

MIL-L-46000C  
25 February 1987  
SUPERSEDING  
MIL-L-46000B  
26 August 1971

## MILITARY SPECIFICATION

### LUBRICANT, SEMI-FLUID (AUTOMATIC WEAPONS)

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

#### 1. SCOPE

1.1 Scope. This specification covers a semi-fluid lubricant for automatic weapons operating within a temperature range of -54 to +127 C (-65 to +260 F). (See 6.1) The lubricant is identified by Military Symbol LSA and NATO Code Number 0-158 (6.7).

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications, standards and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

#### SPECIFICATIONS

##### FEDERAL

P-D-680 - Dry Cleaning Solvent.

TT-T-291 - Thinner, Paint, Mineral Spirits, Regular or Odorless.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to Commander, US Army Armament, Research and Development Center, ATTN SMCAR-ESC-AS, Dover, New Jersey 07801-5001 by using the self-addressed 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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STANDARDS

FEDERAL

- FED-STD-66 - Steel: Chemical Composition and Hardenability.
- FED-STD-313 - Material Safety Data Sheets, Preparation and Submission.
- FED-STD-791 - Lubricants, Liquid Fuels, and Related Products, Methods of Testing.

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

(Copies of publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

ASTM

- ASTM A 304 - Alloy Steel Bars Subject to End-Quench Hardenability Requirements.
- ASTM A 575 - Steel Bars, Carbon, Merchant Quality, M-Grades.
- ASTM A 663 - Steel Bars, Carbon, Merchant Quality, Mechanical Properties, Specifications for.
- ASTM D 127 - Drop Melting Point of Petroleum Wax including Petrolatum, Test Method for.
- ASTM D 130 - Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test, Method for.
- ASTM D 217 - Cone Penetration of Lubricating Grease, Test Method for.
- ASTM D 445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity, Test Method for.

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ASTM D 664 - Neutralization Number by Potentiometric Titration, Test Method for.

ASTM D 942 - Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method, Test Method for.

ASTM D 972 - Evaporation Loss of Lubricating Greases and Oils, Test Method for.

ASTM D 1748 - Rust Protection by Metal Preservatives in the Humidity Cabine, Test Method for.

ASTM D 2625 - Endurance (Wear) Life and Load - Carrying Capacity of Solid Film Lubricants (Falex Pin and Vee Method), Test Method for.

ASTM D 2670 - Measuring Wear Properties of Fluid Lubricants (Folex Pin and Vee Block Method), Method for.

ASTM D 4057 - Manual Sampling of Petroleum and Petroleum Products, Practice for.

ASTM D 4177 - Automatic Sampling of Petroleum and Petroleum Products, Method for.

(Application for copies should be addressed to: ASTM, 1916 Race Street, Philadelphia, PA 19103).

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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 shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Qualification. LSA furnished under this specification shall be a product which is qualified for listing on the applicable Qualified Products List (QPL) at the time set for the opening of bids (4.5.1 and 6.3).

3.1.1 Requalification. Any changes in the formulation or processing of a qualified product will necessitate its requalification. LSA supplied under contract shall be identical, within manufacturing tolerances, to the approved qualification sample. The qualifying activity may, at its discretion, request complete requalification testing or require only partial requalification in order to determine the significance, impact, and acceptability of any proposed formulation change, manufacturing process, or change in manufacturing location.

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3.2 Material. The ingredients of LSA shall be of a grade and quality which have been shown to be suitable for the intended purpose and which will produce a semi-fluid lubricant conforming to the requirements of this specification.

3.2.1 Composition. The composition of the lubricant shall be as specified in table I (4.7).

Table I. Composition of lubricant

Material	Percent by weight
Lithium stearate <u>1/</u>	8.0 $\pm$ 0.3
Bis (2-ethylhexyl) sebacate <u>2/</u>	89.0 $\pm$ 1.0
Diisopropyl phosphite	1.0 $\pm$ 0.2
2, 6 di-tertiary butyl-p-cresol	0.5 $\pm$ 0.1
Barium dinonylnaphthalene sulfonate <u>3/</u>	1.5 $\pm$ 0.3

1/ See 6.5.

2/ Lubricant grade.

3/ Oil-free barium petroleum sulfonate with an average molecular weight of more than 1090 is also acceptable.

3.3 Physical and chemical requirements. LSA shall conform to the respective requirements specified in 3.4 through 3.16 when tested in accordance with applicable test methods in section 4.

3.4 Viscosity of base fluid. The viscosity of the base fluid containing all additives except the thickener shall be no more than 12,000 centistokes (cs) at -54 C (-65 F) nor less than 10.0 cs at 40 C (104 F), when tested in accordance with table II (4.6).

3.5 Acid number. The acid number shall not exceed 3.2 when LSA is tested in accordance with table II (4.6).

3.6 Evaporation loss. The evaporation loss at 149  $\pm$  1 C (300  $\pm$  2 F) shall not exceed 6 percent in 8 hours, when LSA is tested in accordance with table II (4.6).

