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INTERNATIONAL
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-C-29602

Issued AUG 1999

Cleaning Compounds, For Parts Washers and Spray Cabinets

FSC 6850

NOTICE

This document has been taken directly from U.S. Military Specification MIL-C-29602 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-C-29602. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

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1. SCOPE:

1.1 Scope:

This specification establishes the requirements for cleaning compounds, used in parts washers and spray cabinets for cleaning aircraft components.

1.2 Classification:

Compounds conforming to this specification are classified as follows:

TYPE I - Water soluble liquid concentrate.
TYPE II - Water soluble powder.

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
QQ-P-416	Type I Plating - Cadmium (Electrodeposited)
CCC-C-46	Cloth, Cleaning, Nonwoven Fabric
PPP-D-705	Drum, Shipping and Storage, Steel, 16 and 30 Gallon Capacity
PPP-D-729	Drums, Shipping and Storage, Steel 55 Gallon (208 Liters)
MIL-S-7952	Steel, Sheet and Strip, Uncoated, Carbon 1020 and 1025) (Aircraft Quality)
MIL-A-8625	Anodic Treatment - Aluminum Alloys, Chromic Acid Process, Type I
MIL-T-9046	Titanium Sheet, Strip and Plate - 6Al4V Annealed, Type III
MIL-G-9954	Glass Beads, For Cleaning and Peening
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Number 0-156
MIL-C-81309	Corrosion Preventive Compound, Water Displacing, Ultra Thin Film
DOD-L-85734	Lubricating Oil, Helicopter Transmission System, Synthetic Base
FED-STD-313	Material Safety Data Sheets, Preparation and Submission of
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Palletized Unit Loads

2.2 Code of Federal Regulations:

Available from the Superintendent of Documents, Government Printing Office, Washington, DC 20370.

40 CFR Protection of the Environment

2.3 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 240	Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM B 152	Standard Specification for Copper Sheet, Strip, Plate and Rolled Bar
ASTM D 93	Flash Point by Pensky-Martens Closed Tester
ASTM D 95	Water in Petroleum Products and Bituminous Materials by Distillation
ASTM D 2834	Nonvolatile Matter (Total Solids) in Water-emulsion Floor Polishes, Solvent-Based Floor Polishes, and Polymer-Emulsion Floor Polishes
ASTM D 3951	Practice for Commercial Packaging
ASTM E 70	pH of Aqueous Solutions with the Glass Electrode
ASTM F 519	Mechanical Hydrogen Embrittlement Testing
ASTM F 945	Stress Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials
ASTM F 1110	Sandwich Corrosion Test

2.4 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2470	Anodic Treatment, Aluminum Alloys, Chromic Acid Process
AMS 4375	Magnesium Alloy Sheet and Plate 3.0Al-1.0Zn (AZ 31 B-0) Annealed and Recrystallized
AMS 5040	Wrought Carbon Steel, Sheet and Strip, 0.15 Carbon Maximum, Deep Forming Grade
AMS 5536	Sheet, Strip and Plate, Alloy, 47.5Ni 22Cr 1.5Co 9.0Mo 0.60W 18.5Fe, Solution Heat Treated
ARP1755	Effect of Cleaning Agents on Aircraft Engine Materials Stock Loss Test Method

2.5 Order of precedence:

In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets or MS standards), the text of this document takes precedence. Nothing in the document, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS:

3.1 Qualification:

Cleaning compounds furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.3).

3.2 Toxicity:

The concentrated cleaning 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 medical service who will act as advisor to the contracting agency (see 4.4.2 and 6.4).

3.2.1 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 4.6.1 on the finished product. The cleaning compounds shall meet the requirement of a minimum of 90% biodegradable at the end of the 28 day period.

