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PERFORMANCE SPECIFICATION

CLEANING COMPOUNDS, PARTS WASHER AND SPRAY CABINET

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

1. SCOPE

1.1 Scope. This specification covers two types of cleaning compounds used in parts washers and spray cabinets for cleaning aircraft components.

1.2 Classification. The cleaning compounds covered by this specification are classified as follows:

Type I - Water-soluble liquid concentrate
Type II - Water-soluble powder

2. APPLICABLE DOCUMENTS

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

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100 or emailed to thomas.omara@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

AMSC N/A

FSC 6850

2.2 Government documents.

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

FEDERAL SPECIFICATIONS

CCC-C-46	-	Cloth, Cleaning, Nonwoven Fabric. (Inactive for new design)

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-680	-	Degreasing Solvent
MIL-A-8625	-	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-G-21164	-	Grease, Molybdenum Disulfide, for Low and High Temperatures, NATO Code Number G-353
MIL-PRF-83282	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537
MIL-DTL-83488	-	Coating, Aluminum, High Purity

(Copies of these documents are available on line at http://assist.daps.dla.mil/quicksearch/ or www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government document forms a part of this document to the extent specified herein. Unless otherwise specified, the issue is that cited in the solicitation or contract.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR	-	Protection of the Environment

(Copies of this document are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-0001.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM-A240	-	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels, and for General Applications, Standard Specification for. (DoD adopted)
ASTM-B152	-	Copper Sheet, Strip, Plate, and Rolled Bar, Standard Specification for. (DoD adopted)
ASTM-D93	-	Flash-Point by Pensky-Martens Closed Cup Tester, Standard Test Methods for. (DoD adopted)
ASTM-D2834	-	Nonvolatile Matter (Total Solids) in Water-Emulsion Floor Polishes, Solvent-Based Floor Polishes, and Polymer-Emulsion Floor Polishes, Standard Test Method for. (DoD adopted)
ASTM-D3278	-	Flash Point of Liquids by Small Scale Closed-Cup Apparatus, Standard Test Methods for. (DoD adopted)
ASTM-E70	-	pH of Aqueous Solutions with the Glass Electrode, Standard Test Method for. (DoD adopted)
ASTM-F483	-	Total Immersion Corrosion Test for Aircraft Maintenance Chemicals, Standard Test Method for. (DoD adopted)
ASTM-F519	-	Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments, Standard Test Method for. (DoD adopted)
ASTM-F945	-	Stress-Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials, Standard Test Method for. (DoD adopted)
ASTM-F1104	-	Preparing Aircraft Cleaning Compounds, Liquid Type, Water Base, for Storage Stability Testing, Standard Test Method for.

(Copies of these documents are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE-AMS-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet. (DoD adopted)
SAE-AMS4375	-	Sheet and Plate, Magnesium Alloy, 3.0Al - 1.0Zn - 0.20Mn (AZ31B-0), Annealed and Recrystallized. (DoD adopted)
SAE-AMS5046	-	Carbon Steel, Sheet, Strip, and Plate (SAE 1020 and 1025) Annealed. (DoD adopted)
SAE-AMS-QQ-P-416		Plating, Cadmium (Electro Deposited). (DoD adopted)
SAE-AMS-T-9046	-	Titanium and Titanium Alloy, Sheet, Strip, and Plate. (DoD adopted)

SAE-AMS5536 - Nickel Alloy, Corrosion and Heat Resistant, Sheet, Strip, and Plate 47.5Ni - 22Cr - 1.5Co - 9.0Mo - 0.60W -18.5Fe, Solution Heat Treated. (DoD adopted)

(Copies of these documents are available from www.sae.org or SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The cleaning compound furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.3).

3.2 Materials. The cleaning compounds shall not contain known or suspected carcinogens, ozone depleting substances, hazardous air pollutants, volatile organic compounds, or total toxic organic (TTO) compounds as specified in 40 CFR. Surface-active agents used in the cleaning compounds shall be not less than 85 percent biodegradable when determined in accordance with methods appropriate to surface-active agent type.

3.3 Unit of issue. To interface with existing equipment and meet the required storage characteristics, the cleaning compounds shall be furnished in 5-, 15-, or 55-gallon containers. The internal surfaces of all containers shall be protected with a material that shall not adversely affect nor be adversely affected by the cleaning compounds.

3.4 Markings. Markings to identify type I and type II cleaning compounds shall appear on each container to indicate that the product should not be used at full strength.