Table II. Test methods.

Test	FED-STD-791 method no.	ASTM test method no.
Viscosity		D 445
Acid number		D 664 <u>1/</u>
Evaporation loss		D 972 <u>2/</u>
Oxidation stability		D 942
Effect of lubricant on copper	4304 <u>3/</u>	

1/ Agitate the sample before testing.

2/ Use a test temperature of 149  $\pm$  1 C (300  $\pm$  2 F).

3/ The copper plates shall be cleaned and polished in accordance with ASTM D 130. Toluene shall be used to wash the plates rather than benzene.

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3.7 Oxidation stability. The pressure drop shall not exceed 10 psi in 6 hours when LSA is tested for oxidation stability at  $149 \pm 3$  C ( $300 \pm 5$  F) in accordance with table II (4.6).

3.8 Effect of LSA on copper. Copper plates shall show no brown or black stains. Slight darkening of the copper or a slight green stain in the lubricant is acceptable.

3.9 Cone penetration (worked). The worked penetration of LSA at  $25 \pm 0.5$  C ( $77 \pm 1$  F) shall be no less than 350 nor more than 385 when it is tested in accordance with 4.8.

3.10 Load-carrying capacity.

3.10.1 Film strength. When tested in accordance with 4.9.1, LSA shall be capable of supporting a jaw load of 1500 pounds on the 4500-pound load gauge (or 1100 pounds on the 3000-pound load gauge) for one minute without failure. Failure is defined as excessive noise, sudden, rapid increase in torque, or pin shearing.

3.10.2 Extreme pressure characteristics. The incipient seizure load shall be no less than 63 kg, and the welding load shall be no less than 141 kg when tested in accordance with 4.9.2.

3.11 Rust inhibition. After performance of either the 168-hour humidity test specified in 4.10.3.1 or the 400-hour humidity test specified in 4.10.3.2, not more than one of the four test specimens shall have failed. Failure of a specimen shall be defined by either of the following conditions:

- a. The appearance on a given specimen of one rust spot larger than 1 mm in length, width, or diameter.
- b. The appearance on a given specimen of three or more rust spots, all smaller than 1 mm in length, width, or diameter, but which increase in size over a 24-hour period.

3.12 Wear. The average wear-scar diameter shall not exceed 0.5 mm in diameter when LSA is tested in accordance with 4.11.

3.13 Storage stability. After completion of the 6-month storage period specified in 4.12, the requirements in 3.13.1, 3.13.2, and 3.13.3 shall be met.

3.13.1 Accumulation of film. The film accumulated by the separation of oil and soap shall not exceed 3 mm.

3.13.2 Acid number. The acid number of the sample shall not exceed 3.5. Testing shall be performed in accordance with table II (4.6).

3.13.3 Odor. After storage, LSA shall have no disagreeable odor.

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3.14 Toxicity. LSA 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 agency. (See 6.1.) The supplier shall furnish the qualifying activity (6.3) with all the information necessary to evaluate the safety of the product. (See 4.13.) This shall include safety data sheets conforming to FED-STD-313.

3.15 Workmanship. The ingredients of LSA shall be mixed thoroughly to form a homogenous product, free from visible dirt, grit, water, or other foreign matter. When LSA is examined in accordance with 4.14, no lumps or inhomogenous structures shall be apparent.

3.16 Machine gun performance. Use of LSA shall result in satisfactory performance of the M61, 20 mm machine gun, without the formation of dry areas, excessive or uneven wear, galling, or other undesirable effects (4.15).

#### 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 purchase order, suppliers may use their 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 the specified requirements. Unless otherwise specified, the following tests and procedures shall be used.

#### 4.2 Lot.

4.2.1 Production lot. A production lot is an indefinite quantity of a homogenous mixture of product offered for acceptance in a single, isolated container, or manufactured in a single plant, run through the same processing equipment with no change in the ingredient materials, within a 24-hour time period.

4.2.2 Packaged lot. A packaged lot is an indefinite number of unit containers of identical size and type, offered for acceptance at one time, and filled with a homogenous mixture of product manufactured in a single plant, run through the same processing equipment with no change in the ingredient materials, within a 24-hour time period.

#### 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 D 4057 or D 4177.

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#### 4.4 Inspection.

4.4.1 Inspection of material. Perform inspection of material in accordance with method 9601 of FED-STD-791.

4.4.2 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. Container material shall be of a density sufficient to prevent migration of the product or any constituents through the container. The container will be pretreated to ensure that printed identification will properly adhere and will not be removed by the product.

#### 4.5 Classification of inspection.

- a. Qualification inspection
- b. Quality conformance inspection

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

4.5.1.1 Qualification samples. The qualification sample shall consist of four 1-gallon containers of the finished product and, in addition, a 1/2 gallon sample of the base fluid containing all additives except the thickener. The sample will be accompanied by data responsive to 4.13. Sample and report shall be furnished to the address indicated in 6.3.

