

NOT MEASUREMENT SENSITIVE

MIL-L-0046010C(ME)
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USED-IN-LIEU-OF
MIL-L-46010B
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MILITARY SPECIFICATION

LUBRICANT, SOLID FILM, HEAT CURED, CORROSION INHIBITING

This specification is approved for use by the US Army Belvoir Research, Development, and Engineering Center based upon currently available technical information but it has not been approved for promulgation as a coordinated revision of MIL-L-46010B. It is subject to modification. However, pending its promulgation as a coordinated military specification, it may be used in acquisition.

1. SCOPE

1.1 Scope. This specification establishes the requirements for two types of heat cured solid film lubricants intended to reduce wear and prevent galling, corrosion and seizure of metals (see 6.1).

1.2 Classifications. This specification establishes the following types:

- Type I - A cure temperature of 150 ± 3 °C and a storage stability of one year (NATO Code No. S-1738, formerly MIL-L-8937).
- Type II - A cure temperature of 204 ± 3 °C with a storage stability of one year (formerly MIL-L-46010).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications, standards, and handbooks 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: US ARMY BELVOIR RDE CTR, ATTN SATBE TSE, 10101 GRIDLEY RD STE 104, FT BELVOIR VA 22060-5818 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

DISTRIBUTION STATEMENT A. Approved for public release, distribution is unlimited.

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SPECIFICATIONS

FEDERAL

- QQ-A-250 - Aluminum and Aluminum Alloy Plate and Sheet, General Specification For.
- QQ-A-250/5 - Aluminum Alloy, Alclad 2024, Plate and Sheet.
- TT-N-95 - Naptha, Aliphatic.
- VV-D-1078 - Damping Fluid, Silicone Base (Dimethyl Polysiloxane).

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- MIL-C-372 - Cleaning Compound, Solvent, (For Bore of Small Weapons and Automatic Aircraft Weapons).
- MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5.
- MIL-A-8243 - Anti-icing and Deicing - Defrosting Fluid.
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys.
- MIL-L-14107 - Lubricating Oil, Weapons, Low Temperature.
- DOD-P-16232 - Phosphate Coatings, Heavy, Manganese or Zinc Base (for Ferrous Metals).
- MIL-L-23699 - Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
- MIL-L-46000 - Lubricant, Semi-Fluid (Automatic Weapon).
- MIL-L-63460 - Lubricant, Cleaner and Preservative for Weapons and Weapon Systems.
- MIL-C-81302 - Cleaning Compound, Solvent, Trichlorotrifluoroethane.
- MIL-H-83282 - Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537.

STANDARDS

FEDERAL

- FED-STD-791 - Lubricants, Liquid Fuels, and Related Products, Methods of Testing.
- FED-STD-313 - Material Safety, Data Sheets, Preparation and Submission of.

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from: STDZN DCMNT ORDER DESK, BLDG 4D, 700 ROBBINS AVE, PHILADELPHIA PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DEPARTMENT OF LABOR (DOL)

OSHA 29CFR 1910.1200 Hazard Communication Interpretation Regarding Chemicals and Mixtures.

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(Guideline CPL-2.38 may be obtained from OSHA PUBLCTNS OFC, RM S 4203, 200 CONSTITUTION AVE NW, WASHINGTON DC 20210.)

2.2 Non-Government publications. The following document(s) 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 TESTING AND MATERIALS (ASTM)

A 167	- Stainless and Heat-Resisting Chromium-Nickel-Steel Plate, Sheet and Strip.
A 108	- Steel Bars, Carbon, Cold-Finished, Standard Quality.
D 1141	- Substitute Ocean Water.
D 1193	- Reagent Water.
D 1310	- Flashpoint of Liquids by Tag Open-Cup Apparatus.
D 2510	- Adhesion of Solid Film Lubricants.
D 2511	- Thermal Shock Sensitivity of Solid Film Lubricants.
D 2625	- Endurance (Wear) Life and Load-Carrying Capacity of Solid Film Lubricants (Falex Method).
D 2649	- Corrosion Characteristics of Solid Film Lubricants.
F 22	- Standard Test Method for Hydrophobic Surface Films by Water-Break-Test.

