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MILITARY SPECIFICATION

CLEANING COMPOUND, AEROSPACE EQUIPMENT

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for biodegradable, water dilutable, environmentally safe cleaning compounds for use on aerospace equipment to include aircraft, engines and aerospace ground equipment (AGE).

1.2 Classification. The cleaning compounds covered by this specification shall be of the following types.

Type I - Terpene Based, Solvent Emulsion, Water Dilutable Cleaning Compound

Type II - Water Dilutable Cleaning Compound

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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, noted in the solicitation.

SPECIFICATIONS

Federal

O-S-642 Sodium Phosphate, Tribasic, Anhydrous, Dodecahydrate, & Monohydrate, Technical
QQ-A-250/4 Aluminum Alloy 2024, Plate and Sheet
QQ-A-250/5 Aluminum Alloy Alclad 2024, Plate and Sheet
QQ-A-250/12 Aluminum Alloy 7075, Plate and Sheet

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Code (68) SA-ALC/SFRT, Kelly AFB TX 78241-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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QQ-A-250/13	Aluminum Alloy Alclad 7075 Plate and Sheet
QQ-M-44	Magnesium Alloy Plate and Sheet (AZ31B)
QQ-P-416	Plating, Cadmium (Electrodeposited)
TT-E-529	Enamel, Alkyd, Semi-gloss, Low VOC Content
TT-E-781	Ethylene Glycol Monoethyl Ether, Technical
TT-I-735	Isopropyl Alcohol
TT-L-32	Lacquer, Cellulose Nitrate, Gloss, For Aircraft Use
TT-P-1757	Primer Coating, Zinc Chromate, Low Moisture Sensitivity
PPP-D-729	Drums, Shipping and Storage, Steel, 55 Gallon (208 Liters)
PPP-P-704	Pails, Metal: (Shipping, Steel, 1 through 12 gallons)

Military

MIL-L-2104	Lubricating Oil, Internal Combustion Engine, Tactical Service
MIL-M-3171	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
MIL-S-7952	Steel, Sheet and Strip, Uncoated, Carbon (1020 and 1025) (Aircraft Quality)(ASG)
MIL-P-7962	Primer Coating, Cellulose-Nitrate Modified Alkyl Type, Corrosion Inhibiting, Fast-Drying (For Spray Application Over Pretreatment Coating)
MIL-C-8514	Coating Compound, Metal Pretreatment, Resin-Acid (ASG)
MIL-A-8625	Anodic Coatings, For Aluminum and Aluminum Alloys
MIL-S-8802	Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
MIL-T-9046	Titanium and Titanium Alloy, Sheet, Strip and Plate
MIL-G-21164	Grease, Molybdenum Disulfide, For Low and High Temperatures
MIL-C-22750	Coating, Epoxy Polyamide
MIL-P-23236	Paint Coating System, Fuel Salt Water Ballast Tanks
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-S-81733	Sealing and Coating Compound, Corrosion Inhibitive
MIL-H-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft
MIL-C-83286	Coating Urethane, Aliphatic Isocyanate, for Aerospace Application
MIL-P-83310	Plastic Sheet, Polycarbonate, Transparent
MIL-C-83957	Cleaning and Polishing Pad, Non-metallic (For Aircraft)
MIL-C-85285	Coating: Polyurethane, High Solids

STANDARDS

Federal

FED-STD-141	Paint, Varnish, Lacquer and Related Materials Methods of Inspection, Sampling and Testing
FED-STD-313	Material Safety Data Sheets, Preparation and the Submission of

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Military

- MIL-STD-109 Quality Assurance Terms and Definitions
- MIL-STD-129 Marking For Shipment And Storage
- MIL-STD-147 Palletized Unit Loads

(Copies of specifications, standards, handbooks, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue shall be that in effect on the date of the solicitation.

CODE OF FEDERAL REGULATIONS

- 29 CFR - Labor
- 40 CFR - Protection of Environment
- 49 CFR - Transportation

2.2 Other publications. The following non-government documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the non-government documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM Standards

- A 153 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
- D 56 Test Method for Flash Point by Tag Closed Tester
- D 92 Test Method for Flash and Fire Points by Cleveland Open Cup
- D 460 Method for Sampling and Chemical Analysis of Soaps and Soap Products
- D 846 Specification for Ten-Degree Xylene
- D 1193 Specification for Reagent Water
- D 2240 Test Method for Rubber Property - Durometer Hardness
- D 3951 Practice for Commercial Packaging
- E 70 Test Method for pH of Aqueous Solutions with the Glass Electrode
- F 483 Method For Total Immersion Corrosion Test for Aircraft Maintenance Chemicals
- F 484 Test Method for Stress Cracking of Acrylic Plastics in Contact with Liquid or Semi-Liquid Compounds
- F 485 Test Method for Effects of Cleaners on Unpainted Aircraft Surfaces
- F 502 Test Method for Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces

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- F 519 Method for Mechanical Hydrogen Embrittlement Testing of Plating Processes and Aircraft Maintenance Chemicals
- F 1104 Test Method for Preparing Aircraft Cleaning Compounds, Liquid Type, Water Base, for Storage Stability Testing
- F 1110 Test Method for Sandwich Corrosion Test
- F 1111 Test Method for Corrosion of Low Embrittling Cadmium Plate by Aircraft Maintenance Chemicals

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103.)

SOCIETY OF AUTOMOTIVE ENGINEERS

SAE Standards

- AMS 3204 Synthetic Rubber, Low-Temperature Resistant 25-35
- AMS 3209 Chloroprene Rubber, Weather Resistant, 65-75

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale PA 15096.)

UNIFORM FREIGHT CLASSIFICATION RULES (Current Issue)

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

ALUMINUM ASSOCIATION INCORPORATED

AA Standards

- 2090-T-83 Aluminum-Lithium Alloy

AMERICAN IRON AND STEEL INSTITUTE

AISI Standards

- AISI 4340 High Strength, Low Alloy Steel

INTERNATIONAL CIVIL AIR ORGANIZATION (ICAO)

Technical Instructions for the Safe Transport of Dangerous Goods by Air

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INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)

Dangerous Goods Regulations

INTERNATIONAL MARITIME ORGANIZATION (IMO)

International Maritime Dangerous Goods Code

(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 a reference cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Initial qualification. The cleaning compound furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein and has been listed or approved for listing on the applicable Qualified Products List (QPL) at the time of award of contract.

3.1.2 Retention of qualification. In order to retain qualification approval of a cleaning compound furnished under this specification, the manufacturer will be required to certify, at least every three years, that the cleaning compound is still available from the same plant, can be produced under the same conditions as originally qualified, and meet the requirements of the current issue of the specification. Re-examination and retest of the cleaning compound shall be required by the qualifying activity when the manufacturer has modified the product in any way, the specification is revised to affect the characteristics of the product, or when deemed necessary by the qualifying activity to determine that the product continues to meet all of the specification requirements. Any product which does not conform to all of the qualification retention requirements specified herein will be removed from the qualified products list.