4.5.1.2 Retention of qualification. In order to retain qualification of a product approved for listing on the QPL, the manufacturer shall be responsive to 4.5.2 and certify in writing, upon the request of the qualifying activity, certification of product compliance to the requirements contained in this specification. Such certification shall be requested by the qualifying activity at two-year intervals effective from the date of original qualification. The qualifying activity reserves the right to re-test any qualified product whenever it is deemed in the best interest of the Government to do so.

4.5.2 Periodic qualification re-evaluation. At the option of the qualifying activity, a re-evaluation shall be performed on a one-gallon sample of product drawn from the first lot, and each production lot thereafter, of product processed under current contract or purchase order. Periodic re-evaluation samples shall be forwarded to the activity responsible for qualification. (See 6.3.) Samples shall be plainly identified by labels or tags marked with the following information:

- Sample for periodic evaluation
- Lubricant, semi-fluid, for automatic weapons
- MIL-L-46000C
- Name of manufacturer
- Product code number
- Date of manufacture
- Contract or order number
- Lot number

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4.5.2.1 Periodic qualification re-evaluation tests. The re-evaluation of products being manufactured under current contract shall consist of those tests the qualifying activity determines necessary for product identity, verification, and evaluation. Delivery of a product per current contract shall not be delayed pending completion of this test and inspection. The results obtained shall be considered indicative of product quality and production consistency. Failure of a product sample to pass a periodic qualification re-evaluation shall require the acceptance and further shipment of a product to be discontinued until the manufacturer has corrected the conditions which led to the failure and has furnished data and documentation of affidavit to that effect. Further product failure or nonconformance shall constitute a basis for lot rejection and subsequent removal from the QPL.

4.5.3 Quality conformance tests. Tests for quality conformance of individual lots shall consist of tests for all requirements specified in section 3 except storage stability (3.13) and performance (3.16).

4.6 Test methods. Perform tests in accordance with the applicable test methods given in table II and 4.7 through 4.15.

4.7 Composition. The contractor shall submit a certified statement that the lubricant has been formulated in accordance with 3.2.1.

4.8 Cone penetration (worked). Determine the worked penetration of LSA in accordance with ASTM D 217, using a penetrometer cone of the dimensions specified therein, except that:

- a. The weight of the cone, including its shaft, shall be  $30 \pm 1$  grams.
- b. The cone shall be made of a material that is not attacked by the lubricant (6.7).

4.9 Load-carrying capacity. Determine the load-carrying capacity of the lubricant in accordance with 4.9.1 and 4.9.2.

4.9.1 Film strength. Determine the film strength of LSA with a Falex lubricant tester (6.6). Use standard Falex jaw blocks (6.6) made from AISI 1137 steel conforming to FED-STD-66 and No. 8 pins made from FS 3135 steel conforming to ASTM A304. Clean the jaw blocks, pins, and cup thoroughly in hot dry-cleaning solvent conforming to type II of P-D-680. Rinse them in hot dry-cleaning solvent and dry them before inserting in the machine. Fill the cup to the level mark with LSA, place the cup on the holder, and raise it to a point where the block and pin are immersed. Then lock the jaw-loading device by closing the blocks around the pin. Set the jaw loader at zero load. Increase the jaw load by hand to a scale reading of 1000 pounds to ensure that the blocks and pins are securely set in position. Return the jaw loader to zero and turn the motor on. Increase the jaw load from zero to 250 pounds by engaging the eccentric arm of the ratchet wheel. When the jaw load has reached 250 pounds, disengage the eccentric arm and maintain the load for one minute. Repeat the procedure at successively increased jaw-load increments of 250 pounds until the required jaw load of 1500 pounds has been maintained for one minute (3.10.1) or until failure occurs.



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NOTE: Refer to ASTM D 2625 or D 2670 for information on standard materials and calibration procedures.

4.9.2 Extreme-pressure characteristics. Determine the extreme pressure characteristics of LSA with a Falex 4-ball E.P. tester (6.6) in accordance with method 6503 of FED-STD-791 with the following modifications:

- a. Make a series of 1-minute runs instead of the specified 10-second runs.
- b. Define the incipient seizure load as the load at which an abrupt increase in the wear scar diameter occurs.
- c. Define the welding load as the load at which motion of the upper rotating ball, relative to the three stationary balls, is no longer possible. If the lubricant under test does not allow true welding, define the welding load as that load which produces a maximum wear scar diameter of 4 mm.

4.10 Rust inhibition. Make and prepare test specimens in accordance with 4.10.1 and 4.10.2 Determine the rust-inhibiting characteristics of LSA in accordance with either the 168-hour procedure of 4.10.3.1 (cyclic humidity chamber) or the 400-hour procedure of 4.10.3.2 (saturated humidity chamber). Examine the specimens for evidence of rust (3.11) at the end of each 24-hour interval. Express the test results as the average of the times-to-failure of the four specimens.