3.5 Performance requirements.

3.5.1 Biodegradability. The supplier of the cleaning compounds shall ensure that the surfactants used in the cleaning compound are biodegradable in accordance with 40 CFR, Part 796, subpart D. Testing for biodegradability shall be in accordance with 4.5.1. The cleaning compounds shall meet the requirement of not less than 85 percent biodegradable at the end of the 28-day period specified in 4.5.1.

3.5.2 Nonvolatile content. The cleaning compound qualification sample shall be tested for nonvolatile content in accordance with 4.3. Conformance inspection results shall not differ from the qualification values by more than ± 1.0 percentage points.

3.5.3 Flash point

3.5.3.1 Type I. The Pensky-Martens flash point of the concentrated liquid cleaning compound shall be greater than 212 °F (100 °C) when tested in accordance with 4.3.

3.5.3.2 Type II. The Setaflash flash point of the concentrated powdered cleaning compound shall be greater than 212 °F (100 °C) when tested in accordance with 4.3.

3.5.4 pH. The pH of the cleaning compounds shall be tested using the manufacturer's recommended cleaning concentration in accordance with 4.3. Conformance inspection results shall not differ from the qualification values by more than ± 0.5 units.

3.5.5 Foaming characteristics. At the manufacturer's recommended concentration, the cleaning compounds shall produce a foam volume of not more than 100 ml, when tested at 120 °F (49 °C) and 160 °F (71 °C) in accordance with 4.5.2.

3.5.6 Corrosivity.

3.5.6.1 Titanium stress corrosion. The cleaning compounds shall not produce any microscopic cracking when tested at the manufacturer's recommended concentration and examined metallographically at 500X magnification (see 4.3).

3.5.6.2 Total immersion corrosion. The cleaning compounds shall cause neither visual corrosion nor a weight change of any specimen greater than that shown in table I, when tested at the manufacturer's recommended concentration and in accordance with 4.5.3.

Table I. Total immersion corrosion weight changes.

Test panel material	Former designation	Allowable weight change ($mg/cm^2/24$ hours)
Aluminum (SAE-AMS-A-250/4)	Alloy 2024; QQ-A-250/4-T3	0.04
Aluminum (SAE-AMS-A-250/4) anodized per MIL-A-8625, type I	Alloy 2024; QQ-A-250/4-T3 anodized per MIL-A-8625, type I	0.04
Carbon steel (SAE-AMS5046)	SAE 1020	0.04
Copper (ASTM-B152)	NA	0.10
Magnesium (SAE-AMS4375), bare	AZ31B-0	0.20
Nickel (SAE-AMS5536)	Hastelloy X	0.04
Stainless steel (ASTM-A240, Class 410)	NA	0.04
Carbon steel (SAE-AMS5046) plated per SAE-AMS-QQ-P-416, Type I	SAE 1020 plated per SAE-AMS-QQ-P-416	0.20
Titanium (SAE-AMS-T-9046, type III,comp C)	Type I, 6Al 4V	0.04

3.5.6.3 Hydrogen embrittlement. When tested at the manufacturer's recommended concentration in accordance with 4.5.4, neither cadmium plated AISI 4340 steel specimens nor IVD aluminum coated AISI 4340 steel specimens shall exhibit embrittlement. Four specimens of each coating shall be tested using either the sustained load procedure or the step load procedure. For the sustained load procedure, embrittlement is indicated if a specimen fractures in less than 200 hours when loaded to 75 percent notched fracture strength. If only one of the four specimens fractures, step load the remaining three specimens at 5 percent of the notched fracture strength per hour to failure. If these three specimens achieve 90 percent for 1 hour, the chemical shall be considered non-embrittling, For the step load procedure, embrittlement is indicated if a specimen fractures at less than 90 percent of notched fracture strength.

3.5.7 Stability.

3.5.7.1 Hard water stability. When tested at the manufacturer's recommended concentration and as specified in 4.5.5, the cleaning compound shall not cause any corrosion of SAE-AMS-A-250/4 aluminum in excess of that allowed in table I.

3.5.7.2 Storage stability. When tested as specified in 4.5.6 and after a 12 month storage period, the type I cleaning compound shall not exhibit any separation, crystallization, or other deterioration of the cleaning compound or container. The type II cleaning compound shall not exhibit any deterioration of the cleaning compound or container. Stored cleaning compounds shall not fail the total immersion corrosion (3.5.6.2) or cleaning efficiency (3.5.8) requirements. For cleaning efficiency, only the MIL-G-21164 soil shall be tested.