3.2 Materials. The composition and formulation of the cleaning compound shall be optional with the manufacturer within the restrictions specified herein.

3.2.1 Acceptable materials.

3.2.1.1 Type I. Type I shall contain d-limonene as specified in Table I and will consist of a combination of one or more of the following: surfactants, alkaline builders, water conditioning agents, corrosion inhibitors, and/or synthetic detergents to produce a stable, homogeneous product, conforming to the requirements of this specification. Certification from the manufacturer is required on the percentage of total terpenes contained in the cleaning compound. The d-limonene used shall be of a high grade with no extraneous materials.

3.2.1.2 Type II. Type II compound will consist of one or more of the following: surfactants, alkaline builders, water conditioning agents and/or corrosion inhibitors.

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3.2.2 Unacceptable materials. The cleaning compounds shall not contain detectable amounts of any of the following: aliphatic and aromatic hydrocarbons, abrasives, chromates, cadmium, lead, mercury, phenols, cresols, ketones, or chlorinated compounds, except where specified within this specification. The following materials are unacceptable unless they are being used as an essential active ingredient in the cleaner: sodium chloride, urea, sodium sulfate, nitrites, nitrates, sucrose or any sugars. They shall not contain any chemical listed by the current report of known carcinogens of the National Toxicology Program (NTP). The cleaning compounds shall not contain any hazardous compounds as defined in 40 CFR 261 (see para 4.8).

3.3 Toxicity. The cleaning compound shall have no adverse effect on the health of personnel when used for its intended purpose and with proper personal protective equipment (when required). The cleaner must be evaluated and approved for toxicity prior to listing on the QPL.

3.3.1 Formulation. The manufacturer shall submit to the qualifying activity, SA-ALC/SFTT, Kelly AFB TX 78241: (1) written certification that the cleaning compound contains no substance known to be above toxic limits (as defined in 29 CFR and 40 CFR), and (2) a complete formulation including the chemical name and weight percent of each ingredient. Trade names alone will not be considered satisfactory. If this information is proprietary in nature, it will be protected as such.

3.3.2 Material safety data sheet. The manufacturer shall submit a material safety data sheet (MSDS) for each component of the product and for the finished product to the qualifying activity, and to the procuring activity. The MSDS shall be prepared in accordance with the latest revision of FED-STD-313.

3.3.3 Toxicological data. The manufacturer shall submit a copy of pertinent toxicological data/information on their product to the qualifying activity.

3.3.4 Biodegradability. The supplier of the cleaning compound shall furnish certification from the surfactant manufacturers that the surfactants are readily biodegradable in accordance with 40 CFR, Part 796, Subpart D. Biodegradability testing shall be accomplished as specified in paragraph 4.6.24 on the finished product. Biodegradability on the finished product shall be determined over 28 days by the Shake Flask Method monitored by analysis of Total Organic Carbon (TOC). The type I compound shall meet the requirement of a minimum of 75% biodegradable and the type II compound shall meet the requirement of a minimum of 85% biodegradable at the end of the 28 day period.

3.4 Compositional assurance. The cleaning compound shall be tested for nonvolatile matter as specified in paragraph 4.6.1. The concentrated cleaning compound and a 10% solution of the cleaning compound in distilled water shall be tested for pH as specified in paragraph 4.6.3. Results of these tests as well as an infrared spectrogram of the nonvolatile matter (see 4.9) shall be recorded by the qualifying activity for use in quality conformance inspections (see 4.4). Quality conformance inspection results for nonvolatile matter shall not differ by more than 2 percent absolute from the recorded value. Quality conformance inspection results for pH shall not differ by more than 1 pH unit from the recorded value. Quality conformance inspection infrared spectrograms shall show no significant difference when compared to the original qualifying spectrogram.

3.5 Chemical properties.

3.5.1 Chemical requirements. The cleaning compound shall meet the requirements listed in Table I.

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TABLE I. Quantitative Requirements

REQUIREMENT	TYPE I		TYPE II		TEST METHOD
	MIN	MAX	MIN	MAX	
Insoluble Matter (WT%)	---	0.05	---	0.05	4.6.2
Flash Point (°F)					
10% Solution	200	---	---	---	4.6.8
Concentrated Solution	120	---	None ^{\1}	---	
Emulsion Characteristics (ml free water)					
15 min	---	1.0	---	---	4.6.9
8 hours	15.0	---	---	1.0	
24 hours	---	---	15.0	---	
Hard Water Stability (ppm silica)	---	20.0	---	20.0	4.6.10
d-Limonene Content (% vol)	25	40	---	---	4.6.25

^{\1} No flash point should be observed up to the boiling point of the compound.

3.5.2 Volatility. For both types, the volatility of a 10% solution in distilled water shall be less than or equal to the volatility of distilled water when tested in accordance with 4.6.4.

3.5.3 Residue rinsibility. For both types, when a freshly prepared solution of the cleaning compound is tested in accordance with 4.6.5, it shall not leave any residue or stains. A freshly prepared solution is defined as one being prepared no longer than 30 minutes prior to testing. Weight change shall be no greater than that obtained with standard hard water tested under the same conditions.

3.6 Physical properties (all types unless noted).

3.6.1 Heat stability (type II only). The concentrated cleaning compound, when tested in accordance with 4.6.6, will show no marked color change or precipitation and shall not corrode or stain the low carbon test strip (a slight darkening of the steel strip shall not be objectionable). Layering or separation will constitute failure if it does not return to its original homogeneous state upon cooling.

3.6.2 Cold stability. The concentrated cleaning compound shall return to its original homogeneous condition when tested in accordance with 4.6.7.

3.7 Effect on metals.

3.7.1 Hydrogen embrittlement. When tested in accordance with 4.6.11, the concentrated cleaner and a 10% solution of the cleaner in distilled water shall not cause hydrogen embrittlement of cadmium plated AISI 4340 steel.

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3.7.2 Total immersion corrosion. When tested in accordance with 4.6.12, the concentrated cleaning compound and a 10% solution of the cleaning compound in distilled water shall not show any indication of staining, etching, pitting, or localized attack on any of the panels, or cause a weight change of an average of three (3) test panels greater than shown in Table II. A slight discoloration of the panels shall not be objectionable.

TABLE II. Total Immersion Corrosion Requirements

Alloy	Average of 3 Panels Weight Loss, Max (mg/cm ² /168 hrs) \1
Magnesium (AZ 31B-H24) QQ-M-44 surface treated in accordance with Type II of MIL-M-3171	0.21
Aluminum, QQ-A-250/4, T3 surface treated in accordance with Type I, Class I of MIL-A-8625	0.49
Aluminum, QQ-A-250/4, Bare T3 Alloy	0.49
Aluminum, QQ-A-250/12, Bare T6 Alloy	0.49
Titanium, MIL-T-9046, 6A1-4V Class III, Composition C	0.35
Steel, MIL-S-7952, Grade 1020	1.40
Steel, MIL-S-7952, Grade 1020, Hot Dip Galvanized per ASTM A 153	0.50
Aluminum-Lithium, AA 2090-T-83	0.21
Steel, 410 SS, Silver Plated	0.14

\1 Requirements listed is for weight loss after 168 hours. The weight loss after 24 hours should be reported only

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3.7.3 Low-embrittling cadmium plate corrosion. Steel panels coated with low-embrittling cadmium plate immersed in the concentrated cleaning compound and a 10% solution of the cleaning compound in distilled water shall not show a weight change greater than 0.14 mg/cm² for 24 hours when tested in accordance with 4.6.13.