3.3 Composition:

The composition of concentrated cleaning compound shall be optional with the supplier but shall conform to the requirements specified herein. The manufacturer shall certify that the product contains none of the following: a) constituents cited under the Clean Air Act of 1990 for reduction or elimination including ozone depleting substances, hazardous air pollutants and volatile organic compounds, b) constituent concentrations which would require unused product to be disposed as a characteristic or listed waste, with the exception of pH, under the Resource conservation and Recovery Act (RCRA), c) constituents listed as known or suspected carcinogens by the current report of the National Toxicology Program, and d) constituents listed as Total Toxic Organic (TTO) compounds as defined in 40 CFR. Surface active agents used in the cleaning compound shall be at least 90 percent biodegradable, determined in accordance with methods appropriate to surface active agent type.

3.4 Compositional assurance:

The cleaning compound qualification sample for Type I shall be tested for non-volatile content and Type II shall be tested for water content specified in 4.6. The values shall be recorded for use in quality conformance inspection. Quality conformance inspection results shall not differ from the recorded values by more than ±1.0 percentage points for non-volatile matter (Type I cleaners) or by more than ±0.5 percentage points for water content (Type II cleaners).

3.5 Chlorine content:

The chlorine content of the concentrated cleaning compound shall not exceed 100 ppm when tested as specified in 4.6.2.

3.6 Flash point:

The Pensky-Martens flash point of the concentrated cleaning compound shall be greater than 212°F (100°C) when tested as specified in 4.6.

3.7 pH:

The pH of the cleaning compound shall be no less than 10 and no more than 13.5 as specified in 4.6 when run at the manufacturer's recommended cleaning concentration.

3.8 Foaming characteristics:

The cleaning compound shall not produce a foam volume of 100 ml or greater when determined at the manufacturer's recommended cleaning concentration and at two temperatures [the recommended cleaning temperature and 120°F (49°C)] as stated in 4.6.3.

3.9 Corrosivity:

3.9.1 Sandwich corrosion: The cleaning compound shall not cause a corrosion rating greater than one, when tested at the manufacturer's recommended cleaning concentration as specified in 4.6.

3.9.2 Titanium stress corrosion: The cleaning compound shall not produce any microscopic cracking when tested at the manufacturer's recommended concentration and examined metallographically at 500X magnification, as specified in 4.6.

3.9.3 Stock loss corrosion: The cleaning compound shall cause neither visual corrosion nor an average weight change of any specimen greater than that shown in Table I, when tested at the manufacturer's recommended concentration in accordance with 4.6.4.1.

Table I. Stock loss maximum limits.

Test Panel	Stock Loss (um)
Aluminum (QQ-A-250/4-T3)	0.625
Aluminum-Anodized (QQ-A-250/4-T3, (Anodized in accordance with MIL-A-8625, Type I)	0.625
Carbon Steel (AMS 5040)	0.625
Copper (ASTM B152)	0.625
Magnesium (AMS 4375)	0.625
Nickel (AMS 5536)	0.625
Stainless Steel (ASTM A240, Class 410)	0.625
Stainless Steel (ASTM A240, Class 410, Cadmium plated in accordance with QQ-P-416 Type I)	0.625
Titanium (MIL-T-9046, Type III, COMP C)	0.625

3.9.4 Hydrogen embrittlement: When tested at the manufacturer's recommended concentration in accordance with 4.6.4.2, the concentrated cleaner and a 10 percent solution of the cleaner in distilled water shall not cause hydrogen embrittlement of cadmium plated AISI 4340 steel.

3.10 Stability:

3.10.1 Hard water stability: When mixed with synthetic hard water, the cleaning compound solution shall exhibit no separation when tested at the manufacturer's recommended concentration as specified in 4.6.5.1. The cleaning compound shall have an Orbeca-Hellige Turbidimeter value less than 40.

3.10.2 Thermal stability: The cleaning compound shall not layer or separate after being exposed to a temperature of 60°C (140°F) for a period of one hour when tested at the manufacturer's recommended concentration as specified in 4.6.5.2.

3.10.3 Storage stability: After storage as specified in 4.6.5.3, the cleaning compound shall not separate, crystallize or deteriorate; not corrode or darken the metal strip, not show any evidence of incompatibility with its container, or show any evidence of incompatibility with its container, or show any evidence of distortion, leakage or internal corrosion of the container.