3.5.7.3 Accelerated storage stability. After being tested for accelerated storage as specified in 4.5.7, the test sample shall show no marked change in color or uniformity when compared to the control and shall meet the cleaning efficiency requirement for the MIL-G-21164 soil specified in 3.5.8.

3.5.8 Cleaning efficiency. The cleaning compound shall remove not less than 80 percent of unbaked grease in accordance with MIL-G-21164 and not less than 95 percent of baked Alox 2028, when tested at the manufacturer's recommended concentration as specified in 4.5.8.

3.5.9 Oil separation. The oil layer shall be not less than 9 and be not greater than 13 milliliters, when tested as specified in 4.5.9.

3.5.10 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. When examined visually at room temperature, the type II cleaning compound should be free-flowing, lump-free, and free from foreign materials. Upon mixing, the cleaner shall form a liquid with no solid sediment.

3.5.11 Service evaluation. Upon completion of all other tests herein, with the exception of storage stability (see 3.5.7.2), the qualifying activity may request a full evaluation of the cleaning compounds by an aircraft depot maintenance facility (Navy, Air Force, Army, or commercial) in accordance with 4.5.10. The cleaning compounds performance shall be equal to or better than an existing qualified product chosen by the maintenance facility.

4. VERIFICATION

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

a. Qualification inspection (see 4.3).
b. Conformance inspection (see 4.4).

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

4.3 Qualification inspections. Qualification inspection shall consist of all the tests specified in table II. At the discretion of the qualifying activity, service evaluation of the cleaning compound may be required.

TABLE II. Qualification inspection.

Characteristic	Requirement paragraph	Test method or paragraph
Biodegradability	3.5.1	4.5.1
Nonvolatile content 1/	3.5.2	ASTM-D2834
Flash point (type I)	3.5.3.1	ASTM-D93
Flash point (type II)	3.5. 3.2	ASTM-D3278
PH	3.5.4	ASTM-E70
Foaming	3.5.5	4.5.2
Titanium stress corrosion 2/	3.5.6.1	ASTM-F945
Total immersion corrosion 3/	3.5.6.2	ASTM-F483
Hydrogen embrittlement 4/	3.5.6.3	ASTM-F519
Hard water stability	3.5.7.1	4.5.5
Storage stability	3.5.7.2	ASTM-F1104 and 4.5.6
Accelerated storage stability	3.5.7.3	4.5.7
Cleaning efficiency	3.5.8	4.5.8
Oil separation	3.5.9	4.5.9
Workmanship	3.5.10	Visual examination
Service evaluation	3.5.11	4.5.10

1/ Nonvolatile content shall be determined using 2- to 3-gram sample weights, 100-mm diameter glass Petri dishes, and a forced draft oven at 105 ±2 °C (221 ± 4 °F) for 16 hours.
2/ At 500X magnification
3/ As modified in 4.5.3
4/ As modified in 4.5.4

4.3.1 Samples. Qualification test samples shall consist of two 1-gallon containers of the type in which the manufacturer intends to supply contract quantities of the cleaner(s).

4.4 Conformance inspection. The cleaning compound acquired by the Government under this specification shall be source inspected in accordance with 4.4.2 to ensure the material meets the conformance inspection prior to shipment from the manufacturer's plant.

4.4.1 Sampling. Two containers of cleaning compound shall be randomly selected from each lot and tested as specified in 4.4.2.

4.4.2 Testing. Samples selected in accordance with 4.4.1 shall be tested in accordance with the test methods specified in table III. Each sample selected shall be thoroughly mixed prior to testing. Failure of either sample to conform to any requirement of this specification shall be cause for rejection of the lot represented by these samples.

TABLE III. Conformance inspection.

Inspection	Requirement paragraph	Test method or paragraph
Nonvolatile content 1/	3.5.2	ASTM-D2834
Flash point (Type I)	3.5.3.1	ASTM-D93
Flash point (Type II)	3.5.3.2	ASTM-D3278
pH	3.5.4	ASTM-E70
Foaming	3.5.5.5	4.5.2
Titanium stress corrosion	3.5.6.1	ASTM-F945
Total immersion corrosion 2/	3.5.6.2	ASTM-F483

1/ Nonvolatile content shall be determined using 2- to 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 4.5.3.