3.7.4 Effects on unpainted metal surfaces. A 10% solution of the cleaning compound in distilled water shall not cause streaking, stains or other deposits that cannot be easily removed with water when tested in accordance with 4.6.14.

3.7.5 Sandwich corrosion. When tested in accordance with 4.6.19, the cleaning compound shall not cause a corrosion rating greater than two (2) on any test panel.

3.8 Effect on painted surfaces. A 25% solution of the cleaning compound in distilled water shall not cause streaking, blistering, discoloration or a permanent decrease in film hardness of more than one (1) pencil hardness level when tested in accordance with 4.6.15. The Type I material shall be tested using only the (F) Enamel and (P) Polyurethane Paint Systems.

3.9 Stress crazing of stretched (type A and C) acrylic plastics. The concentrated cleaning compound and a 10% solution in distilled water shall not cause stress crazing or staining of acrylic plastics when tested in accordance with 4.6.16.

3.10 Stress crazing of polycarbonate plastic. The concentrated cleaning compound and a 10% solution in distilled water shall not cause stress crazing or staining of polycarbonate plastic conforming to MIL-P-83310 when tested in accordance with 4.6.17.

3.11 Long-term storage stability. After being stored for a period of 12 months, in accordance with 4.6.18, the cleaning compound shall not cause corrosion of the shipping container and shall meet all requirements of this specification.

3.12 Foaming properties.

3.12.1 Type I. The cleaning compound, when tested as specified in 4.6.20, shall produce a stabilized foam which shall not break down nor produce more than 80 ml of liquid after standing for 4 minutes.

3.12.2 Type II. The cleaning compound, when tested as specified in 4.6.20, shall produce a stabilized foam which shall not break down nor produce more than 80 ml of liquid after standing for 6 minutes. The foam produced with foam generating equipment shall cling to the underside of panel surfaces held at 60 degrees to the horizontal and shall remain on all panels tested for not less than 60 seconds.

3.13 Workmanship. The cleaning compound shall be a liquid having a uniform and homogenous appearance. The cleaning compound shall be manufactured from materials entirely suitable for the purpose intended and shall be processed in a manner that will produce a product harmless to metal surfaces and humans when used as directed.

3.14 Effect on polysulfide sealants. A 25% solution of the cleaning compound in distilled water shall not change the durometer hardness of the polysulfide sealant by more than 5 units when tested in accordance with 4.6.21.

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3.15 Rubber compatibility. A 25% solution of the cleaning compound in distilled water shall not change the durometer hardness more than 5 units when tested in accordance with 4.6.22.

3.16 Cleaning efficiency. When evaluated in accordance with paragraph 4.6.23, the cleaning compound shall exhibit a cleaning efficiency equal to or better than the control formula.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his 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 when such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests. The inspection and testing of the cleaning compound shall be as follows. The inspection terms used herein are as defined in MIL-STD-109.

- a. Qualification inspection (4.3).
- b. Quality conformance inspection (4.4).

4.3 Qualification inspection. Qualification inspection shall consist of all inspections and tests specified herein.

4.3.1 Qualification samples. The initial qualification samples shall consist of 8 liters (2 gallons) of the cleaning compound. The cleaning compound shall be furnished in containers of the type to be used in filling contract orders. Samples shall be identified as follows and forwarded to the activity responsible for testing, as designated in the letter of authorization from the activity responsible for qualification (See 6.4):

- Samples for Qualification Tests.
- Cleaning Compound, Aerospace Equipment, Type (I or II),
- MIL-C-87937.
- (Manufacturers Product and Code Number)
- (Name and Address of Contractor)
- Submitted by (Name), (Date) for Qualification Testing in Accordance with the Requirements of MIL-C-87937 Under Authorization (Reference Authority Letter).
- (Mixing and Other Important Instructions.)
- (Safety Information and Precautions.)

4.3.2 Test reports. In addition to the qualification test samples, the contractor shall furnish a certified test report showing that the material conforms to all the requirements of this specification with the exception of the storage stability test. Additionally, a certified statement shall be furnished to the qualifying activity that specifically identifies each ingredient including solvent, in the cleaning compound by a readily recognizable chemical name, source and the percentage by weight contained in the compound. Trade names alone will not be considered satisfactory.

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4.3.3 Qualification required. Prior to actual procurement, the cleaning compound shall pass the qualification inspections and requirements specified herein. If the product is later modified in any way, the modified form shall be subjected to and shall pass the same qualification inspections (see 3.1). Any changes or modifications from the formulation used at the initial qualification shall be approved by the qualifying activity and may require requalification. All qualifications will be granted contingent upon compliance with the long term storage stability requirement specified in paragraph 3.11.

4.4 Quality conformance tests. Quality conformance tests for acceptance of the cleaning compound shall consist of the following tests.

- A. Cold Stability
- B. Insoluble Matter
- C. Immersion Corrosion*
- D. Emulsion Characteristics
- E. Nonvolatile Matter
- F. Hard Water Stability
- G. pH
- H. Flash Point
- I. Infrared Spectrogram

*Immersion Corrosion Quality Conformance Test ran on Aluminum QQ-250/4, Bare T3 alloy panel only.

If during quality conformance testing a lot fails any of the above acceptance tests, all tests required for qualification will be reinstated. These qualification tests will be required until two successive lots meet all requirements of the specification, after which quality conformance testing will again be authorized. (See paragraph 4.4.6)

4.4.1 Sampling. Unless otherwise specified, not less than a 3.8 liter (1 gal) container of the cleaning compound shall be selected at random from each lot and subjected to the tests specified in 4.4.

4.4.2 Lot. A lot shall consist of one of the following:

- a. The cleaning compound produced in not more than 24 consecutive hours from a continuous process which is used to fill shipping containers directly from the process output. A continuous process shall be the production of product by continuous input of raw materials and output of finished product by one manufacturer in one plant with no change in manufacturing conditions or materials.
- b. The cleaning compound from individual runs of a batch process which is used to fill shipping containers directly from the process output. A batch process shall be the production of product by runs from single additions of raw materials which are mixed, reacted, and/or purified forming the product.
- c. The cleaning compound from either or both the continuous and batch processes which is held in a single storage tank and subsequently withdrawn to fill shipping containers. The product will be homogeneous at the time of withdrawal and shall not be added to while being withdrawn. After each addition to the storage tank, the contents shall constitute a separate lot.

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4.4.3 Sampling of product. Unless otherwise specified, quality conformance tests shall be made on the sample of product taken directly from the filled containers. The number of filled containers selected for sampling from each lot shall be in accordance with Table III. The first and last containers to be filled within a given lot shall be sampled. Other containers will be selected at random. The contents of each selected container for sampling shall be thoroughly mixed by rolling and inverting immediately prior to sampling. The samples may be obtained in any convenient manner that does not compromise the integrity of the sample. The sampled containers shall be subjected to the inspections specified in 4.4.5.