3.10.4 Accelerated storage stability: After accelerated storage as specified in 4.6.5.4, the test sample shall show no marked change in color or uniformity when compared to the control, nor shall it pit, corrode or cause uneven darkening of steel surfaces; and shall give a soil removal value not less than 95 percent of that which is obtained with unaged cleaning compound.

3.11 Cleaning Efficiency:

The cleaning compound shall remove at least 95 percent of MIL-L-23699 baked-on soil and at least 90 percent of MIL-C-81309, Type II baked on soil when tested at the manufacturer's recommended concentration as specified in 4.6.6.

3.12 Service Test:

Service tests, when requested by the qualifying activity, shall be initiated upon completion of all laboratory tests. The concentrated cleaning compound shall be tested as specified in 4.6.7 and shall show satisfactory performance in actual use.

3.13 Proper operating concentrations:

The manufacturer shall furnish complete use instructions and a proven method for determining and maintaining the proper concentration of cleaning compound in the parts washer.

3.14 Workmanship:

When examined visually at room temperature, the Type I cleaning compound shall be a homogeneous liquid free of foreign matter. A faint turbidity shall not be cause for rejection.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use its 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

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

4.2 Classification of inspections:

The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.4).
b. Quality Conformance inspection (see 4.5).

4.3 Inspection conditions:

Unless otherwise specified, all inspections shall be performed in accordance with standard conditions. Standard conditions shall be a temperature of 72° ± 4°F (22° ± 2°C) and a relative humidity of 50 ± 20 percent.

4.4 Qualification inspection:

The qualification inspection shall consist of all tests specified in Table II.

4.4.1 Qualification sample:

4.4.1.1 Laboratory test sample: The laboratory test sample shall consist of two four-liter (one-gallon) high density polyethylene containers of the cleaning compound. Samples shall be identified as follows and forwarded to the qualifying activity as designated in the letter of authorization (see 6.3).

Cleaning Compound, Parts Washers and Spray Cabinets
Qualification test samples
Manufacturer's name and product number
Submitted by (name and date) for qualification testing in accordance with authorization (reference authorizing letter)
Manufacturer's recommended dilution
Type I (% dilution), Type II (pounds per gallon).

4.4.1.2 Service test samples: Service test samples shall be packaged in accordance with 5.1.1. Samples shall be forwarded in accordance with instructions contained in the authorizing letter granting service test, which will be sent to the manufacturer on satisfactory completion of all laboratory tests. In addition to the identification in 4.4.1.1, each drum shall be labeled in 2-inch bold lettering with the manufacturer's name and the words:

QUALIFICATION SAMPLE: CLEANING COMPOUND, PARTS CLEANERS AND SPRAY CABINETS

Table II. Qualification inspection.

Characteristics	Requirement Paragraph	Test Paragraph
Biodegradability	3.2.1	4.6.1
Composition	3.3	1/
Water Content	3.4	4.6
Non-Volatile Content	3.4	4.6
Chlorine Content	3.5	4.6.2
Flash Point	3.6	4.6
pH	3.7	4.6
Foaming	3.8	4.6.3
Sandwich Corrosion	3.9.1	4.6
Titanium Stress Corrosion	3.9.2	4.6
Stock Loss Corrosion	3.9.3	4.6.4.1
Hydrogen Embrittlement	3.9.4	4.6.4.2
Hard Water Stability	3.10.1	4.6.5.1
Thermal Stability	3.10.2	4.6.5.2
Storage stability	3.10.3	4.6.5.3
Accelerated storage stability	3.10.4	4.6.5.4
Cleaning Efficiency	3.11	4.6.6
Service Test	3.12	4.6.7
Proper operating concentrations	3.13	3/
Workmanship	3.14	2/

1/ Supplier shall certify to this requirement for qualification (see 4.4.2).
2/ Visual examination.
3/ Instruction sheet furnished with qualification sample.

