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| INCH-POUND |
| MIL-DTL-87177B |
| <u>23 September 2014</u> |
| SUPERSEDING |
| MIL-L-87177A |
| 09 February 1990 |

DETAIL SPECIFICATION

LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC

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

1. SCOPE

1.1 Scope. This specification covers a synthetic, lubricant, water displacing corrosion preventive compound which may be applied from gas pressurized containers, or by dipping or brushing.

1.2 Classification. The compound will be furnished in the specified types and grades (see 6.2).

1.2.1 Types. The compound types will consist of the following:

- a. Type I: Pressurized spray container (for spray application).
- b. Type II: Bulk form.

1.2.2 Grades. The compound grades will be designated as follows:

- a. Grade B: Lubricant, water displacing, synthetic, with added corrosion inhibitor.
- b. Grade C: Lubricant, dry spray, synthetic.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 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

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| Comments, suggestions, or questions on this document should be addressed to: AFLCMC/WWME, Hill AFB, UT 84056. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil |
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FSC 9150

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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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM B 117 | Method of Salt Spray (Fog) Testing (DoD adopted) |
| ASTM D 877 | Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes (DoD adopted) |
| ASTM D 942 | Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method (DoD adopted) |
| ASTM D 1310 | Flash Point of Liquids by Tag Open-Cup Apparatus (DoD adopted) |
| ASTM D 2266 | Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method) (DoD adopted) |

(Copies of ASTM standards may be obtained from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. Electronic copies of ASTM standards may be obtained from <http://www.astm.org>).

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

| | |
|-------------|--|
| SAE-AS22805 | Method of Salt Spray (Fog) Testing (DoD adopted) |
| SAE-AMS5046 | Carbon Steel, Sheet, Strip, and Plate |

(Application for copies should be addressed to SAE, Inc., 400 Commonwealth Drive, Warrendale PA 15096.) Electronic copies may be obtained from <http://www.sae.org/servlets/index>

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), 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 First article. When specified (see 6.2.2.1), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material safety data sheet. Material safety data sheets shall be prepared in accordance with FED-STD-313 and 29 CFR 1910.2100. When FED-STD-313 is at variance with the CPR, 29 CFR 1910.2100 shall take precedence, modify and supplement FED-STD-313.

3.3 Properties. The compound shall conform to the properties specified in table I.

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3.3.1 Type I compound. The type I compound (See table I) shall be contained in a gas pressurized container with a 80 percent volume of the compound and 2.7 percent volume of carbon dioxide.

3.3.2 Type II compound. The type II compound (see table I) shall be in bulk form.

3.3.3 Type packaging

3.3.3.1 Packaging of compound in gas pressurized containers. The pressurized containers shall hold 16 ounces. The containers shall conform to class 2, type IX of PPP-C-96 with a valve opening diameter suitable for the specified valve.

3.3.3.2 Nonpressurized containers. Nonpressurized packaging of the compound shall be in containers conforming to PPP-C-96, type VIII.

3.4 Performance

3.4.1 Type I – pressurized container. The pressurized container shall meet requirements specified herein and shall meet Department of Transportation requirements.

3.4.1.1 Leakage. The pressurized container shall not leak or become distorted when tested as specified in section 4.

3.4.1.2 Content. The pressurized containers shall contain a minimum of 16 ounces when tested as specified in section 4.

3.4.1.3 Performance of compound. The compound packaged in the pressurized containers shall spray uniformly, adhere to the panel, and shall not foam excessively or sag when tested as specified in section 4.

3.4.2 Type II – bulk form. When tested as specified as applicable in section 4, the compound shall meet the properties of table I.

3.4.3 Corrosion resistance. Grade B compound shall show no evidence of corrosion as specified in table I when tested as specified in section 4.

3.4.4 Toxicity. The compound 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.

3.5 Workmanship. The compound shall be homogeneous, free from grit, abrasives and water. A typical formulation is given in table I. The exterior orifice of the pressurized containers shall be symmetrical and free of ragged edges, and the exterior orifice, if drilled, shall be symmetrical and in direct alignment with angle of discharge.