4.10.1 Test specimens. Make four test specimens of 1020 carbon steel rod stock conforming to ASTM A 575 or A 663. The specimens shall be 102 mm (4 inches) long by 9.5 mm (3/8 inch) in diameter, with a hole of suitable size drilled approximately 19 mm (approximately 3/4 inch) from one end to facilitate handling and to permit suspension in the humidity chamber.

4.10.2 Preparation of test specimens. Polish the specimens with abrasive paper or cloth having a No. 600A silicon carbide grit or a No. 500 aluminum oxide grit. Wash the specimens in reagent-grade n-hexane, wipe them with absorbent cotton, and then wash them in reagent-grade petroleum ether having a boiling point of 30-65 C (86-149 F). Immerse the specimens completely in the lubricant under test. Insert each specimen in a rubber stopper with a diameter slightly smaller than the centrifuge trunnion cup. Place the four specimens in a centrifuge and rotate them at 1000 rpm for 10 minutes. Remove each specimen from the centrifuge by inserting a glass rod in the hole near the end.

4.10.3 Tests. Expose the test specimens in either a cyclic humidity chamber for 168 hours or a saturated humidity chamber for 400 hours. Examine the specimens for rust at the end of each 24-hour interval. Express the test results as the average of the times-to-failure of the four specimens.

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4.10.3.1 168-hour test. Suspend the test specimens in a cyclic humidity chamber (6.6), and expose them to the following conditions: 4 hours at a relative humidity of 80 percent and a temperature of 43 C (110 F) followed by 4 hours at a relative humidity of 95 percent and a temperature of 55 C (131 F). (Transition from low to high humidity and temperature produces a controlled condensation period.)

4.10.3.2 400-hour test. Suspend and expose the specimens for 400 hours in a saturated humidity chamber in accordance with the specifications for apparatus and the instructions for procedure in ASTM D 1748 (including appendix I), except that the specimens shall be cylindrical rods instead of panels (4.10.1).

4.11 Wear. Evaluate the anti-wear properties of LSA by determining the average wear-scar diameter of the three stationary balls after testing for one hour in a Falex variable drive 4-ball wear tester (6.6) at 120 C (248 F), 600 rpm, and a 50-kg load.

4.12 Storage stability. Agitate the contents of the original container thoroughly by shaking. Transfer a 100-ml sample to a jar with an inside diameter of approximately 85 mm (approximately 3-1/4 inches). Cap the jar tightly, and store it at  $25 \pm 2$  C ( $77 \pm 3$  F) for 6 months. Following the storage period, examine the contents for conformity to 3.13.

4.13 Toxicity. The supplier shall furnish the qualifying activity (6.3) safety data sheets conforming to FED-STD-313 along with all the information necessary to evaluate the safety of the product. Such information shall be furnished in one of the following forms, at the discretion of the qualifying activity:

- a. A complete listing of the constituent materials, including an infrared profile giving the percentage of composition and using standard chemical nomenclature. (This is the simplest and most direct method. In most instances, it will completely satisfy the requirement for information.)
- b. The results of toxicological testing of a scope and quality acceptable to the qualifying activity.
- c. Some other form acceptable to the supplier and to the qualifying activity.

All information furnished by the supplier in connection with the evaluation of toxicity shall be signed by a responsible official of the supplying firm. Such information shall be held in strict confidence by the qualifying activity and shall not be divulged to other suppliers.

4.14 Workmanship. Prepare a steel panel in accordance with the method for preparation of specimens given in method 5312 of FED-STD-791. Dip the panel vertically into the container of LSA maintained at  $25 \pm 2$  C ( $77 \pm 3$  F). Remove the panel and examine LSA for conformance to 3.15.

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4.15 Machine gun performance. Test LSA for performance in an M61, 20 mm machine gun as follows: Disassemble the gun completely, and clean it of all traces of lubricant and dirt by washing it with Stoddard solvent conforming to type I of P-D-680, or volatile mineral spirits conforming to grade A of either type I or type II of TT-T-291. Do not use a chlorinated solvent. After removing the solvent completely from all surfaces of the gun, coat the cleaned components with the test lubricant using a brush or an oil can.

NOTE: Do not clean or relubricate any bearings initially lubricated with grease.

