

METRIC

MIL-PRF-32177
27 September 2004

PERFORMANCE SPECIFICATION CLEANING COMPOUND, FLIGHT DECK

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 a compound for cleaning flight deck surfaces on aircraft carriers and other air-capable ships.

1.2 Classification. The cleaning compound will conform to the following types:

Type I - For use with fresh (potable) water.

Type II - For use with seawater.

1.3 Part or Identifying Number (PIN). PINs to be used for cleaning compounds acquired to this specification are created as follows:

M 12345- 1

└───┘	Type: 1 – Type I – Use with fresh water
└───┘	2 – Type II – Use with seawater
└───┘	Specification number
└───┘	M prefix

Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to commandstandards@navsea.navy.mil, with the subject line "Document Comment". 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

MIL-PRF-32177

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

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

FEDERAL SPECIFICATION

VV-G-671 - Grease, Graphite

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-G-21164 - Grease, Molybdenum Disulfide, for Low and High Temperatures, NATO Code Number G-353
 MIL-DTL-24441/21A - Paint, Epoxy-Polyamide, Haze Gray, Formula 151, Type III
 MIL-PRF-24635 - Enamel, Silicone Alkyd Copolymer
 MIL-PRF-24667 - Coating System, Non-Skid, for Roll or Spray Application
 MIL-DTL-81381 - Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy
 MIL-PRF-85285 - Coating: Polyurethane, Aircraft and Support Equipment

(Copies of these documents are available online 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 documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

BUREAU OF MEDICINE AND SURGERY (BUMED)

BUMED INST 6270.8 - Procedures for Obtaining Health Hazard Assessments

(Copies of this document are available online at <http://navalmedicine.med.navy.mil/> or from Bureau of Medicine and Surgery, Department of the Navy, 2300 E Street, NW, Washington, DC 20372-5300.)

CODE OF FEDERAL REGULATIONS

40 CFR 60, Appendix A, Method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids and Weight Solids of Surface Coatings
 40 CFR 261 - Identification and Listing of Hazardous Waste
 40 CFR 797, Subpart B - Environmental Effects Testing Guidelines

(Copies of these documents are available online at <http://www.gpoaccess.gov/cfr/index.html> or from the U.S. Government Printing Office Bookstore, 710 North Capitol Street, NW, Washington, DC 20401.)

MIL-PRF-32177

ENVIRONMENTAL PROTECTION AGENCY

OPPTS 835.3110	- Ready Biodegradability
OPPTS 835.3120	- Sealed-Vessel Carbon Dioxide Production Test
SW-846, Test Method 5021	- Volatile Organic Compounds in Soils and Other Solid Matrices Using Equilibrium Headspace Analysis
SW-846, Test Method 8260B	- Volatile Organic Compounds by Gas Chromatography / Mass Spectrometry (GC/MS)

(Copies of these documents are available online at www.epa.gov or from the U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460.)

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

ASTM INTERNATIONAL

ASTM A 123	- Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products (DOD adopted)
ASTM B 69	- Standard Specification for Rolled Zinc (DOD adopted)
ASTM B 209	- Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (DoD adopted)
ASTM B 633	- Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (DOD adopted)
ASTM D 93	- Standard Test Methods for Flash-Point by Pensky-Martens Closed Cup Tester (DoD adopted)
ASTM D 1141	- Standard Practice for the Preparation of Substitute Ocean Water (DoD adopted)
ASTM D 2369	- Standard Test Method for Volatile Content of Coatings (DoD adopted)
ASTM D 2834	- Standard Test Method for Nonvolatile Matter (Total Solids) in Water-Emulsion Floor Polishes, Solvent-Based Floor Polishes, and Polymer-Emulsion Floor Polishes (DoD adopted)
ASTM D 3363	- Standard Test Method for Film Hardness by Pencil Test (DoD adopted)
ASTM D 3792	- Standard Method for Water Content of Coatings by Direct Injection into a Gas Chromatograph (DoD adopted)
ASTM D 3960	- Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings (DoD adopted)
ASTM D 4017	- Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method (DoD adopted).
ASTM D 6450	- Standard Test Method for Flash Point by Continuously Closed Cup (CCCFP) Tester
ASTM E 70	- Standard Test Method for pH of Aqueous Solutions with the Glass Electrode (DoD adopted)
ASTM E 1252	- Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis
ASTM F 483	- Standard Test Method for Total Immersion Corrosion Test for Aircraft Maintenance Chemicals (DoD adopted)
ASTM F 502	- Standard Test Method for Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces (DoD adopted)
ASTM F 519	- Standard Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments (DoD adopted)
ASTM F 718	- Standard for Shipbuilders and Marine Paints and Coatings Product/Procedure Data Sheet (DoD adopted)

MIL-PRF-32177

(Copies of these documents are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.)