4.4.2 Manufacturer's data: The manufacturer shall furnish two copies of the qualification inspection report. Included with the report shall be:

a. Certification showing the material conforms to 3.3 (carcinogens, heavy metals, Total Toxic Organics, biodegradability, volatile organic components and hazardous air pollutants) in lieu of actual test data.
b. Material safety data sheets prepared in accordance with FED-STD-313.
c. Certification that no change shall be made to the product formulation without notifying the Navy activity to which the product has been shipped for test and/or evaluation.
d. Instruction sheet for in use monitoring of concentrations (see 3.13).

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

4.5 Quality conformance inspection:

4.5.1 Lot formation: A lot shall consist of all the cleaning compound produced by one supplier, at one plant, from the same materials, under essentially the same manufacturing conditions provided the operation does not exceed 24 hours. When the process is considered a batch operation, each batch shall constitute a lot.

4.5.2 Visual inspection: A random sample of filled containers, prior to closure, shall be selected from each lot in accordance with Inspection Level I of MIL-STD-105. The sample unit shall be one filled container. Inspection shall be in accordance with Table III. There shall be no defects.

4.5.2.1 Physical property inspection: Two containers shall be randomly selected from each lot and tested to the requirements specified in Table IV. Each sample selected shall be thoroughly mixed prior to testing. Failure of either sample to conform with any requirement specified shall cause to reject the entire inspection lot.

Table III. Quality conformance tests for visual inspection.

Examine	Defect
Fill	Average net content per container less than specified in contract or order (Volume corrected to 60°F (16°C).
Material	Not as specified.
Appearance	Presence of foreign matter. Not homogeneous.

4.5.2.2 Packaging inspection:

4.5.2.2.1 Examination for packaging and marking: An examination shall be made to determine that packaging and marking comply with the requirements of Section 5 of this specification. Defects shall be scored in accordance with Table V. The sample unit for this examination shall be one shipping container fully prepared for delivery except that it shall not be palletized and need not be sealed. Shipping containers fully prepared for delivery that have not been palletized shall be examined for closure defects. The lot size shall be the number of shipping containers in the end item inspection lot. The samples for this examination shall be selected at random in accordance with MIL-STD-105, inspection level S-2. There shall be no defects.

Table IV. Quality conformance testing

Characteristics	Requirement Paragraph	Test Paragraph
Compositional Assurance	3.4	1/
Flash Point	3.7	4.6.3
pH	3.8	4.6.4
Foaming	3.9	4.6.5
Stock Loss Corrosion	3.10.1	4.6.6.1
Workmanship	3.13	1/

1/ See 4.5.3
2/ Visual inspection

4.5.2.2.2 Examination for palletization: An examination shall be made to determine that palletization complies with the requirements of Section 5 of this specification. Defects shall be scored in accordance with Table VI. The sample unit shall be one palletized unit load fully prepared for delivery. The lot size shall be the number of palletized unit loads in the end item inspection lot. The samples for this examination shall be selected at random in accordance with MIL-STD-105, inspection level S-1. There shall be no defects.

Table V. Packaging inspection

Examine	Defect
Packaging	Container not specified; closures not accomplished by specified or required methods or materials. Leakage or seepage of contents. Non-conforming component, component mission, damaged or otherwise defective. Bulged or distorted container.
Markings	Data omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.

4.5.3 Rejection and retest: Failure to meet any quality conformance test shall result in rejection of the batch represented and may constitute sufficient justification for removal of the product from the Qualified Products List.

4.6 Test methods:

The tests of this specification shall be conducted in accordance with the test methods in Table VII and paragraphs 4.6.1 through 4.6.7.

Table VI. Palletization inspection.

Examine	Defect
Finished	Dimension length, width, or height exceeds specified maximum requirement.
Palletization	Not as specified. Pallet pattern not as specified. Interlocking of loads not as specified. Load not banded with required straps as specified.
Weight	Exceeds maximum load limits.
Markings	Omitted, incorrect, illegible, of improper size, location, sequence, or method of application.