Reassemble the gun and test fire it at an ambient temperature of  $25 \pm 3$  C ( $77 \pm 5$  F). This firing shall consist of two groups of five 100-round bursts. Allow 3 minutes of cooling between bursts and complete cooling between groups. During the firing, the gun shall accelerate to a peak firing rate of  $6000 \pm 1200$  or  $-600$  rounds per minute (rds/m) within 0.8 seconds. After completing the test, disassemble the gun and examine it for the presence of dry areas, excessive or uneven wear, galling, or other undesirable effects. Clean, relubricate, and soak the gun at  $-54$  C ( $-65$  F) for 4 hours. Fire three 100-round bursts with the gun at an ambient temperature of  $-54$  C ( $-65$  F) with 2 hours of cooling between bursts. During the firing, the gun shall accelerate to a peak firing rate of not less than 4500 rds/m within 1.6 seconds. After completing the tests, disassemble the gun and examine it for the presence of dry areas, excessive or uneven wear, galling, or other undesirable effects. Clean, relubricate, and soak the gun at  $127$  C ( $260$  F) for four hours. Fire three 10-round bursts with the gun at an ambient temperature of  $127$  C ( $260$  F), with sufficient cooling time to permit reloading. During the firing, the gun shall accelerate to a peak firing rate of  $6000 \pm 1200$  or  $-600$  rds/m within 1.2 seconds. After completing the test, disassemble the gun and examine it for the presence of dry areas, excessive or uneven wear, galling, or other undesirable effects.

## 5. PACKAGING

5.1 Packaging, packing, and marking. Unless otherwise specified in the contract or purchase order (6.2), and except as specified in 5.1.1, LSA shall be packaged, packed, and marked in accordance with MIL-STD-290. If LSA is to be procured in two-ounce plastic bottles, the material, form, and dimensions of the bottles shall conform to the requirements given in figures 1, 2, 3, and 4. LSA shall not be packaged in containers larger than one gallon.

5.1.1 Additional marking. In addition to the marking required by MIL-STD-290 and any special marking required by the contract or purchase order, each unit container shall be marked as follows:

### WARNING

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

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Shake or mix thoroughly before using.

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**NOTES**  
**1. CONTENTS**  
 2 U.S. FLUID OZ MIN LUBRICATING OIL, SEMI FLUID, MIL-L-46000.  
**2. BOTTLES WITH CLOSURE CAP ATTACHED SHALL BE CAPABLE OF PASSING THE LEAKAGE TEST PER MIL-P-116 TORQUE TO 8 LB/IN ± 2 LB/IN.**

REVISIONS				
NO	DATE	BY	DESCRIPTION	APPROVED
1			ISSUANCE & INITIAL W/ENR	
2			SEE MIL-L-46000	

○

FOR LIST OF PARTS, SEE ENGINEERING PARTS LIST - 8436792				PART NO 8436792	
MECHANICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		ORIGINAL DATE OF DRAWING 21 SEP 1967	
SP		FINISHES OR TOLERANCES		DESIGNED BY	ENR
TL	AP448798	APPL. 3.36540	MIL-D-100	APPROVED BY	<i>[Signature]</i>
CL 1		MNS/MNSM		DATE	<i>[Signature]</i>
SA	AP200027	APPL. MNS	PLST MATERIAL	REVISIONS	
BN		AP44, MNSM		BY	<i>[Signature]</i>
AN		8 MNS M		CHECKED	<i>[Signature]</i>
		RELY ABN		DATE	
		USED WITH		SCALE	1/1
		APPLICATION			

DEPT OF THE ARMY  
 ROCK ISLAND ARSENAL ROCK ISLAND, ILL 61201

**LUBRICATING OIL, SEMI-FLUID, 2 OZ. FLAT-OVAL BOTTLE**

ENG DES C 19204 8436792

Figure 1. Two-ounce plastic bottle and cap assembly.