TABLE III. Sampling for Tests

Number of Containers in lot	Number of Containers to be sampled
2 to 15	2
16 to 25	3
26 to 90	5
91 to 150	8
151 to 280	13
281 to 500	20
501 to 1200	32
1201 to 3200	50
3201 to 10000	80
10001 to 35000	125
35001 to 150000	200
150001 to 500000	315
500001 and over	500

4.4.4 Inspection of materials. The contractor is responsible for insuring that materials and components used are manufactured, tested and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or, if none, in accordance with this specification. (See 2.3)

4.4.5 Inspection of the end item. Examination of the end item shall be made in accordance with the following classification of defects. The lot size, for purposes of determining the sample size in accordance with Table III, shall be expressed in units of filled primary containers for the examination specified in 4.4.5.1, and 4.4.5.2, and in units of shipping containers for the examinations specified in 4.4.5.3.

4.4.5.1 Examination for container defects. The end item containers shall be examined for defects in appearance, closure, construction, workmanship, and markings in accordance with Table IV.

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TABLE IV. Examination for Container Defects

EXAMINATION	DEFECT
-Appearance, construction, and workmanship	Not in container specified, cracked, crushed, or any defect affecting serviceability. Not clean; evidence of dirt, rust, or foreign matter.
-Closure	Any leakage or seepage of contents in either an upright or horizontal position. Closure not as specified.
-Markings	Omitted, illegible, incorrect, or not in accordance with contract requirements.

4.4.5.2 Examination for net contents. The quality of the batch shall be unacceptable if the average net content is less than the specified or indicated quantity.

4.4.5.3 Examination of preparation for delivery. An examination shall be made to determine the packing, palletization, and markings comply with Section 5 and Table V.

TABLE V. Examination of Preparation for Delivery

EXAMINATION	DEFECT
-Packing	Container not as specified. Arrangement or number of unit containers per pallet (as applicable) not in accordance with contract requirements. Loose or inadequate strappings, bulged or distorted containers.
-Palletization	Palletization not in accordance with requirements.
-Markings	Data illegible, incorrect, incomplete or not in accordance with contract.

4.4.6 Rejection and retest. When any sample of the product examined and tested in accordance with this specification fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected. Rejected material shall not be resubmitted for acceptance without prior approval of the qualifying activity. The application for resubmission shall contain full particulars

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concerning previous rejections and all measures taken to correct those defects. Samples for retest shall be taken from previously unopened product containers.

4.5 Testing standards. All laboratory tests shall be conducted at standard conditions unless otherwise specified herein. Standard conditions are defined by FED-STD-141, Section 9. Unless otherwise specified, all chemical tests shall be made with ACS specification reagent grade chemicals. Unless otherwise specified, all product dilutions will be made with distilled water which conforms to the requirements of ASTM D 1193, Type IV, reagent water.

4.6 Test methods.

4.6.1 Nonvolatile matter. Weigh 5 ± 0.01 g of the sample in a porcelain or glass dish about 6 to 8 cm in diameter and about 2 to 4 cm in depth. Dry to constant weight in an air oven at a temperature of $105 \pm 2^\circ\text{C}$. Constant weight is attained when successive heating for 1-hour periods shows a loss (or gain) of not more than 0.1%. Nonvolatile matter determinations shall be made on a minimum of two samples and the average shall be reported. If the two weights differ by more than 0.5% the procedure shall be repeated. The nonvolatile content of the each sample shall be calculated as follows.

$$\% \text{NVM} = \left(\frac{A}{B} \right) \times 100$$

Where: A = Weight of residue

B = Weight of sample

%NVM = Percent nonvolatile matter

4.6.2 Insoluble matter. The concentrated cleaning compound shall be thoroughly agitated and a 200 ml test sample withdrawn. The insoluble matter shall be collected with the aid of a vacuum filtering apparatus consisting of a water tap filter pump, a 2,000 ml Erlenmeyer flask, a size 4 (126 mm ID) Buchner funnel and a piece of 126 mm diameter Whatman No 5 filter paper, or equivalent. The filter paper shall be dried at 60°C (140°F) for 30 minutes in a gravity convection oven, cooled for 3 minutes in a desiccator, and weighed to the nearest 0.1 mg. The filter paper shall be placed in the Buchner funnel so that its circumference coincides with the circumference of the funnel. The vacuum shall be started and the filter paper wetted with approximately 10 ml of distilled water in order to secure it properly in place. The test sample shall be filtered. The sides of the beaker which contained the test sample shall be rinsed with 25 ml of distilled water from a wash bottle, and the rinse transferred to the funnel, insuring that any remaining insoluble matter is completely transferred with the rinse. When all the initial liquid and the rinse have been transferred through the filter, the sides of the funnel shall be washed with 25 ml of distilled water from a wash bottle and the rinse allowed to filter. The vacuum on the flask shall be relieved and the filter paper removed from the funnel. The filter paper shall be dried for 1 hour at 60°C (140°F) in a gravity convection oven, cooled for 3 minutes in a desiccator, and weighed to the nearest 0.1 mg. The percent insolubles shall be calculated as follows:

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$$I = \left[\frac{A - B}{W} \right] \times 100$$

Where: A = Final filter paper weight
 B = Initial filter paper weight
 W = Weight of sample
 I = % wt Insoluble matter

Care should be exercised throughout the final drying and weighing cycle to maintain the flat surface of the filter paper in a horizontal position in order that none of the insoluble matter will be lost. Insoluble matter determinations shall be made on a minimum of two samples and the average shall be reported. If the two results differ by more than 0.5% the procedure shall be repeated.

4.6.3 pH value. The pH value of the concentrated cleaning compound and a 10 percent solution of the cleaning compound in freshly boiled distilled water shall be measured in accordance with ASTM E 70.

4.6.4 Volatility. A petri dish, 9 centimeters in diameter and 1.5 centimeters deep shall be placed on each pan of a two-pan beam balance with a minimum of a ± 0.5 gram precision. A sufficient amount of a 10% solution of the compound in distilled water shall be added to cover the entire bottom of one of the dishes. Distilled water shall be carefully poured in the other dish until the dish containing the compound is counterbalanced. The balance with filled dishes on the pans shall be exposed for 60 minutes in a draft free atmosphere having a temperature of 25 ± 3 °C (75 ± 5 °F). At the end of the exposure period, the comparative weight loss will be determined.

4.6.5 Residue rinsibility. Six smooth aluminum dishes, containing no creases or crevices, shall be cleaned in a solution of Brite-Boy, (from 3D Inc., or equivalent), rinsed, dried, and weighed. Ten ml of a 25% by volume solution of the cleaning compound in standard hard water (See 4.6.10.1) shall be placed in three of the precleaned dishes and tested as follows:

Dry for 7 1/2 hours in a circulating oven at 68 ± 2 °C with full draft. Cool in desiccator overnight and weigh. Rinse with running distilled water for 1 minute. Brush with a sash-type brush containing long-fiber bristles (2.5 cm diameter by 3.8 cm to 6.4 cm long) for 1 minute using distilled water. Rinse for 30 seconds with running distilled water. Dry in oven, cool and reweigh. Standard hard water, prepared as described in 4.6.10.1, shall be tested as control for weight change comparison in the remaining three precleaned dishes, using the same procedure as above.