NATIONAL LUBRICATING GREASE INSTITUTE (NLGI)

Lubricating Grease Guide - NLGI Grease Number 2 and Grease Number 3.

(Copies of this document are available from www.nlgi.com or the National Lubricating and Grease Institute, 4635 Wyandotte Street, Kansas City, MO 64112-1596.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AMS-QQ-A-250/4A - Aluminum Alloy 2024, Plate and Sheet UNS A92024 (DoD adopted).
 AMS-QQ-A-250/12 - Aluminum Alloy 7075, Plate and Sheet UNS A97075 (DoD adopted).
 AMS-QQ-A-250/13 - Aluminum Alloy Alclad 7075, Plate and Sheet UNS A87075.
 AMS-5046 - Carbon Steel, Sheet, Strip, and Plate (SAE 1020 and 1025), Annealed. (DoD adopted)

(Copies of these documents are available from www.sae.org or the Society of Automotive Engineers, 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 compounds furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Material. Cleaning compounds supplied under this specification must comply with all Navy occupational health and safety regulations, and meet the following characteristics:

3.2.1 Volatile organic content (VOC). The VOC shall not exceed 250 grams/liter. (See 4.4.1)

3.2.2 Hazardous air pollutants (HAPS). The content of HAPs solvents in the total cleaning compound shall not be greater than the weight percent (%WT) values listed in Table I. (See 4.4.2)

TABLE I. Hazardous solvent content.

Hazardous solvent in total cleaning compound	Maximum, %Wt
Benzene	0.05
Chlorine or Fluorine containing solvents, total	0.05
Class I or Class II ozone depleting chemicals as defined in EPA 40 CFR 82	0.01
Ethyl Benzene	0.05
Methyl, Ethyl and Butyl mono-ethers of Ethylene glycol or the acetates thereof, total (Methyl, Ethyl and Butyl cellosolves and Methyl, Ethyl, and Butyl cellosolve acetates)	0.05
Methyl ethyl ketone (MEK)	0.05
Methyl isobutyl ketone (MIBK)	0.05
Toluene	0.05
Xylene (all forms), total	0.01

3.2.3 Toxicity. The cleaning compound shall have no adverse effect on the health of personnel when used for its intended purpose. The deck tiles shall be assessed by the Navy Environmental Health Center

MIL-PRF-32177

(NAVENVIRHLTHCEN) using the administrative Health Hazard Assessment (HHA). A flowchart for this process can be found as enclosure (1) of BUMEDINST 6270.8. The HHA is a review of the cleaning compound based on information submitted by the manufacturer, to assess health hazards associated with the handling, application, use and removal of the product. The cleaning compound shall not cause any environmental problems during waste disposal (see 4.4.3 and 6.5).

3.2.3.1 The manufacturer shall certify that the cleaning compound does not contain any hazardous material or exhibit any hazardous characteristic as defined under 40 CFR 261 (Code of Federal Regulations). Formulation changes shall require a reevaluation of the material.

3.2.4 Non-volatile content. The non-volatile content of the cleaning compound shall be less than 20 percent by weight. (See 4.4.4)

3.3 Flash point. The flash point of the cleaning compound shall be greater than or equal to 60 degrees Celsius ($^{\circ}\text{C}$) (140 degrees Fahrenheit [$^{\circ}\text{F}$]). (See 4.4.5)

3.4 pH. The pH of the cleaning compound shall be in the range of 6.5 to 12.4. (See 4.4.6)

3.5 Cleaning efficiency. The soil removal characteristics of the cleaning compound shall be not less than the coefficient of friction cleaning efficiency (CE_{cf}) values listed in Table II. (See 4.4.7)

TABLE II. Cleaning efficiency.

