with FED-STD-791, Method 9601.

4.5 Method of examination and tests.

4.5.1 Examination of filled containers. Each of the filled containers, selected in accordance with 4.3.1.1, shall be examined for defects of construction of the container and closure, evidence of leakage, required markings, and net contents. Any container in the sample having one or more defects or which is under the required fill shall be rejected. If the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of ASQC-Z1.4, the lot represented by the sample shall be rejected.

4.5.2 Test methods. Tests shall be performed in accordance with table III.

TABLE III. Test methods.

Test	FED-STD-791 Method No.	ASTM Method No.
Evaporation <u>1/</u>	--	D972
Oxidation stability <u>2/</u>	--	D942
Copper corrosion <u>3/</u>	5304	--
Wear prevention	--	D2266

1/ 22 hours at 99 °C. Use grease cup.

2/ 100 hours at 99 °C.

3/ The copper plates shall be cleaned and polished in accordance with ASTM-D130. Toluene (see 6.4) shall be used to wash the plates rather than benzene.

4.5.3 Thickener purity. An infusion of the thickener shall be prepared by boiling 0.75 g of the thickener in 25 mL distilled water for 30 seconds and filtering through fine #44 Whatman filter paper, or equivalent. Care shall be taken to exclude detergents and other surface-active materials from the infusion. The infusion shall not be diluted or allowed to evaporate appreciably. The surface tension of the infusion shall then be measured by the ASTM-D971 ring method. The test

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method shall be followed in regard to the apparatus, the preparation of the apparatus, and its calibration. The procedure used is that described in the test method for the determination of the surface tension of water. The portion of the procedure dealing with oil-water interfacial tension does not apply here.

4.5.4 Apparent viscosity. The apparent viscosity at  $25 \pm 0.5$  °C and  $-55 \pm 1$  °C shall be measured with the sample as received. A Brookfield model LVT or LVF viscometer, or equivalent, shall be used with a #4 spindle (3.2 mm diameter x 31 mm long) immersed in the lubricant in a container at least 30 mm in diameter. The lubricant sample shall be stirred to ensure uniformity. At 25 °C the spindle shall be rotated at 60 rpm until a constant reading is obtained, and then at 12 rpm for 30 seconds. The scale reading taken after 30 seconds is multiplied by 0.5 to give the apparent viscosity. When measuring the apparent viscosity at  $-55$  °C the sample shall be held at that temperature undisturbed with the spindle immersed for one hour before measurement. The spindle shall then be rotated at 60 rpm for two minutes, and then at six rpm for one minute. The scale reading taken after one minute is the apparent viscosity.

4.5.5 Rust prevention. Steel panels fabricated from plain carbon steel, 51 x 102 x 3.2 mm, with a ground surface, shall be prepared as follows:

- a. Remove obvious contamination, preservatives, and other foreign material,
- b. Wash with hot water and detergent,
- c. Rinse thoroughly with hot water,
- d. Rinse with acetone,
- e. Abrade with clean 320-grit abrasive cloth or paper (do not use wet-or-dry paper),
- f. Rinse with hot tap water followed by distilled water, and
- g. Allow to drain and dry.

The lubricant shall immediately be applied with a glass rod 6 to 8 mm in diameter, by rubbing across the surface several times, and the excess struck off by passing the rod down the length of the panel. The rod shall be spaced 0.13 mm above the surface at each side to leave an even film. The panel shall be placed with one end elevated so that it is inclined  $15^\circ$  from horizontal. A buret tip or other small (2 to 3 mm) glass tube shall be mounted vertically above the panel with the end of the tube 50 mm above a point on the panel on its centerline and 25 to 35 mm from the upper end. A one percent solution of pure sodium chloride in distilled water shall be allowed to drip from the tube onto the lubricant film at  $2 \pm 0.2$  mL/minute. Constant flow rate can be achieved by siphoning the solution from a constant-level reservoir. After 100 mL of the solution passes over the panel, it shall be examined with a 10X magnifier for evidence of rusting in the impingement or drainage areas. Four such tests shall be made on the lubricant sample.