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TABLE I. Physical and chemical properties.

| Characteristics | Limits |
|--|--|
| Dryness | 0.0100 gram (max) |
| Flash point | 243°C(470°F)(min) |
| Dielectric breakdown | 25,000 volts (min) |
| Lubricity | 1.20 mm wear scar diameter (max) |
| Residue soluble trichlorotrifluoroethane | No visible residue |
| Oxidation stability | Less than 5 pounds per 100 hours |
| Grade B corrosion | No evidence of corrosion on the resistance base metal in accordance with methods specified in section 4. |
| Sprayability | Sprayable |
| Grade C shall meet all the physical and chemical properties in table I except the corrosion resistance (Grade B) requirements. | |

4. VERIFICATION

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

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.2.1.

4.2.1 Test conditions. In general, physical tests contained in this specification shall be made under controlled atmospheric conditions having a relative humidity of 50 + 5 % and a temperature range of from 21°C to 27°C (70°F to 80°F). Waiver of this requirement may be permitted where proper conditioning facilities are not available for control testing. However, for referee purposes, the specified tests shall be made upon the compound under the specified atmospheric conditions.

4.2.2 Specimen for test

4.2.2.1 Materials. The material for the test disks and panels shall be carbon steel conforming to composition 1020 of SAE-AMS5046.

4.2.2.2 Size of test disk and panels. Test panels for tests requiring compound coatings shall be 2 by 4 by 1/8 inches; the dryness tests shall require disks with a diameter of 2-1/8 inches and a thickness of 1/16 inch.

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4.2.2.3 Preparation of test panels (or disks). Panels (or disks) shall have all sharp edges and burrs removed and shall have all holes chamfered to prevent injury in handling. The panels (or disks) shall be surface ground and hand polish with a 240 grit silicon carbide or aluminum oxide cloth or paper to produce a surface finish of 10 to 20 microinches (rms). Iron oxide or so-called "wet or dry" papers or cloths shall not be used.

4.2.2.4 Cleaning test panels (or disks). The utensils and cloths used in the cleaning of test panels (or disks) shall be clean and free of contamination. Solvents shall be fresh and renewed frequently. In all stages of treatment the handling of panels (or disks) with the bare hands shall be avoided. The panels (or disks) shall not be permitted to contact contaminated surfaces during the cleaning procedure and shall be handled by tongs and hooks during and after dipping. After polishing, they shall be cleaned with a surgical gauze swab, in a beaker of hot mineral spirits conforming to type I of MIL-PRF-680. Cleaning and scrubbing shall be followed by dipping in (1) a second container of hot mineral spirits, (2) boiling 95 percent methanol, and (3) boiling absolute methanol. The panels (or disks) shall be allowed to dry and shall then be stored in a desiccator until ready for use. If storage of more than 24 hours occurs, the surface preparation shall be repeated starting with the hand polishing.

4.2.2.5 Coating of the test panels (or disks). Application of the compound to the test panels (or disks) shall be carried out under the atmospheric conditions of 4.2.1. The panels (or disks) shall be held at an angle of 30 degrees from the horizontal. A coating of the compound shall be sprayed on the panels (or disks) from a pressurized container or a container conforming to SAE-AS22805 held 12 inches away. After ten minutes, a second coating shall be sprayed on. The combined thickness of the two coats after drying shall be 1.2 to 1.5 mils. After application they shall be conditioned for 24 hours under the atmospheric conditions of 4.2.1 in a draft free, dust free, and fume free atmosphere.

4.2.3 Inspection lot. An inspection lot shall consist of all material produced during a single batch operation and offered for acceptance at one time.

4.3 First article inspection

4.3.1 Waiver of article sample inspection. If a contractor has previously furnished the compound in accordance with the requirements of this specification and his product has been found to be satisfactory, the requirement for a first article sample and its submittal for any subsequent contract or order may be waived at the discretion of the procuring activity.

4.3.2 First article samples. First article sample shall consist of at least five type I filled pressurized containers (see 3.3.1), or 5 quarts of the type II compound (see 3.3.2). Samples shall be selected at random from materials (see 3.1) which have been manufactured or used for filling the contract.