Compound dilution	Cleaning efficiency (CE_{cf}), Minimum percent
Diluted IAW manufacturers instructions	95
Undiluted compound	95

3.6 Total immersion corrosion. The undiluted and diluted cleaning compound, diluted in accordance with manufacturers instructions, shall not cause any visible corrosion nor cause an average weight change of any specimen greater than that shown in Table III. (See 4.4.8)

TABLE III. Corrosion limits.

Panel	Weight change milligrams per square centimeter (mg/cm^2) per 24 hours
Aluminum (AMS-QQ-A-250/4A and ASTM B 209)	0.40
Aluminum (AMS-QQ-A-250/12 and ASTM B 209)	0.40
Alclad aluminum (AMS-QQ-A-250/13 and ASTM B 209)	0.40
Steel (AMS-5046) SAE 1020	0.08
Galvanized steel (ASTM A 123 or ASTM B 633)	0.08
Zinc (ASTM B 69)	0.08

3.7 Effect on organic coatings. When tested in accordance with 4.4.9, the diluted cleaning compound shall not:

- soften MIL-DTL-24441/21A, by more than 2 pencil hardness values,
- soften MIL-PRF-24667, type I coatings to insertion of a sharp probe,
- soften MIL-PRF-85285, by more than 2 pencil hardness values,
- soften MIL-PRF-24635, by more than 2 pencil hardness values,
- cause loss of adhesion,
- cause discoloration or other sign of deterioration.

MIL-PRF-32177

3.8 Effect on polyimide insulated wire. The cleaning compound, when tested in accordance with 4.4.10, shall not cause dissolution, cracking, or dielectric breakdown (leakage) of the polyimide insulated wire in excess of that produced by distilled water.

3.9 Biodegradability. The cleaning product concentrate when diluted in accordance with the manufacturer's label shall be water soluble in fresh or salt water, dilution biodegradable, and readily decomposed by naturally occurring microorganisms. Biodegradability shall be a minimum of 50 % in 23 days when tested in accordance with 4.4.11.

3.10 Aquatic Toxicity. The product shall not be toxic to aquatic life as determined by meeting the following three criteria for acute (Daphnia or fish), acute (algae), and chronic (Daphnia) effects (see 4.4.12):

- (a) Acute: EC50 Daphnia (48 hr.) > 10 mg/L; or LC50 fish (96 hr.) > 10 mg/L
- (b) Acute: EC50 algae (96 hr.) > 10 mg/L
- (c) Chronic: EC50 Daphnia (21-day or > 10 mg/L 15-day minimum).

3.11 Service evaluation. When tested in accordance with 4.4.13, the cleaning compound shall:

- (a) have a minimum coefficient of friction cleaning efficiency (CE_{cf}) average of 95% (listed in Table IV);
- (b) not discolor non-skid being cleaned, or cause discoloration or other sign of deterioration;
- (c) not cause cracking, checking, loss of adhesion, or blistering of the non-skid being cleaned;
- (d) not display any other deficiency which would adversely affect its cleaning performance or the performance of the non-skid being cleaned;
- (e) be visually homogeneous;
- (f) not exhibit separation, lumps, curds or gel formation;
- (g) not cause any visible corrosion in deck equipment, or aircraft launch or recovery equipment.

TABLE IV. Service evaluation.

Compound dilution	Minimum percent cleaning efficiency (CE_{cf})
Diluted IAW manufacturer's instructions	95
Undiluted compound	95

3.12 Workmanship. When examined visually at room temperature, the cleaning compound shall be a homogeneous liquid, free of foreign matter.

3.13 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.14 Hydrogen embrittlement. The cleaning compound shall be considered non-embrittling if all test specimen do not fail within 150 hours after immersion when tested in accordance with 4.4.14.

4. VERIFICATION

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

- a. Qualification inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.1.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.2, 4.3, and 4.4. A lot shall consist of the cleaning compound produced by one manufacturer, at one plant, from the same materials and under the same manufacturing conditions, offered for

MIL-PRF-32177

delivery at one time, provided that the process is continuous. In the event the process is a batch process, each batch shall constitute a lot.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations of and tests specified in Table V.

TABLE V. Qualification inspection.