4.6.1 Biodegradability: Biodegradation will be determined over 28 days by the "Shake Flask Biodegradation Tests" for measuring ultimate or ready degradation potential, monitored by analysis of Total Organic Carbon (TOC), 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 CO_2 evolution.

Table VII. Test methods.

REQUIREMENT PARAGRAPH	PROPERTY	TEST METHOD
3.4	Water by distillation	ASTM D 95-70
3.4	Non-volatile content 1/	ASTM D 2834
3.7	Flash point	ASTM D93
3.8	pH	ASTM E70
3.10.1	Stock loss corrosion 2/	SAE ARP 1755
3.10.2	Sandwich corrosion	ASTM F1110
3.10.3	Titanium stress corrosion 3/	ASTM F945
3.10.4	Hydrogen embrittlement 4/	ASTM F519

1/ Non-volatile content shall be determined using 2-3 gram sample weights, 100 mm diameter glass Petri dishes, and a forced draft oven at 221° ± 4°F (105° ± 2°C) for 16 hours.
2/ As modified in 4.6.6.1
3/ Concentrate for Type I; As-received for Type II
4/ As modified in 4.6.6.2

4.6.2 Chlorine content: The chlorine content of the concentrated cleaning compound shall be determined using a gas chromatographic or microcoulometric method accurate to within 50 ppm or by the use of a portable test kit such as the “Clor-D-Tect 100” (manufactured by Dexsil Corporation.)

4.6.3 Foaming properties: One hundred ml of the recommended concentration of cleaning compound shall be placed in a Waring blender or equivalent. The blender container and cleaner sample shall be conditioned for one hour at the test temperature. Two test temperatures shall be utilized: 1) recommended temperature; and 2) 49° ± 1°C (120° ± 2°F). The blender shall be turned on for two minutes at 8000 ± 1000 rotations per minute. After two minutes the blender shall be turned off and the foam volume shall be determined immediately by reading a graduated scale on the blender container.

4.6.4 Corrosivity:

4.6.4.1 Stock loss corrosion: The cleaning compounds shall be diluted to the manufacturer’s recommended concentration. Corrosion specimens shall be fabricated from the following substrates as specified by the dimensional requirements of SAE ARP1755: aluminum (QQ-A-250/4-T3 and AMS 2470), magnesium (AMS 4375), copper (ASTM B 152), titanium (MIL-T-9046 TYPE III, COMP. C), carbon steel (AMS 5040), stainless steel (ASTM A 240 CLASS 410 and QQ-P-416 TYPE I), and nickel (AMS 5536). Immediately prior to testing, untreated specimens (not plated or coated) shall be abrasive blasted using MIL-G-9954, Size 13 glass beads. Specimens shall be exposed as required by SAE ARP1755, except that the cleaning compound solution shall be conditioned at 71° ± 1°C (160° ± 2°F) for a minimum of one and one-half hours prior to immersion and the test shall be carried out at the above temperature for one hour. Stock loss shall be calculated in units of micrometers and shall conform to 3.9.3.

4.6.4.2 Hydrogen embrittlement: Hydrogen embrittlement shall be determined in accordance with ASTM F 519 using three unstressed Type 1d specimens. The specimens shall be immersed in the product at the manufacturer’s recommended operating temperature and concentration for one hour. The specimens shall then be withdrawn and, while still unrinsed, stressed in accordance with the method and monitored for 150 hours at 22° ± 2°C (72° ± 4°F).

4.6.5 Stability:

4.6.5.1 Hard water stability:

4.6.5.1.1 Preparation of stock solution: Add 40 ml of synthetic hard water (0.20g calcium acetate monohydrate and 0.14g magnesium sulfate heptahydrate diluted to 1 liter with distilled water) to 10 ml of product in a 50 ml graduated cylinder. Shake vigorously for 15 seconds and allow to stand undisturbed for 16 hours at 72° ± 4°F (22°± 4°C). A 10-grain hard water stock solution shall be prepared by dissolving 0.20 ± 0.005 grams (g) of analytical reagent grade calcium acetate, $Ca(C_2H_3O_2)_2 \cdot H_2O$, and 0.14 ± 0.005 g of analytical reagent grade magnesium sulfate, $MgSO_2 \cdot 7H_2O$, in one liter of boiled distilled water.