(Application for copies should be addressed to: AMERCN SCTY & MTRLS, 1916 RACE STRET, PHILADELPHIA PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, (except for related associated detail specifications, specification sheets or MS standards), 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 products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3). Any change in the formulation of a qualified product will necessitate its requalification.

3.2 Materials. Component materials used in the manufacture of both types of this lubricant shall consist essentially of finely powdered lubricating solids dispersed in a suitable binder. The lubricant shall be suitable for application by brushing, dipping or by spraying. The applied film shall be capable of being cured within 60 minutes at 150 ± 3 °C (302 ± 5 °F) for type I and at 204 ± 3 °C (399 ± 5 °F) for type II when applied as specified in 4.5.2 and be of such a nature that it shall conform to the requirements of this specification. The lubricant shall contain no graphite, powdered metal or non-EPA/OSHA approved fluorocarbon

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solvents (see 4.6.1). The contractor shall provide appropriate label warnings if products contain carcinogenic or potentially carcinogenic constituents as defined under the Hazard Communication Standard (HCS) 29 CFR 1910.1200.

3.3 Film appearance and thickness. The bonded solid film lubricant, when examined in accordance with 4.6.2, shall appear uniform in color and shall be smooth, free from any cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, separation of ingredients or other surface imperfections. The thickness of the cured film shall be between 0.005 and 0.013 mm (0.0002 and 0.0005 inch). Film thickness shall be determined in accordance with table III.

3.4 Performance characteristics.

3.4.1 Film adhesion. The bonded solid film lubricant, when tested as specified in table III, shall not be lifted to expose any bare metal surface. A uniform deposit of powdery material clinging to the tape shall not be objectionable.

3.4.2 Resistance to fluids. The bonded solid film lubricant, after immersion in each of the fluids as specified in table III, shall not be lifted by the tape to expose any bare metal surface; nor shall the solid film lubricant soften, lift, blister, crack, or peel. A uniform deposit of powdery material clinging to the tape shall not be objectionable.

3.4.3 Thermal stability. The thermal stability of the bonded solid film lubricant, when tested as specified in table III, shall not flake, crack, nor soften and shall conform to the requirements for film adhesion, 3.4.1.

3.4.4 Endurance life. When tested as specified in table III, the bonded solid film lubricant shall have an average endurance life at 1000 pounds load (lbf) [4450 Newtons (N)] [765 lbf (3400N) on the direct-reading gauge] as follows:

Type I - 250 minutes with no single test less than 210 minutes.

Type II - 450 minutes with no single test less than 390 minutes.

3.4.5 Load carrying capacity. When tested as specified in table III, the bonded solid film lubricant shall have the following capacities:

Type I - At least 2500 pounds (11,120N) gauge, with no single test less than 2250 pounds (10,000N).

Type II - At least 2000 pounds (8900N) load and no single test being less than 1750 pounds (7780N).

3.4.6 Aluminum corrosion resistance (type I only). When subjected to heat and high humidity conditions as specified in table III, the bonded solid film lubricant on anodized aluminum panels shall not show or cause discoloration, pitting, formation of white deposits, or other evidence of corrosion.

3.4.7 Sulfurous acid - salt spray (type I only). When dry steel specimens coated with solid film lubricant are exposed to sulfurous acid - salt spray as specified in table III, there shall be no resultant pitting, visible corrosion, or staining.

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3.4.8 Salt - spray (fog) test (type II only). The lubricant, after being applied to steel panels and cured to a film thickness of 0.0002 to 0.0005 inches (0.005 to 0.013 mm) shall show no more than three rust spots per panel, none greater than 1 mm in diameter after 100 hours exposure to a 5 percent salt spray solution in a salt fog cabinet conforming to FED-STD-791, method 4001.

3.4.9 Solids content. The type II lubricant shall contain a minimum of 40 percent by weight of solid material. The test shall be performed in accordance with 4.6.3 for type II only.