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4.3.2.1 Identification of samples. Samples shall be plainly identified by securely attached durable tags marked with the following information:

LUBRICANT, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING,
SYNTHETIC GRADE _____

Samples of material subjected to first article

Name of Manufacturer (Plant in which material is manufactured)

Manufacturer's Designation

Date of Manufacture

Submitted by (Name) (Date) for Contract No. _____

The manufacturer shall submit a copy of test results with the samples showing conformance with all the requirements of this specification and the applicable requirements of regulation 49 CFR 173.300 of the Department of Transportation. The manufacturer shall submit a certified statement specifically identifying each ingredient in the compound by chemical name, source and percentage by weight.

4.3.3 First article tests. First article sample(s) shall be subjected to all the tests specified in table II to determine compliance with the requirements of section 3 herein.

TABLE II. First article testing. 1/

| Characteristics | Requirements | Test method | ASTM |
|---|--------------|-------------|-----------|
| Dryness | 3.3, table I | 4.5.1 | |
| Flash point | 3.3, table I | | D 1310 |
| Dielectric breakdown | 3.3, table I | | D 877 |
| Lubricity | 3.3, table I | | D 2266 2/ |
| Residue soluble in trichlorotrifluoroethane | 3.3, table I | 4.5.2 | |
| Leakage | 3.4.1.1 | 4.5.3 | |
| Content | 3.4.1.2 | 4.5.4 | |
| Performance of pressurized containers | 3.4.1.2 | 4.5.5 | |
| Oxidation stability | 3.3, table I | | D 942 |

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TABLE II. First article testing - Continued 1/

| Characteristics | Requirements | Test method | ASTM |
|---|--------------|-------------|------|
| Grade B corrosivity | 3.4.3 | 4.5.6 | |
| Sprayability | 3.3, table I | 4.5.7 | |
| Grade C shall meet all the first article testing in table II, except the corrosion resistance (Grade B) requirements. | | | |

1/ Refer to 4.2.1

2/ Compound shall be weathered before loading into ball pot.

4.4 Quality conformance inspection. 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 Sampling plan A. One type I filled pressurized container (see 3.3.1) and one quart of the type II compound (see 3.3.2) shall be selected in accordance with ANSI/ASQ Z1.4, inspection level S-3 with an AQL 4.0 percent defective and shall be subjected to the tests specified in table III.

TABLE III. Quality conformance inspection. 1/

| Inspection | Requirement paragraph | Test paragraph |
|---------------------------------------|-----------------------|----------------------|
| Grade B resistance | 3.4.3 | 4.3, 4.4, 4.5, 4.5.6 |
| Leakage | 3.4.1.1 | 4.5.3 |
| Contents | 3.4.1.2 | 4.5.4 |
| Performance of pressurized containers | 3.4.1.3 | 4.5.5 |

1/ Refer to 4.4

4.4.2 Sampling Plan B. A random sample of type I filled containers shall be selected in accordance with ANSI/ASQ Z1.4, inspection level I with an AQL 2.5 percent defective from each inspection lot (see 4.2.3). The sample container(s) shall be subjected to the tests specified in table II.

4.4.3 Certification. The manufacturer shall certify that there has been no formulation or process change from that which resulted in the production of the first article inspection sample (see

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4.3.2). Each ingredient material shall be identified with the name of its manufacturer and that manufacturer's trade name and formula number.

4.4.4 Inspection of packaged containers. The packaging containers, packing, and marking of type I and type II compound shall be inspected to determine conformance to the requirements of section 5. Selection shall be in accordance with ANSI/ASQ Z1.4, inspection level S-2, 2.5 percent defects per 100 units. Sample units used in sampling plans A and B shall be used for this inspection (see 4.3.2).

4.5 Method of inspection.

4.5.1 Dryness test. Three test disks (4.2.2.2) prepared as specified in 4.2.2.3 shall be cleaned as specified in 4.2.2.4, coated as in 4.2.2.5, and allowed to hang in a vertical position for two hours. They shall then be weighed and completely immersed vertically in talcum powder and withdrawn immediately. They shall then be reweighed to the nearest 0.0001 gram. The average change in weight shall be recorded. This procedure shall be repeated with test disks which have not been coated. These shall be used as controls. The average weight increase of the coated panels as compared with the weight increase of the uncoated panels shall be the measure of dryness.