4.6.5.1.2 Procedure: Ten ml of undiluted Type I cleaning compound and 2 grams of Type II shall be added to 50 ml graduated cylinders. Forty ml of the synthetic hard water shall be added to each graduated cylinder and the contents shaken vigorously for sixty seconds. Allow each solution to stand undisturbed for sixteen hours at a temperature of 25° ± 5°C (77° ± 10°F). At the end of the sixteen hours examine each solution for separation. After the examination, obtain a measurement of turbidity by using an Orbeca-Hellige turbidimeter 8000 series or equivalent under the conditions of no filter and mirror closed.

4.6.5.2 Thermal Stability: Fifty ml of the cleaning compound at the manufacturer's recommended concentration shall be placed in a 50 ml graduated cylinder and stoppered. The cylinder shall be placed in a water bath at 60° ± 1°C (140° ± 2°F) and maintained at that temperature for one hour, minimum. At the end of the one-hour period, remove the cylinder from the water bath and examine the sample for separation or layering. The water bath shall be of sufficient depth to cover 32 ± 2 ml of the cleaning compound.

4.6.5.3 Storage Stability: The one gallon plastic container filled with cleaning compound furnished for storage stability shall be stored for 6 months at 70° ± 5°F (21° ± 3°C). In addition, one gallon of the cleaning compound shall be poured into a glass container to which has been added a cleaned and polished, with 280 grit silicon carbide paper, metal strip conforming to MIL-S-7952. The total surface area of the steel strip shall be 38.7 ± 3.2 sq cm (6 ± 0.5 sq in.). The second gallon shall be stored under the same conditions of time and temperature. After the six month storage period, both samples shall be tested for cleaning efficiency and examined for evidence of separation, crystallization or deterioration, steel corrosion, container incompatibility, distortion, leakage or container corrosion.

4.6.5.4 Accelerated storage stability:

4.6.5.4.1 Preparation of test sample: A 150 ml portion of well shaken undiluted cleaning compound shall be poured into each of two chemically clean 500 ml clear, round, screw cap plastic bottles approximately 2.5 inches in outside diameter. One bottle shall be immediately capped and stored in the dark for at least six days at room temperature (control sample). A strip of steel 150 by 125 by 0.5 mm conforming to MIL-S-7952 shall be polished with 280 grit silicon carbide paper to remove surface contamination and then cleaned by boiling for one minute in chemically pure isopropyl alcohol and one minute in mineral spirits. The steel strip shall be placed in the other test bottle and the bottle immediately capped (test sample) and thoroughly shaken for one minute.

4.6.5.4.2 Procedure: The test sample shall be placed in a water bath, heated to 39°± 2°C (100° ± 4°F) and held at that temperature for a minimum of 8 hours. The bath shall be cooled to room temperature over the next 16 hours. This procedure shall be repeated every day for five additional days. After exposure for a total of six cycles, the test sample shall be removed from the bath and examined for separation of the cleaning compound. The test sample shall then be uncapped, the steel strip carefully withdrawn and examined for evidence of pitting, corrosion or uneven darkening. The test sample shall be recapped and, along with the control sample, thoroughly shaken for one minute, allowed to stand undisturbed at room temperature for a minimum of one hour, then be compared for color and uniformity. When the test sample is in compliance with the visual requirements, it shall be tested for cleaning efficiency (4.6.6) for conformance to 3.10.4 requirements.

4.6.6 Cleaning efficiency: The cleaning compound solution shall be prepared by diluting the cleaning compound to the manufacturer's recommended concentration with distilled water.