4.5 Methods of inspection.

4.5.1 Biodegradability. Biodegradation of the concentrated cleaning compounds shall 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 shall be shown as carbon transformation by both soluble organic carbon reduction and CO_2 evolution.

4.5.2 Foaming. One hundred milliliters (ml) of cleaning solution (prepared in accordance with the manufacturer's instructions) shall be placed in a blender container and conditioned at 160 ± 2 °F (71 ± 1 °C) for 1 hour. The blender shall then be turned on for 2 minutes at 8000 ±1000 rotations per minute. After 2 minutes, the blender shall be turned off and the foam volume shall be determined immediately by reading a graduated scale on the blender container. The test shall be repeated at 120 ± 2 °F (49 ± 1 °C).

4.5.3 Total immersion corrosion. The cleaning compounds shall be diluted to the manufacturer's recommended cleaning concentration. Corrosion specimens that are not plated, anodized, or conversion coated (including magnesium specimens) shall be polished with 240-grit aluminum oxide or silicon carbide paper or cloth. Specimens shall be cleaned with MIL-PRF-680 followed by isopropyl alcohol and exposed as specified in ASTM-F483, except that the cleaning solution shall be heated to 160 ± 2 °F (71 ± 1 °C) prior to and during the test. After 24 hours, the panels shall be removed, cleaned, and weighed in accordance to ASTM-F483.

4.5.4 Hydrogen embrittlement. Hydrogen embrittlement shall be determined in accordance with ASTM-F519, using AISI 4340, type 1a or 1e specimens.

4.5.4.1 Specimen coating. Cadmium-plated specimens shall be prepared as specified using treatment B, without conversion coating. Ion vapor deposited (IVD) aluminum specimens shall be prepared in accordance with MIL-DTL-83488, class 2, type II. The coatings shall cover the notch and surfaces within 0.5 inch of the notch; threaded surfaces shall not be coated. Cadmium-plated specimens shall be baked in accordance with ASTM-F519.

4.5.4.2 Procedure. Four specimens for each coating shall be individually exposed, immediately dried, then immediately tested for embrittlement. Exposure shall consist of immersion in a glass beaker containing fresh cleaning solution per product (at the manufacturer's recommended concentration) at 160 ± 2 °F (71 ± 1 °C) for 30 minutes. Specimens shall be dried without rinsing at ambient conditions for five minutes. Embrittlement testing shall consist of applying a load equivalent to 75 percent of notch fracture strength for 200 hours; or, a load equivalent to 45 percent of notch fracture strength shall be applied for 24 hours, then stepped an additional 5 percent of notch fracture strength each hour until failure. Failure shall be as indicated in 3.5.6.3.

4.5.5 Hard water stability.

4.5.5.1 Preparation of hard water stock solution. A 10-grain hard water stock solution shall be prepared by dissolving 0.20 ± 0.005 gram of analytical reagent grade calcium acetate

($Ca(C_2H_3O_2)_2 \cdot H_2O$) and 0.14 ± 0.005 gram of analytical reagent grade magnesium sulfate ($MgSO_2 \cdot 7H_2O$) in one liter of boiled distilled water.

4.5.5.2 Procedure. In a capped polymethylpentene (PMP) container, prepare 250 ml of total solution by diluting the cleaner concentrate with the prepared hard water stock solution to achieve the manufacturer's recommended concentration. Screw on the cap and shake the container vigorously for 15 seconds, place in a 160 ± 2 °F (71 ± 1 °C) oven for two hours, then allow to stand undisturbed for 16 hours at room temperature. Test the solution for corrosivity on SAE-AMS-A-250/4 aluminum test panels as specified in 4.5.3.

4.5.6 Storage stability. Both types of cleaning compounds shall be stored in their original containers as furnished by the manufacturer. After 12 months of storage in accordance with ASTM-F1104, the cleaning compounds shall be examined for any type of deterioration of the cleaning compounds or of the containers. In addition, a sample of the stored cleaning compounds shall be used to perform the total immersion corrosion test on bare and anodized aluminum alloy (see table II). Finally, the sample shall be tested for cleaning efficiency using only the MIL-G-21164 soil (see 4.5.8) for conformance to the requirements of this specification.

