

NOT MEASUREMENT
SENSITIVE

MIL-PRF-29608B(AS)
18 August 2014
SUPERSEDING
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PERFORMANCE SPECIFICATION

CLEANING AND CLEANING-LUBRICATING COMPOUNDS, ELECTRICAL CONTACT

This specification is approved for use by the Naval Air Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers cleaning and cleaning-lubricant aerosol compounds that do not contain Ozone Depleting Substances (ODSs) for use on electrical contacts, connectors, and switches.

1.2 Classification. The compounds are furnished in the following classes:

Class C - Cleaning compound with no lubricant.

Class L - Cleaning compound containing 1 to 2 percent by weight of silicone lubricant.

2. APPLICABLE DOCUMENTS

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

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 4L8000B120-3, Highway 547, Lakehurst, NJ 08733-5100 or emailed to michael.sikora@navy.mil. 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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2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATION

VV-D-1078 - Damping Fluid, Silicone Base (Dimethyl Polysiloxane)

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-5425 - Plastic, Sheet, Acrylic, Heat Resistant
MIL-PRF-25690 - Plastic, Sheet and Formed Parts, Modified Acrylic Base, Monolithic, Crack Propagation Resistant
MIL-PRF-81309 - Corrosion Preventive Compounds, Water Displacing, Ultra-thin Film
MIL-PRF-83282 - Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537

(Copies of these documents are available online at <http://quicksearch.dla.mil> or <https://assist.dla.mil>.)

2.2.2 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 of these documents are those cited in the solicitation or contract.

CODE OF FEDERAL REGULATIONS

40 CFR 82 - Protection of Stratospheric Ozone
40 CFR 401 - Effluent Guidelines and Standards - General Provisions

(Copies of these documents are available online at <http://www.gpo.gov/fdsys/>.)

DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL TOXICOLOGY PROGRAM (NTP)

Report on Carcinogens

(Copies of this document are available online at <http://ntp.niehs.nih.gov/pubhealth/roc/index.html>.)

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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.

ASTM INTERNATIONAL

- ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
- ASTM D3065 - Standard Test Methods for Flammability of Aerosol Products
- ASTM F484 - Standard Test Method for Stress Cracking of Acrylic Plastics in Contact with Liquid or Semi-Liquid Compounds

(Copies of these documents are available from www.astm.org.)

SAE INTERNATIONAL

- SAE AMS-QQ-A-250/5 - Aluminum Alloy Alclad 2024, Plate and Sheet (DoD Adopted)
- SAE AMS-P-83310 - Plastic Sheet, Polycarbonate, Transparent

(Copies of these documents are available from www.sae.org.)

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, 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), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material. The formulation is optional; however, it shall be in conformance with the requirements of 3.2.1, 3.2.2, and 3.2.3.

3.2.1 Solvent vapor pressure. The pressure of cleaning compound shall be calculated in accordance with the formula in 4.5.1. The calculated vapor pressure of product shall be not less than 190 millimeters of mercury (mm Hg) nor greater than 520 mm Hg at 20 °C (68 °F). In addition, no component shall have a vapor pressure of less than 30 mm Hg at 20 °C (68 °F) (see 6.6).

3.2.2 Lubricant. The total amount of lubricant in Class L shall be 1 to 2 percent by weight. The lubricant shall be dimethyl polysiloxane fluid (silicone oil) conforming to VV-D-1078 with a viscosity of 100 to 500 centistokes (cs) at 25 °C (77 °F).

3.2.3 Propellant. The propellant shall have zero Ozone Depleting Potential (ODP) and shall deliver a uniform spray of usable product. A hydrofluorocarbon (HFC) may be used

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providing it conforms to Environmental Protection Agency (EPA) regulations for aircraft maintenance use of aerosol products.

3.3 Safety.

3.3.1 Flame extension. When tested in accordance with 4.5.2, the flame extension from the aerosol container shall be not greater than 6 inches.