4.5.6 Rubber compatibility. The change in mass shall be determined by the general procedure of ASTM-D471, Section 8, with the following specific provisions:

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a. The test pieces shall be rubber O-rings of 13 mm external diameter and 1.7 mm cross sectional diameter, fabricated from rubber meeting the requirements of MIL-P-25732 (see 6.7).

b. The test temperature shall be 70 °C.

c. The change in mass of the test specimens shall be determined after 72 hours of contact with the lubricant.

d. The mass gain produced by the lubricant under examination shall be compared with that produced in O-rings of the same lot by a reference fluid containing 65 percent by mass of methyl-phenyl silicone (50 centistokes (cSt)) and 35 percent by mass of bis (2-ethylhexyl) sebacate, lubricant grade.

4.5.7 Emulsification resistance. Place  $5 \pm 0.1$  mL of the lubricant in a 50-mL graduated cylinder having an internal height of 16 to 20 cm and a ground glass stopper. To this add  $25 \pm 0.2$  mL of heptane, at least 96 percent pure, and mix with the lubricant by shaking. Then add  $20 \pm 0.2$  mL of distilled water and vigorously hand shake for 30 seconds. The mixture shall be allowed to settle undisturbed at room temperature for  $30 \pm 0.5$  minutes before measuring the depth of the water layer formed at the surface.

4.5.8 Load carrying capacity. The test apparatus shall be that described by ASTM-D2670, Sections 4 and 5, prepared according to section 10, and using the 20,000-N load gage calibrated in accordance with ASTM-D2625. Sixty mL of the test lubricant shall be placed in the cup at  $25 \pm 5$  °C and raised to immerse the V-blocks with the jaws slightly opened. Ensure that the V-blocks and pin are surrounded by the lubricant and that no voids remain. The loading device shall be placed on the jaw arms and the slack taken up. The test shall then proceed in accordance with ASTM-D2625, Procedure B. A decrease in the load shall be considered a failure only if it is so rapid that the load cannot be restored by use of the loading ratchet.

4.5.9 Storage stability.

4.5.9.1 Oil separation. A well-mixed sample of the lubricant shall be placed in an oil sample bottle or other glass container, 30 to 50 mm in diameter, to a depth of  $100 \pm 3$  mm. No lubricant shall be on the walls of the container above the  $100 \pm 3$  mm level. The depth of the oil layer formed at the surface of the lubricant shall be measured after holding the sample at  $50 \pm 1$  °C for 168 hours.

4.5.9.2 Apparent viscosity. After storage for 168 hours at 50 °C, the sample shall be tested in accordance with the as received apparent viscosity test (see 4.5.4).

4.5.10 Machine gun performance. The lubricant shall be tested in an instrumented M61A1/A-7E gun system. Before beginning the tests, the entire system shall be disassembled,

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cleaned, and inspected. All system components shall be degreased with a service approved non-chlorinated solvent. During reassembly the system shall be restored to serviceable condition by reconditioning or replacing all worn parts. The test lube shall be applied to all system components and the gun oiler shall be filled with the test lube.

**CAUTION FOR TEST PERSONEL: DO NOT LUBRICATE SEALED BEARINGS AND RECOIL ADAPTERS WITH TEST LUBRICANT. THESE PARTS ARE PERMANENTLY LUBRICATED DURING MANUFACTURE WITH A SPECIAL LUBRICANT.**

a. The gun system shall be test fired using inert ammunition at ambient conditions  $21 \pm 6$  °C to verify proper operation. Ambient firing shall consist of one burst of 100 rounds with the high rate of fire [6,000 shots per minute (SPM)] selected. Steady state firing rate measured during the burst shall average  $6,000 + 1,200 - 200$  SPM. The time required for the system to reach steady state rate of fire shall be not greater than 0.8 second. After firing the check burst, the weapon and system shall be visually examined to determine service operability. No lubrication shall be applied to the system at this time.