4.6.6 Heat stability. A 141.75 g sample of the well mixed concentrated cleaning compound shall be placed into each of two clean 255 ml (12 oz) clear glass bottles having approximate dimensions of 24 cm in height by 6.35 cm in diameter (9.5 in x 2.5 in). One bottle containing the concentrated cleaning compound shall be sealed with a screw type cap and stored in a dark place at standard conditions for 6 days (144 hrs) for reference purposes. Place into the second bottle of concentrated cleaning compound a strip of steel, 15.24 cm by 1.27 cm by 0.05 cm (6 in x 0.5 in x 0.02 in) conforming to MIL-S-7952. Clean the steel strip by abrasively polishing to remove surface scale and corrosion followed by immersion for one minute in xylene (ASTM D 846) followed by immersion for one minute in isopropyl alcohol (TT-I-735, grade A) at standard conditions. Seal the bottle containing the concentrated cleaning

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compound and the cleaned steel strip with a screw type cover and shake thoroughly for 1 minute. Place the bottle in a bath maintained at 46 ± 2 °C (115 ± 3 °F) for 5 hours, then remove and allow to cool to ambient conditions for 19 hours. This heating/cooling cycle will be repeated 5 times. After completion of the test period, remove the test strip and inspect the portion of the strip which was immersed in the cleaning compound and the portion exposed to the vapor. Any corrosion, pitting or discoloration constitutes failure. The bottle is resealed and along with the control bottle, that has been maintained in the dark, is shaken thoroughly for 1 minute, then allowed to remain undisturbed for 1 hour at room temperature. The bottles are then examined. Any marked change in color, precipitation, layering or separation constitutes failure.

4.6.7 Cold stability. A 50 ml sample of the cleaning compound shall be poured into a suitable test tube and cooled to 0°C. This temperature shall be maintained for one hour. The compound shall then be allowed to reach room temperature. After 5 (five) complete temperature inversion cycles of the test tube, the compound shall be examined for homogeneity.

4.6.8 Flash point. The flash point of the concentrated cleaning compound (both types) shall be determined in accordance with ASTM D 56. The flash point of the 10% solution in distilled water (Type I only) shall be determined in accordance with ASTM D 92.

4.6.9 Emulsion characteristics. Twenty ml of a 25% by volume solution of the cleaning compound shall be placed in a 50 ml glass stoppered, graduated cylinder. Twenty ml of lubricating oil conforming to MIL-L-2104, grade 10W shall be added. An emulsion shall be formed by 10 inversions of the graduated cylinder followed by a vigorous 15 second shake. After the emulsion has stood for 5 minutes, the 15 second shake shall be repeated. At 15 minutes and 8 hours for the Type I cleaner, or at 15 minutes and 24 hours for the Type II cleaner, the amount of free water and cleaner which separates from the lubricating oil shall be recorded.

4.6.10 Hard-water stability.

4.6.10.1 Preparation of stock solution. A 20-grain (as CaCO_3) hard-water stock solution shall be prepared by dissolving 0.40 ± 0.005 g of reagent grade Calcium Acetate, $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$ and 0.28 ± 0.005 g of reagent grade Magnesium Sulfate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, in 1 liter of boiled distilled water.

4.6.10.2 Procedure. Using a 5 ml volumetric pipet transfer 5 ml of a 25% by volume solution of cleaning compound into each of 3 clean 50 ml volumetric flasks. Add hard-water stock solution to each of 3 flasks to make 50 ml. Each solution shall be well mixed and allowed to stand undisturbed for 24 hours at 25 ± 1 °C. Each solution shall then be visually examined for precipitation. Agitate each solution by inverting the flask five times. The turbidity shall be measured with a Hellige turbidimeter or equivalent non-photometric instrument and calibrated as ppm silica.

4.6.11 Hydrogen embrittlement. The hydrogen embrittlement properties of the cleaning compound shall be determined in accordance with ASTM F 519 using Type 1a, Treatment B AISI 4340 steel specimens.

4.6.12 Total immersion corrosion. The total immersion corrosion effects of the cleaning compound on the new, unused metals and metal alloys listed in Table II shall be determined in accordance with ASTM F 483. In order to obtain the best results on test panels in this very low weight category, the panels must be handled with gloves, cleaned in a very careful manner and dried in an oven. They are cooled and dried in a desiccator both before and after each weighing.

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4.6.13 Low embrittling cadmium plate corrosion. The cleaning compound shall be evaluated for corrosion on low-embrittling cadmium plate in accordance with ASTM F 1111.

4.6.14 Effects on unpainted metal surfaces. The cleaning compound shall be evaluated for effects on unpainted metal surfaces in accordance with ASTM F 485.

4.6.15 Effect on painted surfaces. Prepare a 25% solution of cleaning compound with distilled water. Test both the 25% solution and concentrate in accordance with ASTM F 502 except that the panels used for testing shall be coated with the paint systems listed in Table VI. For all paint systems tested, a separate panel will be required for both 25% solution and concentrate. For Type II compound, conduct the test on all paint systems listed in Table VI. For Type I compound, conduct the test only on the enamel (F) and polyurethane (P) paint systems.

4.6.16 Stress crazing of stretched (type A and C) acrylic plastics. The cleaning compound shall be evaluated for stress crazing of stretch (Type A and C) acrylic plastics in accordance with ASTM F 484.

4.6.17 Stress crazing of polycarbonate plastic. The cleaning compound shall be evaluated for stress crazing of polycarbonate plastics using the test procedure outlined in ASTM F 484 with the exception that the acrylic plastics called for in the procedure be replaced with polycarbonate plastic conforming to MIL-P-83310 of the same dimensions and the polycarbonate specimens shall be stressed for 30 ± 2 minutes to an outer fiber stress of 2000 psi.

4.6.18 Long term storage stability. The cleaning compound shall be prepared and stored for long term storage stability in accordance with ASTM F 1104 using two (2) 3.8 liter (one-gallon) cans conforming to PPP-P-704 or non-metallic DOT 34-5.

4.6.19 Sandwich corrosion. The cleaning compound shall be tested in accordance with ASTM F 1110 except that non-conformance shall be determined by the requirements specified in paragraph 3.7.5.

4.6.20 Foaming properties.

4.6.20.1 Type I and type II. One part of the concentrated cleaning compound will be mixed with 15 parts water. 100 ml of this mixture shall be placed in a 500 ml capacity blender with a maximum 9.5 cm (3.75 inch) outside diameter. The blender shall be turned on and run for 2 minutes at 8000 ± 1000 rpm. A stabilized foam is indicated by negligible agitation at the upper surface. The blender shall be turned off after 2 minutes and allowed to stand undisturbed for the time specified in paragraph 3.12.