3.3.2 Toxicity. The Threshold Limit Value (TLV) for the total product shall be a minimum of 100 parts per million (ppm). In addition, the cleaning compound shall comply as follows:

- a. The compound shall not contain any known or suspected human carcinogens as specified in the National Toxicology Program's Annual Report on Carcinogens.
- b. The compound shall not contain any toxic pollutants as specified in 40 CFR 401.
- c. The compound shall not contain any Ozone Depleting Substances as specified in 40 CFR 82.

3.4 Appearance. When examined as specified in 4.5.3, the compound shall be homogeneous and free of suspended matter, sediment, grit, or other foreign material.

3.5 Dispenser.

3.5.1 Type. When visually examined in accordance with 4.5.4.1, the dispenser shall be of the aerosol type and shall have an on/off finger controlled pressure type of dispensing device to produce the spray. When not in use, the dispensing device shall be protected against activation by a snug-fitting protective cap. This cap shall provide a clearance of 1/8 inch (33 mm) over the dispensing device. A 5-inch (127-mm) hollow cylindrical plastic extension designed to fit into the dispensing device, for directing the spray into hard to reach places, shall be attached to the outside of the dispenser by tape, adhesive, or similar material.

3.5.2 Size. The dispenser shall be capable of containing 5, 12, or 22 ounces (142, 340, or 625 grams) of the cleaning or cleaning-lubricating compound (see 6.2) without exceeding 90 percent at 21 °C (70 °F) of the internal volume of the dispenser.

3.5.3 Leakage. When tested as specified in 4.5.4.2, the pressurized dispenser shall not leak or become distorted.

3.5.4 Net contents. The average net contents per dispenser shall be not less than the amount specified for the size dispenser (see 6.2) when tested in accordance with 4.5.4.3.

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3.5.5 Precautionary markings. Each dispenser shall contain precautionary information, marked directly on the surface of the dispenser with marking material which is not affected by the cleaning compound. The warning shall be as follows:

CAUTION: Contents under pressure.
 Do not puncture.
 Use with adequate ventilation.
 Keep away from direct sunlight, radiators, hot water, and other heat.
 Avoid prolonged or repeated breathing of vapors or contact with skin.
 Do not take internally.

3.6 Effect on plastics. After testing as specified in 4.5.5, Class C cleaning compounds shall not cause crazing or strength loss of acrylic or polycarbonate. Class L compounds shall not cause crazing of polycarbonate.

3.7 Effect on elastomers. The cleaning compounds shall not cause cracking, softening, or swelling to butadiene nitrile rubber (NBR), butadiene styrene (Buna S), butyl rubber or ethylene propylene rubber (EPDM) after testing as specified in 4.5.6.

3.8 Cleaning efficiency. When tested in accordance with 4.5.7, the cleaning efficiency of the compounds shall be equal to or greater than the values specified in table I.

TABLE I. Minimum percent cleaning efficiency.

Soil	Class C	Class L
MIL-PRF-81309	80%	35 %
MIL-PRF-83282	90%	85 %
VV-D-1078	80%	45 %

3.9 Low temperature. After being treated with MIL-PRF-29608 material and tested in accordance with 4.5.8, electrical contacts on parts shall function properly in environmental temperatures as low as -54 °C (-65 °F).

3.10 Storage stability. After storage as specified in 4.5.9, the cleaning compounds shall not have deteriorated and shall meet the requirements for appearance (3.4), leakage (3.5.3) and net contents (3.5.4).

4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

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4.2 First article inspection. The first article inspection shall consist of the tests specified in table II. First time suppliers to this specification shall perform the first article inspections specified herein (see 6.3).

TABLE II. First article inspections.

Characteristic	Requirement	Test paragraph/method
Solvent vapor pressure <u>1/</u>	3.2.1	4.5.1
Lubricant <u>1/</u>	3.2.2	----
Propellant <u>1/</u>	3.2.3	----
Flame extension	3.3.1	4.5.2
Toxicity <u>1/</u>	3.3.2	-----
Appearance	3.4	4.5.3
Dispenser	3.5	4.5.4.1
Leakage	3.5.3	4.5.4.2
Net contents	3.5.4	4.5.4.3
Effect on plastics	3.6	4.5.5
Effect on elastomers	3.7	4.5.6
Cleaning efficiency	3.8	4.5.7
Low temperature	3.9	4.5.8
Storage stability	3.10	4.5.9

1/ See 6.6.