4.6.6.1 Soils:

4.6.6.1.1 MIL-L-23699: Five hundred grams of MIL-L-23699 lubricating oil shall be added to 50 grams of Raven 1040 carbon black (Columbia Carbon Company or equal) in a one liter (1 quart), wide mouth jar. The mixture shall be thoroughly agitated on a high speed disperser for five minutes to produce a homogeneous mixture.

4.6.6.1.2 MIL-C-81309 Type II: This corrosion preventive compound shall be used as a soil in its supplied state.

4.6.6.2 Test panels: The (ASTM A 240 stainless steel) test panels shall conform to the dimensions as specified on Figure 1. The panels shall be solvent wiped with acetone (dimethylketone) using CCC-C-46 Class 7 aerospace wipes. The pre-cleaning shall continue until the wipe is free from visual residue. Dry the panels in an oven maintained at 105° ± 2°C (22° ± 4°F) for 30 minutes. The panels shall then be removed from the oven, air-cooled to room temperature and weighed to the nearest 0.1 mg (W_1).

4.6.6.3 Apparatus: The cleaning apparatus shall be capable of completely immersing and removing the panel vertically at a rate of 20 ± 1 cycles per minute for the clean and rinse test method while maintaining a constant temperature of 71° ± 1°C (160° ± 2°F) (see Figure 2).

4.6.6.4 Soil removal: Prepare 1000 ml of the cleaning solution according to the manufacturer's recommended concentration. Apply approximately 75 mg of the oil/carbon black soil by brush and uniformly coat panel by swiping with a Scotchbrite fine abrasive mat (3M Company or equivalent). A dipping machine similar to the Fisher-Payne Dipcoater shall be used to give a uniform coating of the MIL-C-81309 Type II soil. The panel should be immersed to the shoulder in 15 to 20 seconds and removed in approximately 70 seconds. All panels shall be placed in a 105° ± 2°C (221° ± 4°F) oven for one hour. The panels shall then be air-cooled to room temperature and weighed to the nearest 0.1 mg (W_2). Only use panels with more than 60 mg and less than 90 mg of soil. The cleaning test shall be run at 71° ± 1°C (160° ± 2°F). The cleaner shall be maintained at the specified temperature throughout the test. Two soiled panels shall be simultaneously immersed and withdrawn from the cleaning solution at a rate of 20 ± 1 cycles per minute for a period of five minutes. The panels shall then be rinsed for 60 ± 1 seconds in distilled water using the same equipment and procedure. The panels shall then be dried for one hour at 105° ± 2°C (221° ± 4°F). The panels shall be air-cooled and re-weighed (W_3). The percent soil removal (cleaning efficiency) shall be calculated as follows:

Percent soil removal = 100 X $(W_2 - W_3)/(W_2 - W_1)$

Three trials shall be used for this test when determining the average of the cleaning efficiency.

4.6.7 Service Test:

4.6.7.1 Equipment: A cabinet style parts washer capable of spray washing at a nozzle pressure of 50 psi minimum and 110 psi maximum shall be charged with the cleaning compound at the manufacturer's recommended concentration. The solution shall be stabilized at 71° ± 6°C (160° ± 10°F) prior to initiation of the service test.

4.6.7.2 Test Specimens: A minimum of three transmission or engine components shall be selected for the service test. Components shall be representative of actual shapes and configurations encountered during normal cleaning. Components shall weigh a maximum of three pounds so that soil weight can adequately be measured. At least one component shall be of a low carbon steel so that flash rusting concerns may be addressed. Components shall be cleaned by glass bead blasting followed by immersion in an aqueous ultrasonic cleaner or by an equivalent method. Initial cleanliness shall be determined by visual inspection to verify the absence of any detergent film and blast residue particles, and black light inspection to verify the absence of any residual oils on the surface prior to beginning the service test.

4.6.7.3 Soiling Procedures: A standard soil shall be prepared by combining transmission fluid (DOD-L-85734) or lubricating fluid (MIL-L-23699) with carbon black in a ratio of 5 parts carbon black to 100 parts fluid by weight. Soil shall be applied to the components using an appropriate brush or wiping cloth. The soiled components shall then be baked at 104° ± 3°C (220° ± 5°F) for 1 hour. Components shall be weighed before soiling and just prior to cleaning to provide a means to quantify soil removal.