4.6.20.2 Type II only. If the cleaning compound meets the requirements of 4.6.20.1 the test should be continued by spraying as a foam from a B&B Chemical Portafoamer 20 or equivalent, using tap water. The first application shall be made to an aluminum panel, 61 x 61 cm (24 x 24 in), from a hose having an inside diameter of 2.5 cm (1 in) and 15.2 to 22.9 m (50 to 75 ft) long at a dilution ratio set at 1 part compound to 9 parts water. The second application shall be made to a similar panel with a hose having an inside diameter of 1.9 cm (3/4 in) and 7.6 m (25 ft) in length with dilution set at 1 part compound to 9 parts water. The panels shall be held at an angle of 60 degrees to the horizontal.

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TABLE VI. Test Panel Finishes

Primer Coatings				
Panel Set No.	Primer Material Specification	Dry Film Thickness Per Coat/ mm (inches)	No. of Coats	Drying Time Before Topcoating
L	MIL-C-8514, Coating Compound Metal Pretreatment Resin-Acid (First Coat)	0.0051 - 0.0102 (0.0002 - 0.0004)	1	2 - 8 hours
	MIL-P-7962, Lacquer Primer (Second Coat)	0.0076 - 0.0127 (0.0003 - 0.0005)	1	2 - 8 hours
EPH	MIL-P-23377, Primer, Coating Epoxy-Polyamide	0.0178 - 0.0229 (0.0007 - 0.0009)	1	2 - 8 hours
F	TT-P-1757 Primer Coating Zinc Chromate	0.0178 - 0.0203 (0.0007 - 0.0008)	1	2 - 8 hours

Top Coats, Color Number 17925 per FED-STD-595						
Panel Set	Topcoat Material	Dry Film Thickness Per Coat/ mm (inches)	No. of Coats	Drying Time Between Coats	Dry Film Thickness mm (inches)	Days to Dry Before Testing
L	TT-L-32 Lacquer, Acrylic Gloss	0.0102 - 0.0127 (0.0004 - 0.0005)	2	1 hour	0.0203 - 0.0254 (0.0008 - 0.0010)	7
E	MIL-C-22750 Coating, Epoxy Topcoat	0.0102 - 0.0127 (0.0004 - 0.0005)	2	1 hour	0.0203 - 0.0254 (0.0008 - 0.0010)	7
P	MIL-C-83286 Polyurethane	0.0203 - 0.0305 (0.0008 - 0.0012)	2	1 hour	0.0457 - 0.0610 (0.0018 - 0.0024)	7
H	MIL-C-85285	same as P				
F	TT-E-529 Enamel Semigloss	0.0203 - 0.0305 (0.0008 - 0.0012)	2	1 hour	0.0457 - 0.0610 (0.0018 - 0.0024)	7
D	DOD-P-23236 Paint Coating Requires No Primer	0.0457 - 0.0610 (0.0018 - 0.0024)	1	24 hours		

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4.6.21 Effects on polysulfide sealant.

4.6.21.1 Preparation of test specimens. MIL-S-81733, Type I, and MIL-S-8802, Type I, sealants shall be mixed as specified by their respective manufacturers and each pressed into a 1/8 inch thick sheet mold until cured (this will be the sheet stock for each sealant). The sealants will be cured for 7 days at 49°C. The specimens shall be cut from the sheet stock.

4.6.21.2 Test procedures. Immerse two specimens of each sealant in a 25% solution of the cleaning compound at room temperature for 30 minutes. Remove from the solution, rinse with cool tap water, and test within 30 minutes for Shore A hardness in accordance with ASTM D 2240.

4.6.22 Test on rubber compatibility. Tests will be conducted on AMS 3204 and AMS 3209 rubbers for compatibility with the cleaning compounds.

4.6.22.1 Preparation of test specimens. Three (3) test specimens will be used for each type rubber specified. Test specimens will be cut from 1/8 inch sheet stock.

4.6.22.2 Test procedure. Test and record the Shore A hardness of each test specimen in accordance with ASTM D 2240. Immerse each specimen in 25% solution of the cleaning compound at room temperature for 30 minutes. Remove from the solution, rinse with cool tap water, and test within 30 minutes for a Shore A hardness in accordance with ASTM D 2240.

4.6.23 Cleaning efficiency.

4.6.23.1 Preparation of control formula. The control formula shall be prepared by the testing laboratory in accordance with Table VII and subjected to the cleaning test. The cleaning efficiency of the cleaning compound shall be compared to the cleaning efficiency of the corresponding control formula to determine if the cleaning compound meets the requirements of paragraph 3.16.

TABLE VII. Control Formulas for Cleaning Efficiency Test

Component	Composition (% by weight) \1	
	Control for Type I Cleaning Compounds	Control for Type II Cleaning Compounds
d-limonene	30.0	---
di-ethanolamine	5.0	---
non-ionic surfactant (Triton X-100)	5.0	2.0
sodium metasilicate pentahydrate	---	7.0
trisodium phosphate dodecahydrate (O-S-642)	---	5.0
ethylene glycol monoethyl ether (TT-E-781)	---	6.0
distilled water (ASTM D 1193, type IV)	60.0	80.0

\1. These formulations are corrosive and solely intended for use as the control for the cleaning efficiency test. They will not qualify to the other requirements listed in this specification.

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4.6.23.2 Panel preparation. Aluminum alloy panels 15.2 x 6.4 x 0.05 cm (6 x 2.5 x 0.02 in) shall be finished in accordance with panel set no. P of Table VI. Panels shall then be conditioned for one week at 66°C (150°F). Only those panels having a 60-degree gloss not less than 2.0 and not more than 4.0 shall be used for this test. The lightness value (L-value in a L-a-b color system) shall be measured using a McBeth 1010S colorimeter (illuminant C) or equivalent prior to soil application (Lv), prior to cleaning (Ls), and following cleaning (Lc).

4.6.23.3 Soil preparation. Hydraulic fluid soil shall be prepared by blending 50 grams of carbon black and 500 grams of MIL-H-83282 fluid with a speed Cowles type dispersator for 15 minutes. Molybdenum disulfide grease soil shall be prepared by blending 50 grams of carbon black and 500 grams of MIL-G-21164 grease with a mechanical grease worker for 15 minutes. Wire rope lubricant (Sprayon No. 201) is applied from an aerosol spray can as received.

4.6.23.4 Application of hydraulic fluid and grease soils. Using a soft bristle brush, gently paint the coated surface of a test panel with the test soil. Remove excess hydraulic fluid soil by covering the test panel with folded absorbent tissue and exerting pressure by rolling over the tissue with a five pound rubber cylinder; Repeat this blotting procedure twice. Remove excess grease soil by stroking the test panel with a piece of MIL-C-83957 cleaning pad 5 times. Brush each test panel using ten strokes of a hog bristle brush (Pacific Scientific, Bethesda, MD; catalog no. WG2000B or equivalent). Each freshly soiled panel shall be baked at 105 ± 1°C (221 ± 2°F) for 60 minutes then cooled to room temperature and used within 4 hours.