4.2.1 First article samples. When first article inspection is required, the first article sample shall consist of four filled dispensers of the class specified in the contract or order (see 6.2 and 6.4). The samples shall be identified by securely attached tags or labels marked with the following information:

Sample for first article inspection
 Cleaning and Cleaning-Lubricating Compound, Electrical Contact,
 MIL-PRF-29608B(AS)
 Class
 Manufacturer
 Manufacturer's product identification
 Batch or lot number
 Date of manufacture

4.3 Conformance inspection.

4.3.1 Lot formation. A lot shall consist of all the cleaning compound or cleaning lubricant produced by one supplier, at one plant, from the same materials, under essentially the same manufacturing conditions and offered for inspection at one time.

4.3.2 Sampling for conformance inspection. Sampling shall be as specified in table III.

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TABLE III. Sampling plan.

Lot size	Number of unit samples selected
1 to 50	2
51 to 500	3
501 to 35000	5
over 35000	8

4.3.3 Inspection procedures. The samples selected in 4.3.2 shall be subjected to the inspections in table IV. There shall be no defects.

TABLE IV. Conformance inspections.

Examination	Paragraph	
	Requirement	Test
Dispenser, type, and size	3.5.1 and 3.5.2	4.5.4.1
Leakage	3.5.3	4.5.4.2
Net contents	3.5.4	4.5.4.3

4.4 Inspection conditions. Unless otherwise specified in the test method or paragraph specified herein, all tests shall be conducted at 21 ± 3 °C (70 ± 5 °F) and 50 ± 10 percent relative humidity.

4.5 Test methods.

4.5.1 Solvent vapor pressure. The solvent vapor pressure (excluding the propellant), P_{total} shall be calculated as follows: $P_{total} = P_1 * x_1 + P_2 * x_2 + P_3 * x_3 + \dots$ for each component (excluding the propellant).

where P_i = the pure component vapor pressure at 20 °C (68 °F) and
 x_i = the component mole fraction concentration

4.5.2 Flame extension. Flame extension testing of the aerosol shall be performed in accordance with ASTM D3065. The flame extension shall conform to the requirements of 3.3.1.

4.5.3 Appearance. A visual examination shall be made of the product after spraying throughout the first article inspection to determine conformance to 3.4.

4.5.4 Dispenser.

4.5.4.1 Visual examination. The dispenser shall be visually examined to determine conformance to 3.5.1 and 3.5.2.

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4.5.4.2 Leakage. Using a filled pressurized dispenser, the solvent shall be sprayed five times for three seconds with a two-second pause between sprays. The dispenser shall then be submerged completely in water maintained at 54 ± 1 °C (130 ± 2 °F) for five minutes. The emission of bubbles indicates leakage. At the end of the five minutes, the dispenser shall be removed from the water and examined for conformance to 3.5.3.

4.5.4.3 Net contents. The net weight of the dispenser shall be determined by the difference between the gross weight and the tare weight. Results shall be in conformance with 3.5.4.

4.5.5 Effect on plastics.

4.5.5.1 Equipment. The equipment used for this test shall be an ASTM D543 compliant Constant Strain Loading Fixture (radius of curvature = 6.2 inches) (see 6.8).

4.5.5.2 Test coupons. The dimensions of the test coupons shall be 0.125 by 0.5 by 5.0 inches. The plastic materials for this test shall consist of:

- a. MIL-PRF-5425 cast acrylic (annealed in accordance with ASTM F484)
- b. MIL-PRF-25690 stretch acrylic
- c. SAE AMS-P-83310 polycarbonate

4.5.5.3 Procedure. The specimens shall be secured in the loading fixture. The product shall be applied onto the top surface of the plastic by spraying back and forth three times in ten seconds from a distance of six inches. The test coupons shall be allowed to air dry for one hour and then shall be examined for crazing and strength loss. Crazing is evident when a flashlight is used to illuminate the specimen from a direction tangent to the specimen bend. Strength loss is evident if, when removed from the fixture, it fails easily when bent by hand (using an unexposed specimen as a control). Test results shall conform to 3.6.