3.4.10 Storage stability. The lubricant in its original container shall, after a minimum storage period as specified in 4.6.4, conform to the requirements for endurance life, for type I and type II (see 3.4.4); the sulfurous acid-salt spray test, for type I only (see 3.4.7); and the salt spray (fog) test, for type II only (see 3.4.8), when tested as specified in table III.

3.5 Toxicity. The lubricant shall have no adverse effects on human health when it is used as intended (see 6.1). Prior to award of qualification, MSDS's for all components (especially for the solvent and lubricant) shall be submitted to the appropriate departmental medical activity to ensure conformity to toxicity requirements. Questions on toxicology shall be referred by the procuring activity to the appropriate departmental medical service after consulting the qualifying activity (see 6.3). A material safety data sheet will be submitted in accordance with 4.6.6.

3.6 Application. The lubricant shall be applied in accordance with the appendix of this specification. The surfaces upon which the lubricant is applied shall also be pretreated in accordance with the appendix of this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order and unless disapproved by the Government, the contractor's own facilities or any other, suitable for the performance of the inspection requirements specified herein, may be used. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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4.2 Classification of inspections. The inspections specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).
- c. Inspection of packaging (see 4.7).

4.3 Qualification inspection. The qualification inspection performed by the qualification laboratory shall consist of approval of the manufacturer's submitted report, and subjecting the qualification sample, 4.3.1, to examination and testing for all the requirements of this specification (see table III).

4.3.1 Qualification samples. The qualification sample shall consist of 1 gallon of the lubricant dispersion from one batch provided in 1-gallon containers, and two copies of the supplier's report for the product for which qualification is desired. The report shall show the product inspection results for all the requirements of this specification and shall refer specifically to the applicable paragraphs in the specification. The samples, reports and Material Safety Data Sheets for each component and the confidential formula for the product shall be forwarded to: US ARMY BELVOIR RDE CTR, SATBE FL, FT BELVOIR VA 22060-5818. The samples shall be plainly identified by securely attached durable tags or labels and marked with the following information:

Sample for qualification inspection.

LUBRICANT, SOLID FILM, HEAT CURED, CORROSION INHIBITING, type I (NATO Code Number S-1738) or type II.

Name of manufacturer.

Product code number.

Date of manufacture.

Submitted by (name) (date) for qualification inspection in accordance with MIL-L-46010 under authorization of (reference authorizing letter) (see 6.3).

4.3.2 Retention of qualification. In order to retain qualification of a product approved for listing on the qualified products list (QPL), the manufacturer shall verify by certification to the qualifying activity, that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in five-year intervals from the date of original qualification. The Government reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.4 Quality conformance inspection. The quality conformance inspection shall consist of inspection of samples for tests (see 4.4.2) for all of the tests specified in table III, (except for thermal stability [3.4.3], aluminum corrosion resistance [3.4.6], and storage stability [3.4.10]), and inspection of samples of filled containers (see 4.4.3) for conformance to section 5 packaging. Samples shall be labeled completely with information identifying the purpose of the sample, name of product, specification number, lot and batch number, date of sampling, and contract number.

4.4.1 Lot and batch. All lubricant manufactured as one batch shall be considered a lot and shall be numbered as such for purposes of inspection. A batch is defined as the end product of all the raw materials mixed or blended in a single operation.

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4.4.2 Sample for tests. The sample for test shall consist of 4 separate quarts of lubricant selected at random from each lot of lubricant. The lot shall be unacceptable if a sample fails to meet any of the test requirements specified.

4.4.3 Sample for examination of filled containers. When the lubricant lot is in solid film dispersion, a random sample of filled containers shall be selected from each lot of lubricant in accordance with MIL-STD-105 at inspection level II and presence of one or more defects shall be cause for rejection.

4.5 Inspection conditions.

4.5.1 Atmospheric conditions. Unless otherwise specified, all examinations and tests shall be performed at a temperature of 25 ± 3 °C (77 ± 5 °F) and at a relative humidity between 45 and 55 percent. Physical values specified in 3.4.4 and 3.4.5 apply to the average of the determinations made on the samples.