4.5.7 Accelerated storage stability.

4.5.7.1 Preparation of test sample. For type I cleaners, a 150-ml portion of well-shaken concentrated cleaning compound shall be poured into each of two clean 500 ml clear, round, screw cap polymethylpentene (PMP) bottles with an outside diameter of 2.5 inches. One bottle shall be immediately capped and stored in the dark at room temperature for a minimum of 6 days (control sample). The second bottle is the test sample. For type II cleaners, place the powder in a dry capped container and proceed as for type I cleaners.

4.5.7.2 Procedure. The test sample shall be placed in a water bath heated to 140 ± 4 °F (60 ± 2 °C) and held at that temperature for not less than 8 hours. The bath shall then be cooled to room temperature over the next 16 hours. This procedure shall be repeated every day for 5 additional days. After exposure for a total of 6 cycles, the test sample shall be removed from the bath and visually examined for degradation of the cleaning compound. The test sample shall be recapped and, along with the control sample, thoroughly shaken for 1 minute, allowed to stand undisturbed at room temperature for a minimum of 1 hour, then be compared to the control sample. When the test sample is in compliance with the visual requirements of 3.5.7.3, it shall be tested for cleaning efficiency using only the MIL-G-21164 soil (see 4.5.8) for conformance to the requirements of this specification.

4.5.8 Cleaning efficiency. The cleaning compound solution shall be prepared by diluting the concentrated cleaning compound to the manufacturer's recommended cleaning concentration with hard water stock solution (see 4.5.5.1).

4.5.8.1 MIL-G-21164 grease. Molybdenum disulfide grease soil shall be prepared by blending 50 grams of Raven 1040 carbon black (see 6.5) or equal as approved by the qualifing activity and 500 grams of grease in accordance with MIL-G-21164 with a mechanical grease worker for 15 minutes.

4.5.8.2 Alox 2028. Alox 2028 (see 6.5) shall be used as a soil, as received.

4.5.8.3 Test coupons. Test coupons shall be aluminum or stainless steel 0.25 by 1.0 by 4.0 inches with a 0.0625-inch deep rectangular depression 0.75 by 2.75 inches, located 0.375 inches from one end. Prior to soil application, the coupons shall be solvent wiped with acetone (dimethylketone) using wipes in accordance with CCC-C-46, class 7. The pre-cleaning shall continue until the wipe is free of visual residue. The coupons shall be dried in an oven at 221 ± 4 °F (105 ± 2 °C) for 30 minutes. The coupons shall then be removed from the oven, air-cooled to room temperature, and weighed to the nearest 0.1 mg (W_1).

4.5.8.4 Apparatus. The cleaning apparatus shall consist of a 600 ml beaker, heavy-duty glass beaker, a 2-inch long by 0.375-inch diameter cylindrical magnetic stirring bar, a test coupon, and a digital stirrer/hot plate with speed and temperature controls.

4.5.8.5 Soil removal. Test coupons shall be loaded (using a clean acid brush) by brushing the entire bottom of the depression with a test soil to give a uniform film. Avoid contact with the vertical edges. Following the conditioning in table IV, the coupons shall be weighed (W_2). Use only test coupons with soil weights between 100 and 150 mg. Prepare the cleaning solution by diluting the cleaning compounds to the manufacturer's recommended concentration using synthetic hard water as described in 4.5.5.1. Add 500 ml of the cleaning solution and stirring bar to the beaker and stabilize at 160 ± 2 °F (71 ± 1 °C) using the stirrer/hot plate. Clamp the 3 coupons to the side of the beaker so that the soiled depression is fully immersed. Set the stirring speed at 500 rpm and continue stirring for 10 minutes. Rinse the specimen as indicated in table IV.

TABLE IV. Conditioning and rinsing.

SOIL	CONDITIONING	RINSING
MIL-G-21164	None	Remove the test coupon from the beaker and immediately rinse for one minute under a 4-liter/minute water stream from a laboratory faucet with serrated tip. The test coupon shall be 10-12 inches from the tip and held 45° to the water stream.
Alox 2028	1 hour at 221 °F (105 °C); Air-cool to room temperature	Pour the solution from the beaker and immediately place the beaker with coupon under flowing cold tap water for one minute without impinging on the soiled area.

Soils shall be cleaned sequentially in the same prepared solution, with coupons soiled with MIL-G-21164 grease, followed by coupons soiled with Alox 2028.