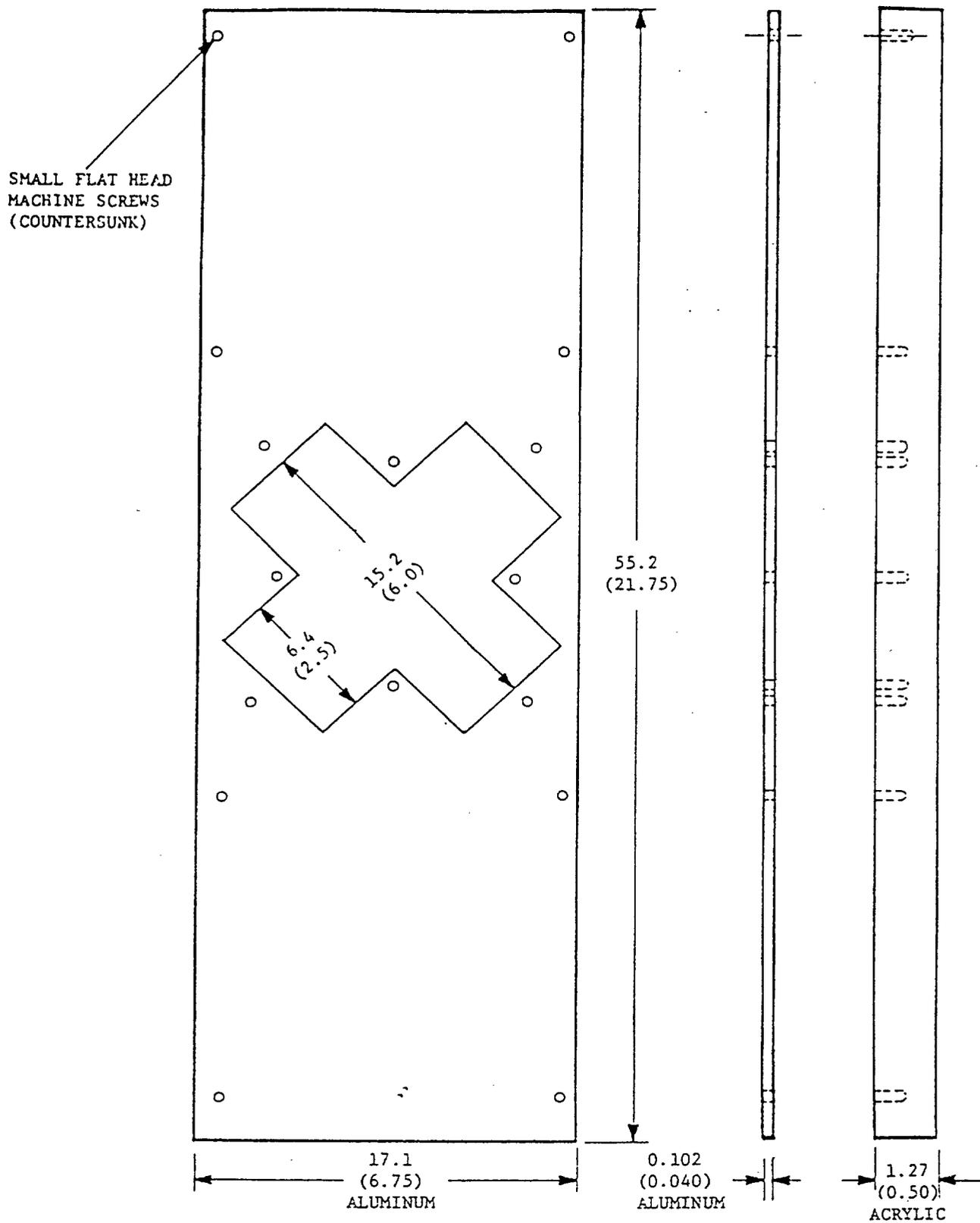
4.6.23.5 Application of wire rope lubricant. Place wire rope lubricant (Sprayon No. 201) onto a test panel and immediately wipe back and forth using a piece of MIL-C-83957 cleaning pad (3/8 inch thickness) to achieve a uniform soil in the center of the panel. Color and uniformity of all test panels shall be similar. Bake the soiled test panels at 105 ± 1°C (221 ± 2°F) for 60 minutes then cool to room temperature prior to use.

4.6.23.6 Cleaning. The test panel shall be cleaned using a Gardner heavy duty wear tester, or equivalent, fitted with a cellulose sponge. The sponge shall be cut such that the dimension parallel to the cleaning stroke is 9 cm (3.5 in) and the width is 7 cm (2.75 in). The cleaning head with the dry sponge attached shall be weighed to a mass of 1370 to 1380 grams. The cleaning compound and the control formula shall be diluted 1 part cleaner with 9 parts distilled water. After placing a soiled test panel in the template at 45 degrees (see figure 1), the cleaning solution shall be applied to the sponge then applied to the soiled test panel so that it is completely covered. After allowing a 30 second dwell time, the test panel shall be cleaned using 5 cycles of the wear tester, then turned 90 degrees and cleaned for an additional 5 cycles. The panel shall then be rinsed under cold running tap water and allowed to dry.

4.6.23.7 Evaluation. The colorimeter L values for unsoiled panel (Lv), after soiling (Ls), and after cleaning (Lc) shall be used in determining the percent cleaning efficiency as follows:

$$\% \text{Cleaning Efficiency} = \left[\frac{L_c - L_s}{L_v - L_s} \right] \times 100$$

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DIMENSIONS IN CENTIMETERS (INCHES).

Figure 1. Template

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4.6.24 Biodegradability. Biodegradation will be determined by the "Shake Flask Biodegradation Tests" for measuring ultimate or ready degradation potential, as found in EPA Chemical Fate Test Guidelines 40 CFR Method 796.3100 (Aerobic Aquatic Biodegradation Test) or 40 CFR Method 796.3240 (OECD Screening Test for Ready Biodegradability). Biodegradability will be shown as carbon transformation by both soluble organic carbon reduction and CO₂ evolution.

4.6.25 d-Limonene content (Type I only). Test for d-limonene content of the concentrated cleaning compound shall be determined by the following procedure.

4.6.25.1 Gas chromatographic column. The column to be used for this analysis is the 6 foot Poropak P column, or equivalent, connected to a thermal conductivity detector.