4.5.6 Effect on elastomers. Four elastomeric specimens (butadiene nitrile rubber (NBR), butadiene styrene (Buna S), butyl rubber, and ethylene propylene rubber (EPDM)) shall be used. The product shall be sprayed on each specimen until the surface is completely wet. The specimens shall be re-wetted after 4 and 8 hours and then be permitted to stand for a total of 24 hours. The specimens shall then be examined for conformance to 3.7.

4.5.7 Cleaning efficiency.

4.5.7.1 Specimen preparation. Nine panels, 2 by 5 by 0.020 inch, cut from aluminum alloy 2024 conforming to SAE AMS-QQ-A-250/5 shall be solvent-wiped, weighed (W1), and soiled with the following:

- a. MIL-PRF-81309 (corrosion preventative)
- b. MIL-PRF-83282 (hydraulic fluid)
- c. VV-D-1078 (silicone damping fluid) with a viscosity of 100 to 500 centistokes (cs) at 25 °C (77 °F).

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4.5.7.2 Equipment (see figure 1).

- a. Paint stripper test rack (60 deg incline) attached to a Gardco Washability & Wear Tester with variable traverse rate
- b. Guide for aerosol spray can (60 deg incline)

4.5.7.3 Procedure. The cleaned test panels shall be weighed (weight = W1). The test soil shall be applied using cotton tipped swab to the lower 2.5" of test panel and spread evenly to within about 1/16" of edge. This procedure shall be repeated for the remaining test soils. The weight of the soiled panels shall be recorded as W2. The test panels shall be placed (coated surface facing up with the soiled area at the bottom) on a test rack, such that the test panel forms a 60-degree angle with the horizontal. The rack shall be lined with a laboratory wiper to catch the overspray. Using a 3.5-inch standoff, the traverse rate on the Gardco Washability & Wear Tester shall be set at 3 inches/sec (setting = 1.5). The aerosol can shall be positioned to spray from 3.5 inches away (panel to nozzle) so that spray hits panels at 90 degrees. The aerosol shall be sprayed using three single passes only (not back and forth) on three successive cycles aiming at the top, then middle, then bottom third of the soil. The aerosol shall be allowed to evaporate for 15 minutes, then the reverse of the panel shall be wiped to remove displaced soil. The test panels shall be reweighed and recorded as W3. Cleaning efficiency shall be determined as follows with the average results of each soil reported:

$$\% \text{ CE} = (W2 - W3)/(W2 - W1) * 100$$

The average of three replicates for each soil shall be calculated (9 test panels). Results shall conform to 3.8.