Inspections	Requirements	Tests
Volatile organic content (VOC)	3.2.1	4.4.1
Hazardous air pollutants (HAPs)	3.2.2	4.4.2
Toxicity	3.2.3	4.4.3
Non-volatile content	3.2.4	4.4.4
Flash point	3.3	4.4.5
PH	3.4	4.4.6
Cleaning efficiency	3.5	4.4.7
Total immersion corrosion	3.6	4.4.8
Effect on organic coatings	3.7	4.4.9
Effect on polyimide insulated wire	3.8	4.4.10
Biodegradability	3.9	4.4.11
Aquatic Toxicity	3.10	4.4.12
Service evaluation	3.11	4.4.13
Workmanship	3.12	---
Hydrogen embrittlement	3.14	4.4.14

4.2.1 Qualification sample. The qualification sample shall consist of a volume sufficient to run all the tests from each type of cleaning compound acquired at any one time.

4.3 Conformance inspection. Conformance inspection shall be performed on a representative sample. Sampling shall be conducted in accordance with Table VI. This inspection shall include the requirements of 3.3 through 3.4 and 3.12. Failure of any test, by any sample, shall be cause for rejection unless the procedure described in 4.3.1 is followed.

4.3.1 Noncompliance. If a sample fails to pass its conformance inspection, the contractor shall notify the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected; which were manufactured with essentially the same materials and processes; and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, suitable to the inspection activity, has been taken. After the corrective action has been taken, appropriate inspections shall be repeated on additional sample units. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity.

TABLE VI. Sampling for cleaning compound.

Number of containers in a batch or lot	Number of sample containers
2 to 25	2
26 to 150	3
151 to 1,200	5
1,201 to 7,000	8
7,001 to 20,000	10
20,001 to 35,000	15
Over 35,000	20

MIL-PRF-32177

4.4 Test procedures.

4.4.1 Volatile organic content (VOC). The VOC of the cleaning compound, in ready-to-use condition, shall be determined by ASTM D 3960. The determination of VOC may necessitate the use of ASTM methods D 2369, D 3792, D 4017 and EPA 40 CFR, Chapter 1, Part 60, Appendix A, Method 24.

4.4.2 Hazardous air pollutants (HAPs). The content of HAPS solvents in the total cleaning compound, in ready-to-use condition, shall be determined by methods 5021 and 8260B of EPA SW-846. Solvent fractions shall be identified in accordance with ASTM E 1252.

4.4.3 Toxicity. To determine conformance with the requirements of 3.2.3, the cleaning compound shall be evaluated using the HHA process. Sufficient data to permit a HHA of the product shall be provided by the manufacturer/distributor to the NAVENVIRHLTHCEN. To obtain current technical information requirements specified by the NAVENVIRHLTHCEN, see 6.5.

4.4.4 Non-volatile content. The non-volatile content of the cleaning compound, in ready-to-use condition, shall be determined by ASTM D 2834.

4.4.5 Flash point. The flash point of the cleaning compound, in ready-to-use condition, shall be determined by ASTM D 93 or ASTM D 6450.

4.4.6 pH. The pH of the cleaning compound, in ready-to-use condition, shall be determined by ASTM E 70.

4.4.7 Cleaning efficiency (CE_c). Testing shall be conducted as follows:

4.4.7.1 Test panel preparation. Two test areas are required. One test area is to be cleaned with diluted cleaning compound and one area is to be cleaned with undiluted cleaning compound. Each test area shall consist of three 0.6 meter by 0.6 meter sections each of which has been coated with one type of MIL-PRF-24667 non-skid. The individual 0.6 meter by 0.6 meter (approximately 2 feet by 2 feet) section of test surface (smooth blast-cleaned steel plate) shall be laid side by side and coated with MIL-PRF-24667, type I non-skid in accordance with the manufacturer's ASTM F 718 data sheet. The MIL-PRF-24667, type I non-skids shall be rolled parallel to the 1.8 meter (6 foot) dimension. The non-skid shall be cured one week prior to proceeding to soil application. The coefficient of friction of the cured non-skid shall be greater than 0.5 (see 4.4.7.4) before soil application. Measure and record the coefficient of friction value for each cured panel prior to application of soil. Calculate and record the average coefficient of friction for of all six panels for use in the calculation in 4.4.7.3.1 (F_0).