Dry the coupons for 5 minutes at 105 ± 2 °C (221 ± 5 °F), cool, and then weigh (W_3). The cleaning efficiency result for each of the two soils shall be an average of three test coupons. Calculate coupon cleaning efficiency (CE) as follows:

$$CE\ (\%) = \frac{(W_2 - W_3)}{(W_2 - W_1)} \times 100$$

4.5.9 Oil separation. Prepare a 100 ml sample of the manufacturer's recommended concentration of the cleaning compound in a stoppered 100 ml graduated cylinder. Discard 10 ml of the solution and replace it with 10 ml of hydraulic fluid in accordance with MIL-PRF-83282. Place the cylinder in a forced convection oven at 160 ± 2 °F (71 ± 1 °C) for one hour. Remove the cylinder from the oven, shake it vigorously for 10 seconds, and allow it to stand at room temperature for one hour. After one hour, observe and record the volume of the top (oil) layer.

4.5.10 Service test. Service testing may be performed at a military aviation depot using an automated parts washer on soiled parts which are typical of those cleaned at the depot. Alternatively, artificially soiled parts may be prepared using fluids normally encountered in service to coat clean parts. In either case, results for the product being tested shall be compared to the results for a product which is already qualified to this specification.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The cleaning compounds covered by this specification are used in the maintenance of military aircraft exposed for prolonged periods to extreme seagoing environments not encountered by civilian aircraft. The cleaning compound is intended for use in parts washers

and spray cabinets for cleaning aviation weapons systems, and engine and support equipment components. The cleaning compound will remove oily contaminants which are present on disassembled components.

6.2 Acquisition requirements. Acquisition documents should specify the following:

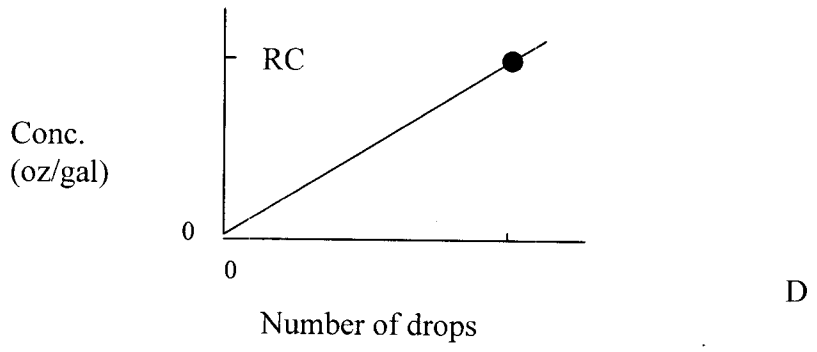
a. Title, number, and date of this specification.
b. Type of cleaning compound required (see 1.2).
c. Unit of issue required (see 3.3).
d. Quantity required.
e. Packaging requirements (see 5.1).

6.3 Solution test kit use. The following test kit components and procedures can be used to maintain the cleaning solution in a tank by replenishment with the concentrated cleaning compound:

25 ml measuring vial
5 ml measuring vial
50 ml chemical resistant plastic flask
25 ml dropper bottle of 0.5 percent phenolphthalein indicator
100 ml dropper bottle of 1.0 N sulfuric acid.

6.3.1 Procedure. This procedure requires the user to make a chart using titration for the product being used, if one has not been made previously. Using this chart and titration results on a questionable tank solution, the amount of cleaner concentrate to be added to the tank can be calculated.

6.3.1.1 Chart. Make up the manufacturer's recommended concentration (RC) and make sure it is well dissolved. Take the appropriate sample size (20 ml for a liquid and 5 ml for a powder), add it to the flask, then add 6 drops of indicator. Add the sulfuric acid solution a drop at a time, swirling the mixture after each drop. Count the number of drops (D) it takes until the pink color is completely gone (use a sheet of white paper under the flask to help see the color). Repeat this procedure to make sure that you have done this correctly. Mark this point on simple graph paper and draw a straight line to the origin (see example below).



6.3.1.2 Determining the concentration of the cleaner solution. Take a sample of the questionable cleaning solution: 20 ml for a type I solution or 5 ml for a type II solution. Pour the sample into a clean 50 ml plastic flask. Add 6 drops of indicator to the flask and swirl to mix. The solution will be a pink or red pink color. Add the sulfuric acid solution a drop at a time, swirling the mixture after each drop. Count the number of drops it takes until the pink color is completely gone. Using the chart above, determine the concentration of the sample by finding the number of drops on the horizontal axis and the corresponding concentration on the vertical axis.