4.5.2 Preparation of test panels.

4.5.2.1 Preparation of and application to test panels for solid film lubricant, type I. The panels shall be made from: aluminum alloy conforming to QQ-A-250/5, anodized to conform to MIL-A-8625, type 1, and measuring approximately 0.020 by 3 by 6 inches; and corrosion resistant steel conforming to ASTM A 167, and measuring approximately 0.036 by 3 by 6 inches. The panels shall be precleaned with naphtha, aliphatic conforming to TT-N-95 or any EPA compliant cleaner that sufficiently cleans surfaces to pass ASTM F 22. Application of the lubricant shall be performed in a well-ventilated area or hood where no flames or ignition sources are present. Only one side of each panel shall be fully coated, except for two of the anodized aluminum panels which shall have the lubricant applied to a 1-inch wide strip to enable measurement of the film thickness. A spray application technique shall be used to coat the panels for the tests specified herein. The solid film lubricant thickness, after cure, shall be 0.005 to 0.013 mm (0.0002 to 0.0005 inches). Three coats shall be the maximum number required to obtain the desired film thickness. An air dry temperature of 25 ± 3 °C (77 ± 5 °F) for ten minutes between coats is allowed. After the final coat has been applied, the coated specimens shall be allowed to air dry for 30 minutes. The coated specimens shall then be placed in an air circulating oven at 150 ± 3 °C (302 ± 5 °F) for one hour. The coated specimens shall be removed from the oven and allowed to cool to room temperature. At least two test panel specimens shall be used in each test method.

4.5.2.2 Preparation of and application to test panels for solid film lubricant, type II. The panels shall be steel panels approximately 0.125 by 3 by 6 inches conforming to ASTM A 108. Phosphatize the panels in accordance with DOD-P-16232, using FED-STD-791, method 3816 to measure the thickness of the phosphated panels. The type II panels shall be dipped or sprayed to the same thickness as specified for the type I panels (see 4.5.2.1). After air drying 30 minutes, bake the panels in an air circulating oven at 204 ± 3 °C (400 ± 5 °F) for one hour. The coated specimens shall be removed from the oven and allowed to cool to room temperature. At least two test panel specimens shall be used in each test method.

4.6 Methods of inspection. Methods of inspection shall be in accordance with table III and 4.6.1 through 4.6.5.

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4.6.1 Graphite and powdered metal. The contractor shall submit for the contracting officer's approval, certification that no graphite or powdered metal are present in the product furnished under this specification.

4.6.2 Film appearance. The bonded solid film lubricant specimens shall be examined visually and microscopically at a magnification of 12X for uniformity in color, smoothness and evidence of cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, separation of ingredients, and any other surface imperfections.

4.6.3 Solid content. Stir the lubricant thoroughly, weigh 5.0 ± 0.5 grams into a disposable weighing dish (Fisher Scientific catalog number 08-732). Place the dish and contents into a forced draft oven maintained at a temperature of 120 ± 5 °F (49 ± 3 °C) for 18 ± 1 hour. Remove from oven and place in desiccator. Raise temperature of oven to 400 ± 2 °F (204 ± 1 °C) and replace dish with residue into 400 °F (204 °C) oven for 1 additional hour. Remove dish and contents and cool in a desiccator. When cool, weigh dish and contents. Calculate percent of total solids in lubricant as follows:

$$\text{Percent total solids} = \frac{\text{Weight of solid materials (grams)}}{\text{Weight of sample (grams)}} \times 100$$

4.6.4 Storage stability. Set aside a one-quart type I qualification sample in a storage of 25 ± 3 °C (77 ± 5 °F) for a period of 1 year ± 7 days. At the end of the storage period, determine the endurance life (see 3.4.4) of the cured lubricant film and perform the sulfurous acid - salt spray (see 3.4.7). Set aside a one-quart type II qualification sample in storage of 25 ± 3 °C (77 ± 5 °F) for a period of 1 year ± 7 days. After this period determine the endurance life of the cured film (see 3.4.4), perform the salt-spray (fog) test (see 3.4.8).