4.4.7.2 Soil composition formulation. One part of carbon black (Raven 1040, Columbian Chemicals Co. or equivalent) shall be dispersed into 10 parts VV-G-671 grease or National Lubricating Grease Institute (NLGI) No. 2 (or No. 3 consistency (medium soft and medium) commercial Lithium based grease), 10 parts MIL-G-21164 Molybdenum disulfide grease (or commercial Molybdenum disulfide based NLGI no. 2 consistency grease), 1 part of hydraulic fluid (typical automobile hydraulic brake fluid), and 1 part JP-5 jet fuel (or commercial automobile diesel fuel), using a mechanical grease worker.

4.4.7.2.1 The soil described in 4.4.7.2 shall be gently brushed on to a one meter wide strip centered on the test areas with a soft bristle broom brush. The soil shall be applied in sufficient quantity to completely cover the non-skid grit. After application, the wet soil shall then be stroked in one direction parallel to the long dimension with the soft bristle broom brush. The test area shall be allowed to dry for one week at ambient conditions, which shall not be less than 20°C (68°F). Brush parallel to the long dimension with a clean soft bristle broom brush to remove loose soiling compound.

4.4.7.3 Cleaning and evaluation. Cleaning shall be in accordance with manufacturer's instructions for the cleaning compound. Separate test areas shall be cleaned with the undiluted cleaning compound and the diluted cleaning compound (diluted with water per the manufacturer's instructions). The test areas shall be rinsed using ambient temperature ASTM D 1141 synthetic seawater and allowed to dry. Fresh (tap, potable) water shall not be used. After cleaning and drying, the coefficient of friction determination (see 4.4.7.4) shall be repeated on the

MIL-PRF-32177

cleaned tested areas, and the average of each set of three panels recorded (F_{C1} and F_{C2}) for use in the calculation in 4.4.7.3.1 below.

4.4.7.3.1 Calculations. Coefficient of friction cleaning efficiency (CE_{cf}) shall be calculated as follows:

$$CE_{cf} = \frac{(F_{C1} \text{ or } F_{C2})}{F_0} \times 100$$

CE_{cf}	=	The percentage ratio defined by (F_{C1} or F_{C2}) divided by F_0 multiplied by 100.
F_{C1}	=	Average friction reading of the first set of three test panels after cleaning with dilute solution (in accordance with manufacturers recommendations) (see 4.4.7).
F_{C2}	=	Average friction reading value of the second set of three test panels after cleaning with cleaning compound.
F_0	=	Average friction reading of the six original, unsoiled test panels.

4.4.7.4 Friction test apparatus. Testing shall be conducted using a slipmeter and shall be constructed with the following features:

(a) A steel sled having a flat surface 100 by 125 mm \pm 2.5 mm on each dimension (4 by 5 in), and a thickness of 25 to 40 mm (1 to 1.5 in). One 100 mm (4 in) side of the sled shall have a screw eye in the center of the face to which the force gauge is attached. One 100 by 125 mm (4 by 5 in) face of the sled shall be covered with vulcanized neoprene having Type "A" durometer hardness of 57 ± 2 and a thickness over its entire surface of 3 mm (1/8 in) (nominal). The edges of the rubber shall be beveled. The total weight of the sled with the rubber facing shall be 2.7 ± 0.2 kg (6.0 ± 0.5 lb). The sled or the platform movement shall be parallel to the non-skid panel, and shall not tend to lift the sled from the panel.

(b) A force gauge shall be used which: (a) measures 0 to 4.5 kg (0 to 10 lbs) full scale, (b) reads out directly in kg (lbs) on an electronic display with an accuracy of ± 4.5 g (± 0.01 lb), and (c) can be preset to lock onto the highest force encountered. A Chatillon Gauge Model DFG-10 has been found to be satisfactory for this purpose.

(c) A platform which moves across a minimum of a 100 mm (4 in) distance at a constant speed of 300 m (12 in) per minute (nominal). The platform shall have provisions to hold the non-skid panel firmly during the test to prevent twisting or lifting of the panel without interfering with the motion of the sled.

Illustrations of the friction apparatus are contained in MIL-PRF-24667.