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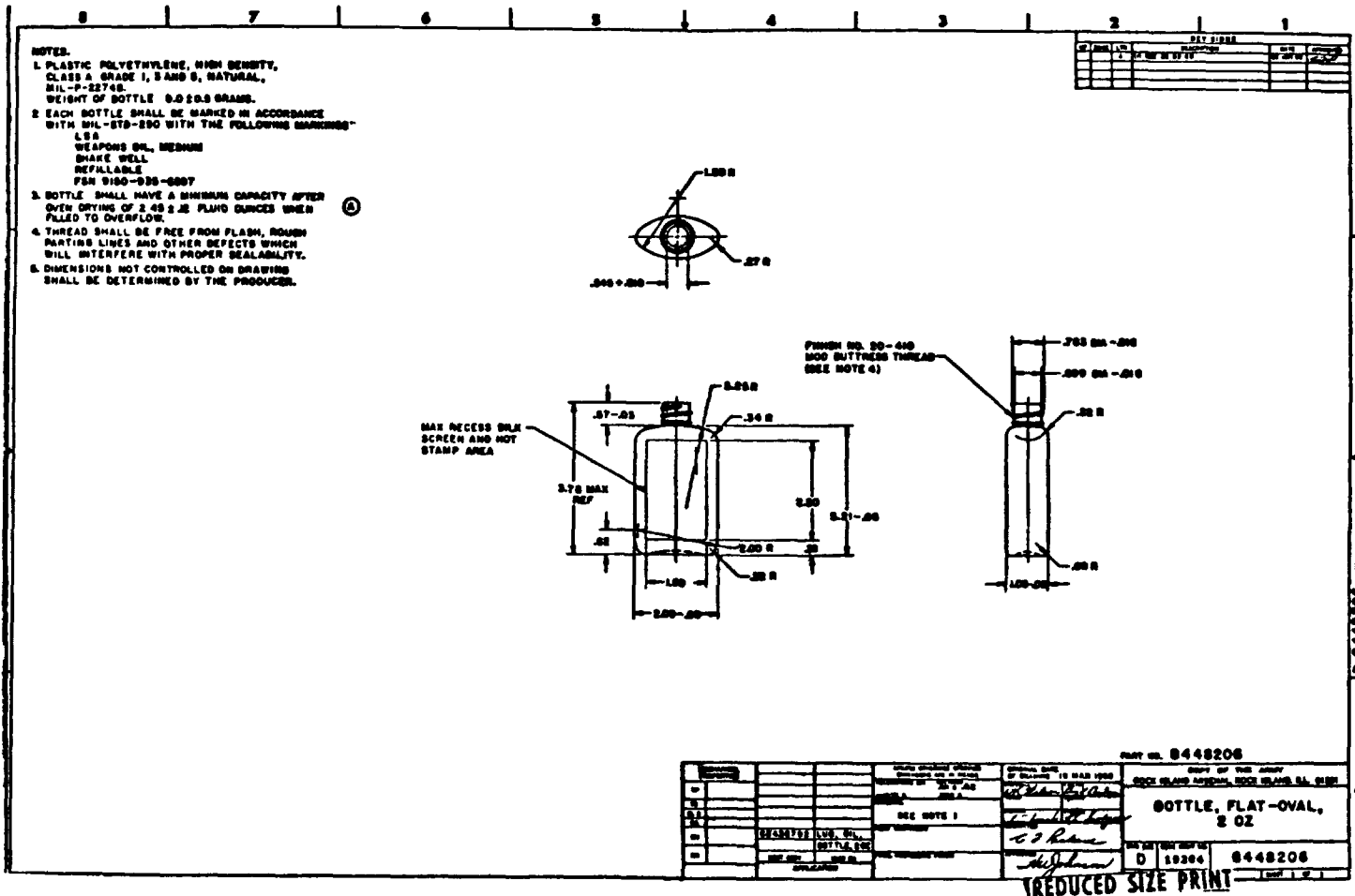


Figure 2. Two-ounce plastic bottle.

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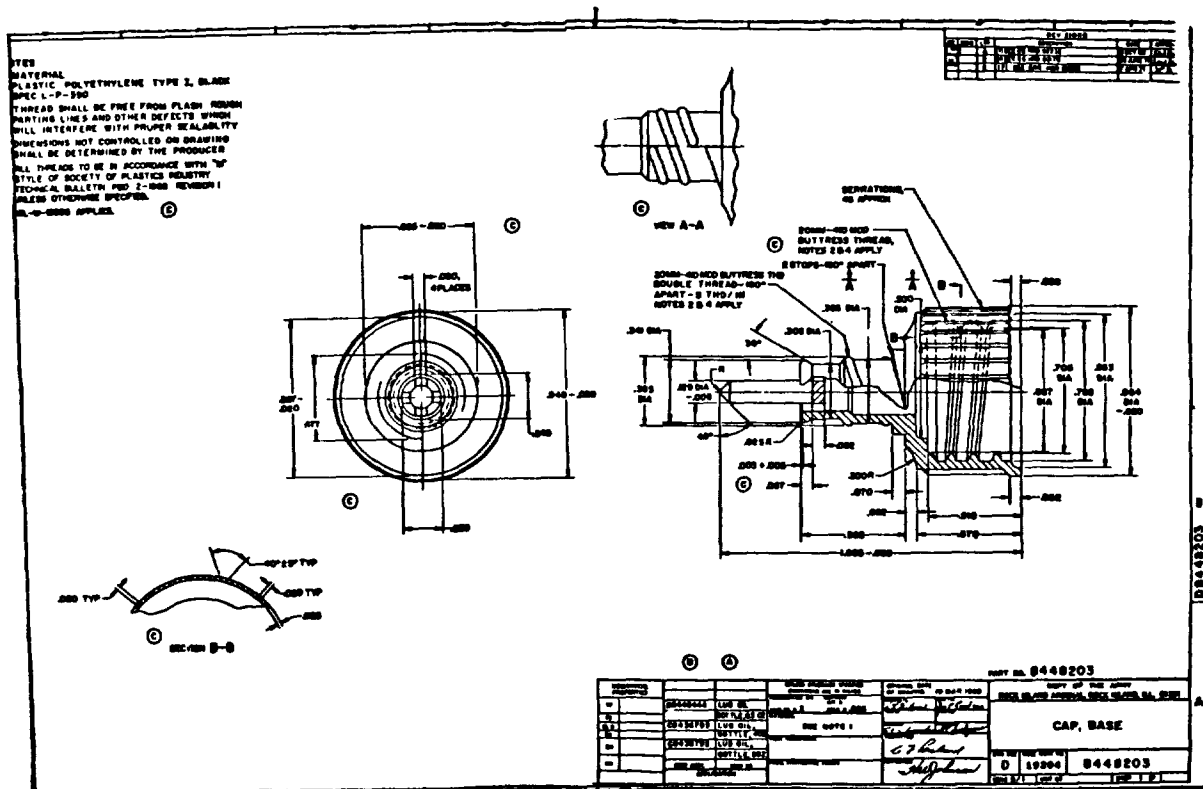