6.3.1.3 Determine the amount of cleaner concentrate to add. Suppose the parts washer has a 150 gallon tank of cleaning solution made up using a type I product designed to be used at 7.5 oz/gal (fluid ounces per gallon). You would use the larger vial to take a 20 ml sample from the tank. After pouring that sample into the flask and adding the correct amount of indicator, you find that it takes a certain number drops of acid to cause the color to change. Suppose your chart indicates the cleaner concentration in the parts washer is 5.0 ounces per gallon (oz/gal). If you want to bring the concentration back up to 7.5 oz/gal, you need to calculate the makeup volume of cleaner to add to the tank. Subtract the indicated concentration from the desired concentration then multiply by the volume of the tank:

Volume = (7.5 - 5.0) oz/gal X 150 gal = 375 oz (or 2.9 gal)

This is the volume of cleaner concentrate that must be added to the tank. If the total of all makeup additions is more than the amount of cleaner initially charged to the tank, the tank should be dumped, cleaned, and recharged with fresh cleaner and water.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-29602 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the 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 products covered by this specification. Information pertaining to qualification of products may be obtained from the Naval Air Warfare Center Aircraft Division, Building 2188, 48066 Shaw Road, Unit 5, Patuxent River, MD 20670-1908.

6.4.1 Inspection reports and additional information. When authorizing the forwarding of qualification samples, the qualifying activity will require the manufacturer to submit, along with the samples, the following:

a. Two copies of the manufacturer's test report containing complete test data showing that the material submitted for qualification conforms to the requirements of this specification.
b. Certification that the cleaning compound contains no carcinogens, ozone depleting substances, hazardous air pollutants, volatile organic compounds, or total toxic organic and is biodegradable (see 3.2).

c. Material safety data sheets prepared in accordance with FED-STD-313 (see 6.8)
d. Two copies of the manufacturer's instructions for use of the cleaning compound.
e. A proven method for determining and maintaining the proper concentration of cleaning compounds in the parts washer.

The samples must be plainly and durably marked with the following information and forwarded to the test facility identified in the letter of authorization to submit samples:

- Sample for qualification inspection
- CLEANING COMPOUND, PARTS WASHERS AND SPRAY CABINETS
- Specification MIL-PRF-29602A
- Type I or II, as applicable
- Manufacturer's name and address
- Manufacturer's product identification
- Manufacturer's recommended dilution
- Batch number
- Date of manufacture
- Submitted by (name and date) for qualification inspection in accordance with the requirements of MIL-PRF-29602A under authorization of (reference authorization letter).

6.5 Supplier information.

Table V. Item supplier information.

Item	Identification	Supplier	Location
Measuring vial, 25 ml	Cat. No. 2172-40	Hach Company	Loveland, CO
Measuring vial, 5 ml	Cat. No. 2172-38		
Plastic flask, chemical resistant, 50 ml	Cat. No. 20898-71		
Dropper bottle of 0.5% phenolphthalein indicator, 25 ml	Cat. No. 162-36		
Dropper bottle of 1.0 N sulfuric acid, 100 ml	Cat. No. 1270-26		
Carbon black	Raven 1040	Columbia Carbon Company	Atlanta, GA
Soil	Alox 2028	Alox Corporation	Niagara Falls, NY

6.6 Retention of qualification. To retain qualification of the products approved for listing on the QPL, the manufacturer will 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 will be every two years from the date of original

qualification and will be initiated by the Government. The Government reserves the right to re-examine the qualified product whenever deemed necessary to ensure that the product continues to meet any or all of the specification requirements.

6.7 Lot formation. Unless otherwise specified, a lot consists of all the cleaning compound produced by one manufacturer, at one plant, from the same materials and under essentially the same conditions, provided the operation is continuous and does not exceed a 24 hour period. In the event the process is a batch operation, each batch will constitute a lot.

6.8 Toxicity. The cleaning compounds, when used for their intended purpose, must have no adverse effect on the health of personnel. Questions pertaining to this effect will be referred by the acquiring activity to the appropriate medical service who will act as an adviser to the contracting agency.

6.9 Material Safety Data Sheets (MSDSs). MSDSs for items supplied to the Government will conform to FED-STD-313, Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

6.10 Subject term (key word) listing.

Aqueous
Biodegradable
Dilutable
Service evaluation

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

Custodians:
Army - EA
Navy - AS
Air Force - 68

Preparing activity:
Navy - AS

(Project 6850-1493)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at www.dodssp.daps.mil.