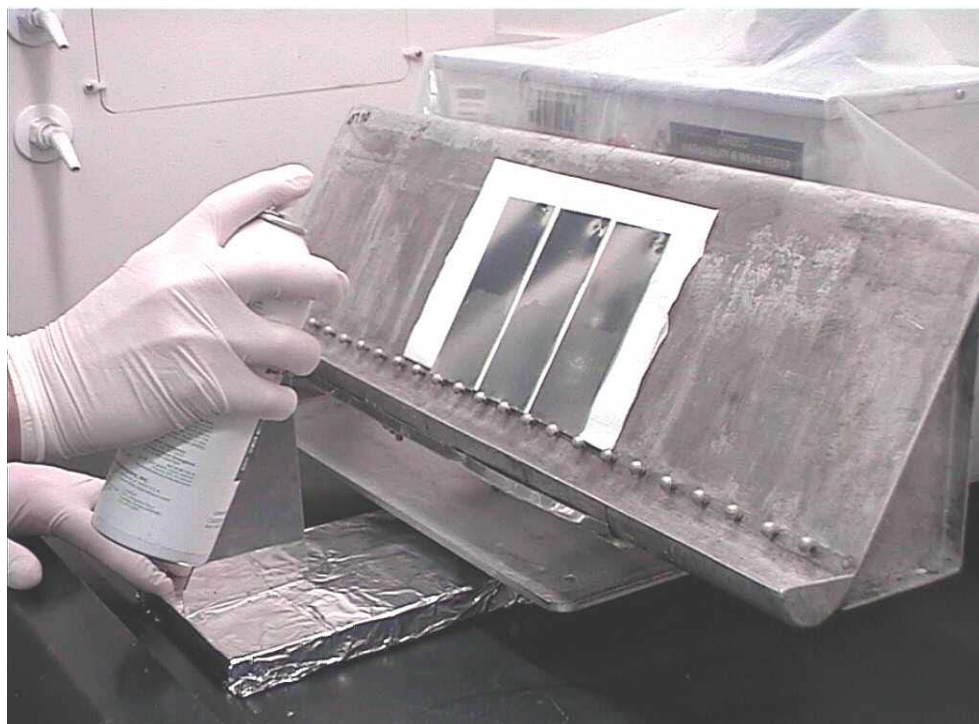


FIGURE 1. Cleaning efficiency test setup.

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4.5.8 Low temperature. Low temperature requirements shall be demonstrated by observing the operation of an in-service electrical part after the part has been cleaned. Conformance to 3.9 shall be noted.

4.5.9 Storage stability. One aerosol dispenser filled with product shall be stored for 12 months at ambient laboratory temperature and humidity. After the storage period, the sample shall be tested for conformance to 3.10.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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 contact cleaner (Class C) or cleaner-lubricant (Class L) is to be used for the cleaning or cleaning and lubrication of electrical contacts. These products contain a mild cleaning agent which will effectively remove light oils and particulates. They should not significantly affect materials; however, they are slightly more aggressive than CFC-113 based products, and may affect some materials in extreme cases of exposure. Class L products contain electronics grade silicone lubricant, which is effective in reducing contact wear and extends the life of switches. The combination of all the properties for the products meet the requirements for a contact cleaner and cleaner-lubricant used within the extremes of the naval aviation environment. There are no commercial equivalents that meet the combination of all properties of MIL-PRF-29608.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Class of compound (see 1.2).
- c. Whether first article inspection is required (see 3.1 and 6.3).
- d. Dispenser size (see 3.5.2).
- e. Packaging requirements (see 5.1).
- f. Copy of the first article test report, if required (see 6.5).
- g. Certifications for solvent, lubricant, propellant and toxicity (see 6.6).

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6.3 First time suppliers. The contracting officer must ensure that first-suppliers to this specification perform and pass the first article inspection prior to delivery of any products. Performance of the first article inspection does not exempt the supplier from performing the conformance tests (see 4.3).

6.4 First article samples. The aerosol cleaner, cleaner-lubricant must be packaged as specified in 49 CFR 173 for delivery to the testing laboratory (see 4.2.1).

6.5 Manufacturer's report. The manufacturer may be requested to submit two copies of their first article inspection report. The report, when requested, shall show conformance to this specification (see 6.2).

6.6 Verification of solvent, lubricant, propellant, and toxicity. For verification of the requirements for solvent (3.2.1), lubricant (3.2.2), propellant (3.2.3), and toxicity (3.3.2), a certification from the manufacturer that the manufacturer's material meets these requirements is required.

6.7 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.8 Equipment for testing effects on plastic. Equipment that meets the requirements of this test method is available through: Material Testing Technology Co., (Palatine, IL), Model No. ASTM D0543.10.

6.9 Subject term (key word) listing.

Aerosol
Hydrofluorocarbon
Ozone Depleting Substance
Silicone
Solvent
Toxicity

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

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CONCLUDING MATERIAL

Preparing activity:
Navy - AS
(Project 6850-2014-007)

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