Figure 3. Base cap for 2-ounce plastic bottle.

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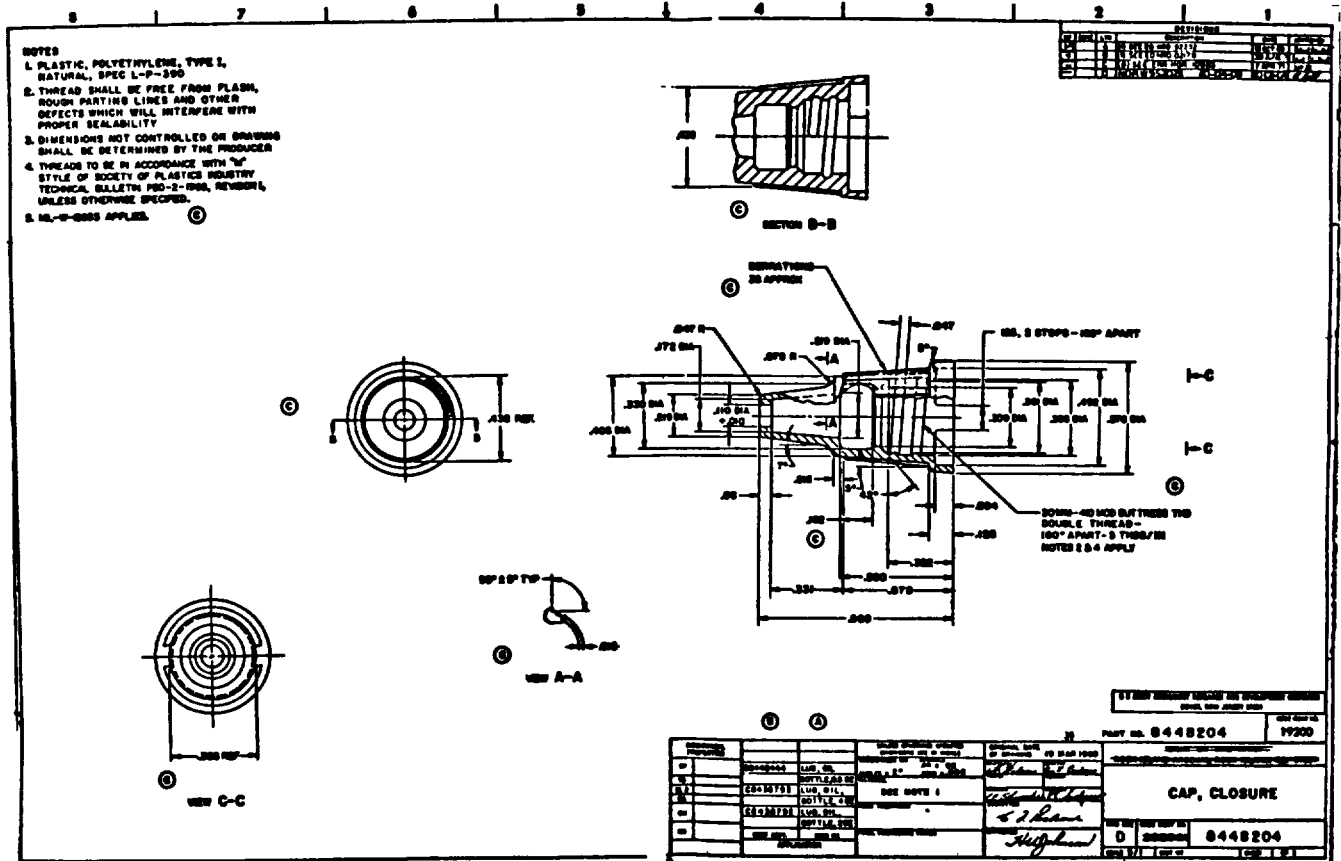


Figure 4. Closure cap for 2-ounce plastic bottle.

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## 6. NOTES

6.1 Intended use. LSA covered by this specification is intended for use in the operation of the M61, M39, and related types of automatic weapons under conditions of extreme pressure in the temperature range of -54 to +127 C (-65 to +260 F).