4.6.5 Examination of filled containers. Each filled container selected in accordance with 4.4.3 shall be examined for defects of the container and the closure, for evidence of leakage, and for unsatisfactory markings. Each sample container shall also be weighed to determine the amount of the contents. Sample size shall be determined using the appropriate sampling plan of MIL-STD-105. Rejection of a lot shall occur when one or more defects are found.

4.6.6 Toxicity. A material safety data sheet conforming to FED-STD-313 is required for each component of the product at the time of qualification.

4.7 Inspection of packaging. The packaging, packing, and marking shall be examined and tested in accordance with the quality assurance provisions of MIL-STD-290.

5. PACKAGING

5.1 Packaging, packing, and marking. The lubricant shall be packaged, packed, and marked in accordance with MIL-STD-290. The type and size of containers and the level of packaging and packing shall be as specified by the acquiring activity (see 6.2).

5.2 Precautionary marking. In addition to the marking specified in 5.1, the individual containers and the shipping containers shall be marked to show the date

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of manufacture, recommended conditions for storage, and flash point by Tag open cup method, ASTM D 1310, and the marking shall include the following information:

- a. WARNING! Do not use this lubricant in food processing or food handling equipment on surfaces that may contact foods.
- b. CAUTION! Use only in a well ventilated area or in a hood where no flames or other ignition sources are present.
- c. NOTE. Use this lubricant within 12 months from date of manufacture.

5.2.1 Additional marking. The individual containers shall be marked with the following application instruction:

- a. Degrease and clean component part thoroughly.
- b. Spray wet at 40 psi, 10 to 12 inches from part (shake mixture constantly), using a Binks No. 18 spray gun with No. 66DS nozzle or equivalent.
- c. Allow 10 minutes air dry between coats (to dullness).
- d. Do not exceed 0.0005 inches (0.013mm) total thickness.
- e. For type I, after spraying, air dry for 1/2 hour and cure at 150 °C (302 °F) for 1 hour. For type II, after spraying, air dry 1/2 hour and cure at 204 °C (400 °F).

6. NOTES

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

6.1 Intended use. The solid film lubricant covered by this specification is intended for use on aluminum, aluminum alloys, copper and copper alloys, steel and stainless steel, titanium, and chromium and nickel bearing surfaces (see appendix for application instructions). It is useful under the following conditions:

- a. To touch up worn surfaces originally coated with lubricant conforming to MIL-L-8937 or MIL-L-46010.
- b. For sliding motion applications such as plain and spherical bearings, flap tracks, hinges, threads, and cam surfaces.
- c. Where conventional lubricants are difficult to apply or retain, or where other lubricants may be easily contaminated with dirt and dust.
- d. For use within 12 months of the date of manufacture.
- e. Where temperatures may range from -90 to 400 °F (-68 to 204 °C).
- f. If mechanisms are operated at infrequent intervals or are lubricated for life.
- g. Where long-term corrosion protection is required.
- h. Where a solvent-resistant coating is required.
- i. Where a lubricant requires extremely heavy load ability in initial start-up of heavy loaded mechanism designed for fluid lubrication.

6.1.1 Use limitations. This lubricant should not be used under the following conditions:

- a. On materials which will be adversely affected by the curing temperatures of 150 - 204 °C (302 - 400 °F) for 1 hour.
- b. In operations consisting of rotary motion above 100 rpm under heavy loads where the possibility of conventional fluid lubricant contamination exists. The cured lubricant film is highly resistant to conventional fluid lubricants, but the high fluid pressures developed in heavily loaded sleeve

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type bearings drastically reduces the wear life provided by the solid lubricant film.

- c. On bearings containing rolling elements.
- d. Where there is potential contact with liquid oxygen.