4.6.25.2 Gas chromatographic parameters. Experimental parameters for analysis are as follows:

Sample size	1 μ l
Carrier gas	Helium
Carrier gas flow rate	20 ml/min
Initial column temperature	150°C (302°F)
Initial isothermal hold time	10 min
Gradient heating rate	10°C/min (18°F/min)
Final temperature	230°C (446°F)
Final isothermal hold time	10 min

4.6.25.3 Calibration procedure. Obtain the normalization factors for d-limonene by observing the areas produced by a specially prepared mixture, designated the reference standard. Prepare the standard with all reagent grade components of known assay. The composition of the mixture should be approximately 10% butyl cellosolve and 90% d-limonene. Weigh each component to 0.1 milligram. Calculate the actual composition as follows:

$$\%Com_i = \frac{W_i \times \%P_i}{W}$$

Calculate the normalization factor for d-limonene as follows:

$$K_i = \frac{\%Com_i \times A_b}{A_i \times \%Com_b}$$

- Where:
- W_i = Weight of d-limonene in standard (mg)
 - $\%P_i$ = Purity of d-limonene in standard (%)
 - W = Total weight of standard (mg)
 - $\%Com_i$ = Weight % of d-limonene in standard (%)
 - $\%Com_b$ = Weight % of butyl cellosolve in standard (%)
 - A_i = Area under peak for d-limonene
 - A_b = Area under peak for butyl cellosolve
 - K_i = Normalization factor for d-limonene

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4.6.25.4 Test procedure. Weigh out $9.00 \pm .01$ g of the concentrated cleaning compound in a 15-20 ml screw top vial. Add $1.00 \pm .01$ g of butyl cellosolve to the vial. Screw the cap onto the vial tightly and invert several times to mix. Equilibrate the instrument and make at least one blank run. Insert a $1\mu\text{l}$ sample of the cleaning compound spiked with 10% butyl cellosolve at least five times. Take an average of the area counts for each component.

4.6.25.5 Calculation.

$$\%C_i = \frac{A_i \times K_i \times \%C_b}{A_b}$$

Where: $\%C_i$ = Weight % of d-limonene

$\%C_b$ = Weight % of butyl cellosolve

A_i = Average of areas under peak for d-limonene

A_b = Average of areas under peak for butyl cellosolve

K_i = Normalization factor for d-limonene

4.6.25.6 Reagents and equipment. The following equipment and reagents shall apply as test conditions for 4.6.25.

a. Equipment.

- (1) Gas chromatograph: incorporating a thermal conductivity detector.
- (2) Column: Poropak P 6 foot (80/100 mesh), or equivalent.

b. Reagents.

- (1) Butyl cellosolve (2-butoxy ethanol): Baker D648 or equivalent.
- (2) d-Limonene: Fisher Scientific 1980 or equivalent.

4.7 Toxicity and waste disposal characteristics. The supplier shall furnish the toxicological data or formulations required (See 3.3) to evaluate the safety of the material proposed for use. The manufacturer will provide current procedures for disposal per federal EPA regulations. The supplier shall also furnish certification of the percent activity and percent biodegradability of the cleaner. The data will be forwarded to San Antonio Air Logistics Center, Attention SFTT, Kelly AFB, Texas 78241-5000.

4.8 Filler materials. The contractor shall furnish certification that the cleaning compound contains only the materials allowed and does not contain any filler materials disallowed per paragraph 3.2.

4.9 Infrared spectrograms graph. Infrared spectrograms of the nonvolatile matter shall be prepared by the Government approved qualification laboratory (See 3.4). The method of sample preparation of the spectra shall be provided with each graph to the qualifying activity by the qualification laboratory.

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5. PACKAGING

5.1 Packing. Packing shall be Level A, or Industrial for required net fill, as specified.

5.1.1 Level A. The cleaning compound shall be furnished in 208 liter (55 gallon) drums conforming to PPP-D-729, Type II and UN 1A1 or in 18.9 liter (5 gallon) containers conforming to PPP-P-704, Type I, Class 4 and UN 1A1, or non-metallic DOT 34-5.

5.1.2 Industrial. The cleaning compound shall be packed in accordance with ASTM D 3951. Containers shall be in accordance with Uniform Freight Classification rules or regulations of other carriers applicable to the mode of transportation.

5.1.3 Compatibility of materials. The container, closure, lining, or sealing compound shall not interact physically or chemically with the contents so as to corrode, be altered, or to alter the strength, quality or purity of the contents.

5.2 Palletization. When specified, the cleaning compound, shall be palletized in accordance with Load Type III (strapped) of MIL-STD-147 except that for overseas shipment the overall height of the load shall not exceed 109.2 cm (43 inches.)

5.3 Marking. Containers shall be marked in accordance with MIL-STD-129 and 49 CFR. For international shipments, containers shall also be marked in accordance with ICAO, IATA, and IMO as applicable for mode of transportation. The shipment marking nomenclature shall be:

CLEANING COMPOUND, AEROSPACE EQUIPMENT, TYPE - (I OR II)

DIP TANK IMMERSION METHOD:

Dilute the concentrate with a minimum of two parts water unless otherwise specified in Technical Order (TO). Normal dilution ratios are 1:4 for heavy soils, 1:10 for light soils.

EXTERIOR CLEANING METHOD:

Aircraft and AGE: Dilute the concentrate 1:10 to 1:20 with water depending on the amount of soil to be removed. Dilute the concentrate with 4 to 10 parts water depending on the amount of soil to be removed for spot cleaning. Not recommended for cleaning canopies.

Engines: Dilute the concentrate with 3 to 10 parts water depending on the amount of soil to be removed. Not recommended as a spot cleaner for engines.

5.3.1 Storage temperature. The markings on the container shall include a caution statement stating the temperature range within which the product can be stored without compromising the performance of the product.

5.4 Material safety data sheet. Contractor shall comply with the requirements of the latest revision of FED-STD-313.

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5.5 Hazardous material warning labels. A hazardous warning label shall be developed in accordance with the requirements of the OSHA Hazardous Communication Standard (29 CFR 1910.1200) and MIL-STD-129.

6. NOTES

6.1 Intended use. The two types of cleaning compound covered by this specification are intended to be used for cleaning Aerospace Equipment including aircraft, engines and aerospace ground equipment (AGE). The cleaners shall be used in place of other cleaners when approved by the System Program Manager of the equipment being cleaned. Type I should be used only on polyurethane and enamel coatings as it may attack acrylic nitrocellulose lacquer coatings. Type I material is intended for light to heavy duty removal of greases, oils, hydraulic fluid, and carbon. Type II is intended for medium to light cleaning and is not intended to remove heavy soils.

6.2 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.

6.3 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Type I or Type II.
- c. Size containers required.
- d. QPL reference or test number.
- e. Level of packing required.
- f. Palletization, when applicable.

6.4 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 the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and contractors are urged to arrange to have their 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 orders for the products covered by this specification. The activity responsible for the Qualified Products List is San Antonio Air Logistics Center, Attention SFTT, Kelly AFB Texas 78241-5000; and information pertaining to qualification of products may be obtained from that activity (See 4.3.1).

CUSTODIANS:
Air Force - 68

PREPARING ACTIVITY:
Air Force - 68

REVIEW ACTIVITIES:
Air Force - 11
Navy - AS

PROJECT NO. 6850-1100

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INSTRUCTIONS

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-C-87937A

2. DOCUMENT DATE (YYMMDD)
911016

3. DOCUMENT TITLE

Cleaning Compound, Aerospace Equipment

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

SA-ALC/SFRT

b. TELEPHONE (Include Area Code)
(1) Commercial
(512) 925-7847

(2) AUTOVON
945-7847

c. ADDRESS (Include Zip Code)

SA-ALC/SFRT
Kelly AFB TX 78241-5000

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