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 required (5.1).
- d. Level of packaging and level of packing required (5.1).
- e. Special marking, if required (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 QPL 46000 whether or not such products have actually been so listed by that date. The attention of the contractors 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 purchase orders for the products covered by this specification. The activity responsible for the QPL is U.S. Army Armament Research, Development and Engineering Center (ARDEC), ATTN: SMCAR-ESC-S, Picatinny Arsenal, NJ 07806-5000, and information pertaining to qualification of products may be obtained from that activity.

6.4 Preparation of semi-fluid lubricant. A lubricant which has been found to comply with all the requirements of this specification was prepared as follows: The rust, oxidation, and extreme pressure additives were added to the base fluid and brought to complete solution by stirring and gentle warming. The thickener was then added slowly with stirring until evenly distributed and the mixture run through a homogenizer set at clearance of 1 mil. The mixture was then heated to  $188 \pm 2$  C ( $370 \pm 4$  F) in a stainless steel beaker, then rapidly chilled. This was accomplished by pouring the hot lubricant into a shallow aluminum pan over dry ice, the depth of the lubricant layer not being allowed to exceed 9 mm (3/8 inch) in order to prevent large cooling gradients. After hardening, and while still below room temperature, the lubricant was transferred to a grease worker, as specified in ASTM D 217, and subjected to 100 strokes. A plunger with perforations of 1.6 mm (1/16 inch) diameter was used. The lubricant was then poured into a two-necked flask and evacuated for approximately two hours under 2-5 mm of mercury. (This procedure can be facilitated by simultaneously exposing the lubricant to a vibrator or shaker.) The amount of ingredient materials and the temperatures used in preparation have a critical effect on the properties, workmanship, and stability of the final product.

6.5 Lithium stearate. It is recommended that the properties of the lithium stearate used in the formulation be as shown in table III.



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Table III. Formulation.

Chemical composition	Percent by weight maximum
Lithium	2.5
Free fatty acid	0.5
Moisture	0.5
Chlorides	None
Fatty acids combined with lithium stearate	Remainder

The softening point should be 210-215 C (410-419 F) as determined by ASTM D 127.

6.6 Sources for test equipment. Suppliers cited below can furnish the indicated test equipment. Equipment of equal quality and equivalent design may be substituted.

Penetration cone F200	- Falex Corp. 2055 Comprehensive Dr. Aurora, IL 60505-1374
Falex 4-ball wear machine	- Falex Corp. 2055 Comprehensive Dr. Aurora, IL 60505-1374
Falex 4-ball E.P. tester	- Falex Corp. 2055 Comprehensive Dr. Aurora, IL 60505-1374
Falex pin and vee block	- Falex Corp. 2055 Comprehensive Dr. Aurora, IL 60505-1374
Bench top temperature humidity chamber	- Tenney Engineering, Inc. 1090 Springfield Road Union, NJ 07083-8119

6.7 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement (NATO STANAG 1135). When amendment, revision, or cancellation of this specification is proposed which would modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

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6.8 Subject term (key word) listing.

Acid  
Cone penetration  
Evaporation loss  
Film strength  
Galling  
Lithium stearate  
Oxidation stability  
Rust inhibition  
Semi-fluid lubricant  
Storage stability  
Viscosity

6.9 Changes from previous issue. Asterisks or vertical lines are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodian:  
Army - AR  
Navy - AS  
Air Force - 68

Preparing activity:  
Army - AR  
Project No. 9150-0793

Review activities:  
Army - MD  
Navy - OS, SA  
DLA - GS

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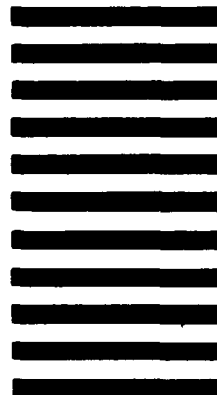
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<b>1 DOCUMENT NUMBER</b> MIL-L-46000C	<b>2 DOCUMENT TITLE</b> LUBRICANT, SEMI-FLUID (AUTOMATIC WEAPONS)
<b>3a. NAME OF SUBMITTING ORGANIZATION</b>	<b>4 TYPE OF ORGANIZATION (Mark one)</b> <input type="checkbox"/> VENDOR  <input type="checkbox"/> USER  <input type="checkbox"/> MANUFACTURER  <input type="checkbox"/> OTHER (Specify) _____
<b>b. ADDRESS (Street, City, State, ZIP Code)</b>	
<b>5 PROBLEM AREAS</b>	
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<b>b. Recommended Wording</b>	
<b>c. Reason/Rationale for Recommendation</b>	
<b>6 REMARKS</b>	
<b>7a. NAME OF SUBMITTER (Last, First, MI) – Optional</b>	<b>b. WORK TELEPHONE NUMBER (Include Area Code) – Optional</b>
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