4.6.7.4 Cleaning: The components shall be cleaned in a normal wash cycle for 30 minutes. The components shall be cleaned in the candidate material two times: Once with an automatic rinse cycle and once without rinsing. The standard soiling procedure outlined in 4.6.7.3 shall be followed prior to each of the cleaning cycles.

4.6.7.5 Cleanliness evaluation: Evaluation of the components for cleanliness shall consist of a visual inspection; a weight comparison before and after cleaning and a visual inspection under black light fluorescence. The cleaner shall be rejected if one of the following conditions apply after cleaning:

a. More than 5% of the soil remains (by weight)
b. Fluorescence exists on more than 5 % of the component surfaces
c. Candidate material foams during the service test in a sufficient quantity to cause the solution to overflow the parts washer cleaning sump.

5. PACKAGING:

5.1 Preservation:

Preservation shall be level A or Commercial, as specified (6.2e).

5.1.1 Level A: The cleaning compound shall be furnished in 19, 57 or 208-liter (5-, 15- or 55-gallon) containers, as specified (See 6.2d). Unless otherwise specified in the contract or order, the containers shall conform to Type II of PPP-D-705 and type II of PPP-D-729, respectively. The flanges shall have three or more full threads, and the plugs shall have sufficient length of thread that three or more full threads are engaged when the plug is screwed tight with gaskets in place. The threads shall be American Standard modified pipe threads. The 19-liter (5-gal.) pail in which the cleaning compound is furnished for uses, other than the foam generator, shall have a flexible spout. The internal surfaces of all containers shall be protected with a material that shall not adversely affect nor be adversely affected by the cleaning compound. In addition to the above requirements, the cleaning compounds shall be packaged in containers having a 1mm (0.040 inch) polyethylene liner.

5.1.2 Commercial: The cleaning compound shall be preserved in accordance with ASTM D 3951.

5.2 Packing:

Packing shall be level A, B or Commercial, as specified (see 6.2).

5.2.1 Level A and B: The cleaning compound, when packaged as specified in 5.1.1, shall be palletized in accordance with load type III of MIL-STD-147, except the for overseas shipment, the over-all height of the load shall not exceed 1.1 meters (43 inches). Each prepared load shall be banded with primary, secondary and horizontal straps in accordance with means K, L and E and shall have storage aid 5 applied.

5.3 Palletization:

Unless otherwise specified (see 6.2), cleaning compound of one type only, packaged in 19, 57 or 208-liter (5, 15 or 55-gal.) containers as specified in 5.1, shall be palletized in accordance with load type III of MIL-STD-147, except that for overseas shipment, the over-all height of the load shall not exceed 1.1 meters (43 inches). Each prepared load shall be banded with primary, secondary and horizontal straps in accordance with K, L and E and shall have storage aid 5 applied.

5.4 Marking:

In addition to any special marking required by the contract or order, shipping containers and palletized unit loads, when applicable, shall be marked in accordance with MIL-STD-129.

5.4.1 Type I:

5.4.1.1 Product identification: The following identification marking shall appear in 2-inch high bold block lettering on each product container:

PARTS WASHER / SPRAY CABINET CLEANER
TYPE I WATER-BASED CLEANER CONCENTRATE

5.4.1.2 Warnings: The following warning shall appear on each product container:

Do not use full strength (dilute to recommended concentration).

Use at recommended temperature.

5.4.2 Type II:

5.4.2.1 Product identification: The following identification marking shall appear in 2-inch high bold block lettering on each product container:

PARTS WASHER / SPRAY CABINET CLEANER
TYPE II WATER-SOLUBLE POWDER

5.4.2.2 Warnings: The following warning shall appear on each product container:

Do not use full strength (dilute to recommended concentration).

Use at recommended temperature.