4.4.7.4.1 Test procedure. The test shall be conducted on the six panels prepared in accordance with 4.4.7.1. Each panel shall be subjected to the test procedure under the following conditions:

COF test shall first be run with the panel dry. Each panel shall be secured on the moving platform and the sled of the slipmeter shall be placed on the panel. The hook of the sled shall be attached to the hook on the force gauge, and the force to be applied by the sled shall be along the axis of the force gauge. The gauge shall be set to zero, and set to display the highest force encountered. The platform shall be started in motion at a rate of 254 ± 51 mm (10 ± 2 in) per minute, and allowed to travel a minimum of 100 mm (4 in). The highest force encountered by the sled shall be recorded during the test. The coefficient of friction shall be computed by dividing the reading on the gauge by the mass of the sled. Five replicate measurements shall be made; the panel shall then be turned 90 degrees and five additional measurements shall be made. The average of the ten readings for each panel (60 total) shall be computed. Since friction readings are a function of the surface condition of the steel sled rubber surface, a steel sled with a new vulcanized neoprene rubber shall be used for each product tested. In addition, sleds used for the different test conditions shall be used only for the same conditions. That is a sled used dry shall only be used to test dry friction specimens; sleds used with soiled panels shall be used only with soiled panel specimens. Sleds shall be calibrated against a flat steel block having machined cross-hatched v-shaped grooves having a nominal depth of 1.27 mm (0.05 in) and a nominal groove peak distance of 0.25 mm (0.01 in). Sleds may continue to be used in testing the same product until repeat measurements on the calibration surface changes by more than five percent (plus or minus). All

MIL-PRF-32177

calibrations shall be performed on the same calibration block since the intent of the calibration blocks is only to determine reproducibility of readings by the rubber pad and thus rubber pad replacement criteria. Calibration of sleds on different calibration blocks during the determination of friction values on a test specimen is not permitted. Calibration shall be performed before and after test specimen friction determinations, and the values obtained shall be recorded and reported with the test value. Other methods to move the sled across the panel are acceptable. Some methods use a portable motor that moves the force gauge 100 mm (4 in) at a rate of about 300 mm (12 in) per minute; the force gauge is connected to the sled with a light chain.

4.4.8 Total immersion corrosion. Corrosion specimens shall be fabricated from aluminum alloys SAE AMS-QQ-A-250/4A, SAE AMS-QQ-A-250/12, SAE AMS-QQ-A-250/13, mild steel SAE 1020 (AMS 5046), galvanized steel (ASTM A 123 or ASTM B 633), and zinc (ASTM B 69) with dimensions as specified in ASTM F 483. Solvent clean and remove any coatings or markings before testing. One set of specimens shall be totally immersed in diluted cleaning compound, diluted in accordance with manufacturers instructions. The other shall be totally immersed in undiluted cleaning compound for a period of 48 hours. Weight changes shall be calculated as milligrams per square centimeter per 24 hours. The corrosion limits of the panels cannot exceed the requirements in 3.6.

4.4.9 Effect on organic coatings.

4.4.9.1 Effect on MIL-DTL-24441/21A. The effect on organic coatings shall be determined in accordance with a finish conforming to MIL-DTL-24441/21A. Paint shall be mixed and applied to a blast cleaned, steel plate in accordance with the manufacturer's directions. The coating shall be cured for 24 hours at 40°C (104°F) and then scribed through to the substrate metal in an "X" pattern at least 4 inches square in two places. Pencil hardness shall be determined in accordance with ASTM D 3363 before immersion in cleaning compound. Apply 10 milliliters (mL) of diluted cleaning compound and 10mL of undiluted cleaning compound to separate scribed areas of the test panel and cover with watch glasses. The panels shall be exposed for 2 hours at room temperature. The watch glasses shall be removed and the test areas allowed to dry at room temperature for 24 hours. After exposure, pencil hardness shall be determined in accordance with ASTM D 3363. Scribed area shall be inspected for loss of adhesion and wetted area inspected for discoloration. The results shall be in accordance with the requirements of 3.7.