6.1.2 Corrosion protection life. This lubricant can be expected to provide corrosion protection for five years in indoor storage and approximately two years protection in outdoor storage when lubricant is applied over phosphated steel to a thickness of 0.0005 inch (0.013 mm). Where maximum corrosion protection on steel is desired, the lubricant should be applied over phosphated steel to a thickness of 0.001 inch (0.025 mm). The heavier coating can be expected to provide outdoor corrosion protection for approximately four years.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type required (see 1.2).
- c. Packaging, packing, and marking data with requirements in detail (see 5.1).
- d. Quantity (see 6.2.1.1).

6.2.1.1 Age limitation. The lubricant should not be ordered for use beyond 12 months from the date of manufacture.

6.2.1.2 Packaging options. In the preparation of contracts or orders, it must be noted that various options, choices and alternatives, as indicated in MIL-STD-290, may be exercised in the preparation of this lubricant for delivery.

6.3 Qualifications. Awards will be made only for products which are qualified for inclusion on the qualified products list at the time set for the opening bids. Products shall not be considered for inclusion in QPL-46010 until such time as the appropriate departmental activity has reviewed all pertinent Material Safety Data Sheets. This qualification will be approved by the qualifying activity for a period not to exceed five years from the date of original qualification. If a product is submitted for requalification and there has been no change in specification requirements, the qualifying activity may, at its discretion, waive complete retesting or require only partial retesting of the product to determine its continued acceptability. The activity responsible for the qualified products list and information pertaining to qualification is US ARMY BELVOIR RDE CTR, ATTN SATBE FL, FT BELVOIR VA 22060-5818. Contracting officers will designate the 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 sheets are listed in appendix B of FED-STD-313.

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6.4 Part or Identifying Number (PIN). Solid film, heat cured, corrosion inhibiting lubricant furnished under this specification shall be identified by a PIN number consisting of the prefix "M" and basic specification number followed by a two-digit number taken from table I indicating the unit container and type I or II as shown in the following example:

M46010-02 000

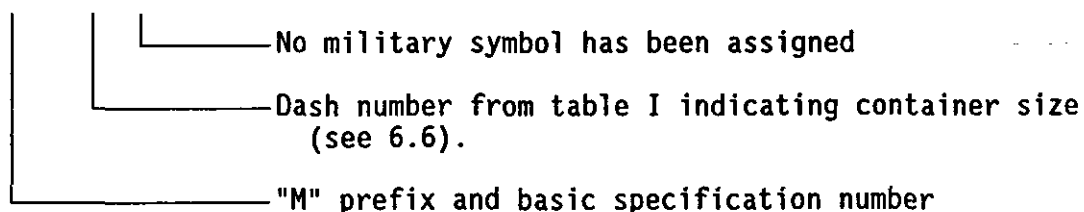


TABLE I. Container size.

Dash Number	Container size
01	1 pint (type I)
02	1 gallon (type I)
03	1 quart (type II)
04	1 gallon (type II)

6.5 Falex lubricant tester. Information pertaining to the Falex lubricant tester (see 3.4.4) can be obtained from the Falex Corporation, 2055 Comprehensive Drive, Aurora IL 60505. The attention of the operator is called to the fact that reproducible test results can only be obtained if the test instrument is in proper calibration.

6.6 International standardization agreements. Certain provisions of this specification (see 1.1) are the subject of international standardization agreement (ASCC Air Standard 15/1, NATO STANAG 1135, Annex C). When amendment, revision, or cancellation of this specification is proposed, which will effect or violate the international agreement concerned, the preparing activity should take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

6.7 Container size and stock number.

TABLE II. Container size and stock number.

National stock number	Container size
9150-00-834-5608	1 pint (type I)
9150-00-985-7255	1 gallon (type I)
9150-00-948-6912	1 quart (type II)
9150-00-948-7025	1 gallon (type II)

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6.7 Subject term (key word) listing.

Lubricant, bonded solid film.
Lubricant, corrosion inhibiting.
Lubricant, heat cured.
Lubricant, solid film.

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

Custodian:
Army - ME

Preparing activity:
Army - ME

Project 9150-A818

Review activities:
Army - AR, AV, MI, AL, SM, AT, MD

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TABLE III. Qualification inspection tests.