4.5.2 Determination of solubility in R-134. At least three dip clean coated test panels shall be dipped in boiling 95 percent methanol and let stand for one hour. After one hour, the test panels shall be rinsed twice with fresh R-134 and examined visually. There shall be no visible residue on panels.

4.5.3 Leakage test. The pressurized container shall be completely submerged for five minutes in water maintained at 130°F + 2°F during which it shall be observed for the emission of bubbles. Distortion of the container or the emission of bubbles from any part of the container shall be considered evidence of leakage.

4.5.4 Determination of container weight. A sample container shall be weighed and then shall be sprayed at three minute periods with one-minute intervals until the container is exhausted. The container shall be re-weighed. The net difference shall be at least 16 ounces by weight.

4.5.5 Performance of pressurized containers. Panels as described in 4.5.1 shall be used. A panel shall be supported such that the longer dimension forms a 45 degree angle with the horizontal. Type I shall be sprayed on the panel from a distance of 12 inches. The panel shall be examined for uniformity of spray, foaming, and adherence to the substrate. After a 10 second pause the same panel shall be resprayed and examined for adhesion and sagging. After a 5 second pause the same panel shall be resprayed again and likewise examined.

4.5.6 Grade B – corrosion resistance test. The corrosion resistance test shall be conducted in accordance with the procedure specified in ASTM B 117 to determine conformance with 3.4.3.

4.5.7 Sprayability (in pressurized container) test. A filled pressurized container shall be cooled to 0°F held at that temperature for 3 hours, and then stored at 40°F for 20 hours. Immediately after

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conditioning, the container shall be shaken vigorously for 15 seconds and the material sprayed for 30 seconds. The material shall be considered as having passed the test if it can be satisfactorily sprayed.

5. PACKAGING

5.1 Packaging requirements. For acquisition purposes, the packaging requirements shall be as specified in the contract or ordering data (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 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The compounds covered by this specification may be used on any metal surfaces. They are primarily intended for in-service treatment of moving parts. The ability of these materials to lubricate, to prevent corrosion, to displace water and to be used at temperatures up to 20°C (40°F) make these particularly suited for service use. The temperature durability is a particular advantage of this material.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this performance specification.
- b. Grade and type.
- c. Quantity. (Specify number of containers.)
- d. Packaging desired (see 5.1)
- e. Level of packing required (see 5.1)
- f. Labeling or other special marking required (see 5.1)

6.2.1 Completed material safety data sheets. Contracting officers will identify those activities requiring copies of completed material safety data sheets prepared in accordance with 3.2. The pertinent government mailing addresses for submission of data are listed in appendix B of FED-STD-313.

6.2.2 Contract provision. Contracts will specify the following provision for first article inspection.

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6.2.2.1 First article. When a first article is required for inspection and approval (see 3.1, 4.4, and 6.2), the contract will specify the following provision for first article inspection. When a contractor is in continuous production of the compound from contract to contract, consideration should be given to waive the first article inspections. If inspection is required, indicate:

a. If first article inspections are conducted at the contractor's plant or a government approved laboratory, an inspection report will be forwarded to the procuring activity for certification.

b. That the approval of first article samples or the waiving of the first article inspection will not relieve the contractor of his obligation to fulfill all other requirements of the specification and contract.

6.3 Typical formulation of compound for Grade B. Grade B is intended for applications where severe corrosion is possible. Grade B can be used for control of surface static electricity and as a barrier film to minimize surface contamination.

6.4 Samples. Samples will be furnished at no cost to the Government, and the manufacturer will pay the transportation charges to and from the designated point where tests are to be made. In the case of failure of the sample or samples submitted, considerations will be given to the request of the manufacturer for additional test only after it has been clearly shown that changes have been made in the product which the Government considers sufficient to warrant additional tests, and a new designation is given the material by the manufacturer.

6.5 Heat testing of metal containers. Section 173.306 of the Department of Transportation Regulations specifies that each completed metal container filled for shipment must be heated until the contents reaches a minimum temperature of 130°F without evidence of leakage, distortion, or other defects.

6.6 Subject term (key word) listing.

Compound
Gas pressurized containers
Synthetic sea water

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

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