b. The entire system shall be cooled to  $-50 \pm 1$  °C and stabilized at this level for a minimum of two hours. The hydraulic power supply shall be operated in the standby mode for five minutes to warm the fluid. A firing attempt shall then be made (high rate setting selected). The time required to reach steady state rate of fire shall be not greater than one second.

c. The system shall be heated to  $15 \pm 2$  °C and 60 percent humidity, and maintained for two hours. After this period, the system shall again be stabilized at  $-50 \pm 1$  °C and maintained at this level for two hours. After operating the power supply for five minutes, the gun system shall be fired at the high rate of fire. Minimum steady state rate shall be not less than 5,000 SPM. The time required to reach steady state rate of fire shall be not greater than one second.

d. Conditions in the test chamber shall be returned to ambient. The gun and ammunition handling system shall be completely disassembled and examined for signs of damage.

4.5.11 Coating appearance. A smooth steel panel, 51 x 102 mm, shall be dipped in the vertical position into a recently agitated lubricant, removed with a smooth vertical motion, and examined for lumps, nonhomogeneities, and foreign matter.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military

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Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

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

6.1 Intended use. The lubricant covered by this specification is intended primarily for use on 20-mm rotary guns such as the M61A1 and M197. The lubricant is used on all parts of the system with the exception of the prelubricated sealed bearings and the recoil spring assemblies. This lubricant reduces corrosion due to exposure to the marine environment, permits high firing rates at low temperatures, and permits operations under icing conditions.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- c. Packaging requirements (see 5.1).
- d. Material safety data sheet (see 6.4).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-85336, whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from the Commander, Naval Air Warfare Center Aircraft Division, Attn: Code 4.3.4.1, Building 2188, 22347 Cedar Point Road, Unit 6, Patuxent River, MD 20670-1161.

6.4 Material Safety Data Sheet. Contracting officer will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313; and 29 CFR 1910.1200 requires that the Material Safety Data Sheet for each hazardous chemical used in an operation must be readily available to personnel using the material. Contracting officers will identify the activities requiring copies of the Material Safety Data Sheets.

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6.5 Thickening agent. Lithium stearate has been used as a thickener in the past.

6.6 Lubricant formulation. A lubricant successfully used in the past had the following formulation in mass percent:

Isodecyl pelargonate	38.9 ± 1.0
Hexadecyl isostearate	30.4 ± 0.5
Methyl-phenyl silicone, 50 cSt	17.3 ± 0.5
Lead dinonylnaphthalene sulfonate (50 percent)	4.3 ± 0.1
Antimony dialkylphosphorodithioate	1.9 ± 0.1
2,6-Di-tertiary-butyl-4-methylphenol	0.4 ± 0.01
2-Mercaptabenzothiazole	0.3 ± 0.01
Lithium stearate	6.5 ± 1

6.7 O-ring. An example of an O-ring meeting the requirements is that specified in MS28775, referred to in MIL-P-25732.

6.8 Subject term (key word) listing.

Copper  
Guns, rotary, 20-mm  
Toluene

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

## CONCLUDING MATERIAL

Custodians:  
Army – AT  
Navy - AS  
Air Force - 68

Preparing activity:  
Navy - AS  
(Project 9150-1220)

Review interest:  
Army - AR

# 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-PRF-85336B

2. DOCUMENT DATE (YYMMDD)  
980910

3. DOCUMENT TITLE

LUBRICANT, ALL-WEATHER (AUTOMATIC WEAPONS)

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:

7. DATE SUBMITTED  
(YYMMDD)

(2) DSN:  
(*If Applicable*)

8. PREPARING ACTIVITY

a. NAME  
COMMANDER  
NAVAL AIR WARFARE CENTER  
AIRCRAFT DIVISION

b. TELEPHONE NUMBER (*Include Area Code*)  
(1) Commercial (732) 323-2947 (2) DSN 624-2947

c. ADDRESS (*Include Zip Code*)  
CODE 414100B120-3  
HIGHWAY 547  
LAKEHURST, NJ 08733-5100

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT  
Defense Logistics Agency (DLSC-LM),  
Attn Carla Jenkins/John Tascher  
8725 John J. Kingman Road, Ste 2533  
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