Characteristic	Test Method		Requirement Paragraph	
	FED-STD-791	ASTM	Type I	Type II
1	2	3	4	5
Film thickness <u>1/</u>	3816 <u>7/</u>		3.3.8 <u>8/</u>	3.3
Film adhesion		D 2510 <u>7/</u> Procedure A	3.4.1	3.4.1
Resistance to fluids <u>2/</u>		D 2510 <u>7/</u> Procedure C	3.4.2	3.4.2
Thermal stability <u>3/</u>		D 2511 <u>7/</u>	3.4.3	3.4.3
Endurance wear life <u>4/</u>		D 2625 <u>7/</u> Procedure A	3.4.4	3.4.4
Load carrying capacity (Falex pin and Vee-block method <u>4/</u>)		D 2625 <u>7/</u> Procedure B	3.4.5 11,120 N (2500 lbf) average with no single test less than 10,000 N (2250 lbf)	3.4.5 8900 N (2000 lbf) average with no single test less than 7780 N (1750 lbf)
Aluminum corrosion resistance <u>5/</u>	5331 <u>7/</u> (type I <u>6/</u>) 4001.2 (type II <u>5/</u>)	D 2649 (type I)	3.4.6	Not required
Corrosion protection			3.4.7	Not required
Solids content (4.6.3)			Not required	3.4.8
Storage capability			Not required 3.4.10	3.4.9 3.4.10

- 1/ Film thickness is determined after panels are prepared in accordance with FED-STD-791, method 3816 and air dried and baked for 60 ±5 minutes at:
- 150 ±3 °C (302 ±5 °F) for type I.
 - 204 ±3 °C (400 ±5 °F) for type II.
- 2/ Test fluids shall be in accordance with table IV.
- 3/ Any condensation shall be removed with clean, dry compressed air. The dried panel shall then be subjected to the film adhesion test.
- 4/ The surface of test pins and Vee-block shall be pretreated with phosphate in accordance with DOD-P-16232 or grit blasted (120 steel grit, 50-60 RMS).
- 5/ All lubricants film thicknesses must fall within 0.0002 - 0.0005-inch when prepared in accordance with 4.5.2 (type II) before placing in salt fog cabinet in accordance with FED-STD-791, method no. 4001.

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- 6/ The panels shall be subjected to 4 cycles. Each cycle consisting of 2 hours spray time and 24 hours drying time before inspection.
- 7/ When performing ASTM D 2510, D 2511, D 2625, or FED-STD-791 Methods 3816 or 5331 for surface cleaning use naphtha, aliphatic conforming to TT-N-95 or any EPA compliant cleaner that sufficiently cleans surfaces to pass ASTM F 22 instead of MIL-T-27602, Trichloroethylene Oxygen Propellant Compatible, MIL-C-81302, Cleaning Compound, Solvent, Trichlorotrifluoroethane, or MIL-T-81533, 1,1,1-Trichloroethane (Methyl Chloroform), Inhibited, Vapor Degreasing.
- 8/ 0.0002 - 0.0005 in. (0.005 - 0.013 mm)

TABLE IV. Test fluids.

Fluid	Specification
1,1,1-Trichloroethane, Inhibited, Vapor Degreasing.	MIL-T-81533
Anti-icing fluid.	MIL-A-8243, any type
Cleaning compound, solvent for bore of small arms and automatic weapons.	MIL-C-372
Trichlorotrifluoroethane.	MIL-C-81302
Reagent water.	ASTM D 1193, type III
Substitute Ocean Water.	ASTM D 1141, Vol. 31
Hydraulic fluid, Synthetic hydrocarbon base.	MIL-H-83282
Turbine fuel.	MIL-T-5624, Grade JP-4
Lubricating oil, aircraft turbine engine, synthetic base.	MIL-L-23699
Damping fluid, silicone base (dimethyl polysiloxane).	VV-D-1078, any type
Lubricating oil, weapons, low temperature.	MIL-L-14107
Lubricant, semi-fluid (automatic weapons).	MIL-L-46000
Lubricant, cleaner and preservative for weapons and weapons systems.	MIL-L-63460

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INSTRUCTIONS FOR APPLYING LUBRICANT, SOLID-FILM,
HEAT-CURED, CORROSION INHIBITING

10. SCOPE

10.1 Scope. This appendix is a mandatory part of the specification. The information contained herein is intended for guidance for surface pretreatment, temperature, and baking time required to cure the solid film lubricant when it is applied over the bearing surfaces of various metals.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

QQ-P-35 - Passivation Treatments for Corrosion-Resisting Steel.

MILITARY

MIL-F-495 - Finish, Chemical, Black, for Copper Alloys.

MIL-M-45202 - Magnesium Alloy, Anodic Treatment of.

30. REQUIREMENTS

30.1 General application instructions for all metals. Do not touch the pre-treated surfaces with the fingers. Apply the lubricant by brushing, dipping, or spraying to a film thickness of 0.005 to 0.013 mm (0.0002 to 0.0005 inch) and permit the coated parts to air dry for at least 30 minutes to assure complete removal of solvent. Bake at 150 °C (302 °F) for one hour or 204 °C (400 °F) for types I and II respectively. The coated surface of the piece must remain at the cure temperature for the specified time. This may require that the coated piece remain in the oven for a period longer than that specified to assure compliance with this requirement.

The use of a thermocouple attached to the coated surface to indicate the temperature of the coating has been found to be satisfactory for determining the beginning of the timed baking period.

30.2 Application on aluminum and aluminum alloys. Vapor degrease the surfaces to be coated with 1,1,1-trichloroethane meeting the requirements of MIL-T-81533. Anodize and seal the surface in accordance with MIL-A-8625, types I, II, or III, class 1.

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30.3 Application on copper and copper alloys. Vapor degrease the surface with 1,1,1-trichloroethane meeting the requirements of MIL-T-81533. Sandblast the surfaces with 130 mesh clean, dry sand. Form a black oxide finish on the surfaces in accordance with MIL-F-495.

30.4 Application on magnesium and magnesium alloys. Vapor degrease the surfaces to be coated with 1,1,1,-trichloroethane meeting the requirements of MIL-T-81533. Anodize the surface in accordance with MIL-M-45202, type I, class A, B, or C.

30.5 Application on steel. Vapor degrease the surfaces to be coated with 1,1,1-trichloroethane meeting the requirements of MIL-T-81533. Sandblast the surfaces with 120 mesh clean, dry sand or steel grit. Phosphatize in accordance with DOD-P-16232, type M, class 3 or type Z, class 3.

30.6 Application on stainless steels. Vapor degrease the surfaces to be coated with 1,1,1-trichloroethane meeting the requirements of MIL-T-81533. Sandblast the surfaces with 120 mesh clean, dry sand. Passivate the surfaces with QQ-P-35, types I, II, or III as applicable.

30.7 Application on titanium and titanium alloys. Degrease the surfaces to be coated with aliphatic naphtha meeting the requirements of TT-N-95. Sandblast the surface with 120 mesh clean, dry sand or steel grit and alkaline anodize.

30.8 Engineering tolerances. The operating thickness of this lubricant ranges for 0.005 to 0.013 mm (0.0002 to 0.0005 inch) per lubricated surface. This thickness seldom requires alteration of established clearances between moving parts. There is one exception. The lubricant coating thickness must be considered in the case of small parts which normally operate with very little clearance. The cured lubricant film is relatively soft and any interference produced by the thickness of the lubricant will cause rapid wear of the lubricant film to the point where interference is eliminated.

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.

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1. RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MIL-L-0046010 C	2. DOCUMENT DATE (YYMMDD) 931206
3. DOCUMENT TITLE LUBRICANT, SOLID FILM, HEAT CURED, CORROSION INHIBITING			
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 (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME US ARMY BELVOIR RDE CTR		b. TELEPHONE (Include Area Code) (1) Commercial (703) 704-2150 (2) AUTOVON 654-2150	
c. ADDRESS (Include Zip Code) ATTN: SATBE TSE 10101 GRIDLEY RD, STE 104 FT BELVOIR, VA 22060-5818		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	