4.4.9.2 Effect on MIL-PRF-24667. The effect on non-skid coatings shall be determined in accordance with a finish conforming to MIL-PRF-24667, Type I. Coating shall be mixed and applied to two (2) blast cleaned, steel plates in accordance with the manufacturer's directions. The coating shall be cured for 24 hours at 40°C (104°F) and then scribed through to the substrate metal in an "X" pattern at least 4 inches square in two places. Immerse one panel in diluted cleaning compound and the second panel in undiluted cleaning compound so that the scribed areas are fully immersed. The panel shall be exposed for 2 hours at room temperature. The test panels shall be removed from the solutions and the test areas allowed to dry at room temperature for 24 hours. After exposure, the immersed and non-immersed areas of the test panels shall be probed with a sharp pointed 10 mm (1 inch) wide blade, wood chisel and any softening determined. Scribed area shall be inspected for loss of adhesion and wetted area inspected for discoloration. The results shall be in accordance with the requirements of 3.7.

4.4.9.3 Effect on MIL-PRF-85285. The effect on aircraft polyurethane topcoats shall be determined in accordance with a finish conforming to MIL-PRF-85285. Paint shall be mixed and applied to an aluminum plate, prepared in accordance with ASTM F 502, in accordance with the manufacturer's directions. The coating shall be cured for 24 hours at 40°C (104°F) and then scribed through to the substrate metal in an "X" pattern at least 4 inches square in two places. Pencil hardness shall be determined in accordance with ASTM D 3363 before immersion in cleaning compound. Apply 10 milliliters (mL) of diluted cleaning compound and 10mL of undiluted cleaning compound to separate scribed areas of the test panel and cover with watch glasses. The panels shall be exposed for 2 hours at room temperature. The watch glasses shall be removed and the test areas allowed to dry at room temperature for 24 hours. After exposure, pencil hardness shall be determined in accordance with ASTM D 3363. Scribed area shall be inspected for loss of adhesion and wetted area inspected for discoloration. The results shall be in accordance with the requirements of 3.7.

4.4.9.4 Effect on MIL-PRF-24635. The effect on silicone-alkyd topside coatings shall be determined in accordance with a finish conforming to MIL-PRF-24635. Paint shall be mixed and applied to two (2) blast cleaned,

MIL-PRF-32177

steel plates in accordance with the manufacturer's directions. The coating shall be cured for 24 hours at 40°C (104°F) and then scribed through to the substrate metal in an "X" pattern at least 4 inches square in two places. Pencil hardness shall be determined in accordance with ASTM D 3363 before immersion in cleaning compound. Immerse one panel in diluted cleaning compound and the second panel in undiluted cleaning compound so that the scribed areas are fully immersed. The panels shall be exposed for 2 hours at room temperature. The test panels shall be removed from the solutions and the test areas allowed to dry at room temperature for 24 hours. After exposure, pencil hardness shall be determined in accordance with ASTM D 3363. Scribed area shall be inspected for loss of adhesion and wetted area inspected for discoloration. The results shall be in accordance with the requirements of 3.7.

4.4.10 Effect on polyimide insulated wire. Coil two segments of MIL-DTL-81381/11-20 wire approximately 61 cm (24 in) and place into separate 118 ml (4 oz) wide mouth jars. To one jar add sufficient concentrate cleaning compound to completely cover the wire coil. To the other jar (control sample) add sufficient distilled water to cover the wire coil. Cap both jars and store at room temperature (20 - 25 °C) for 14 days. At the end of the storage period remove both coils, rinse thoroughly with distilled water and suspend to allow complete draining and drying. Uncoil the wires, examine each closely for dissolution, and report the results. The wire immersed in the cleaner shall perform as well as the wire immersed in distilled water. Both wires shall then be subjected to a double reverse wrap on a 0.3 cm (0.125 in) mandrel and examined for cracking. (Note: Failure of the control sample here voids the test and shall be repeated using new MIL-DTL-81381/11-20 material). Wire immersed in the cleaner shall then be examined for cracking. If cracking occurs results shall be reported and the test ended. Passing wire shall then withstand a one minute dielectric test of 2,500 volts (rms), using a Hypot model number 4045 or equivalent, and examined for breakdown or leakage. Wire immersed in the cleaner shall perform equally well as the control wire immersed in distilled water.

4.4.11 Biodegradability. The biodegradability of the cleaning compound shall be determined by either EPA OPPTS 835.3110 (Ready Biodegradability) or EPA OPPTS 835.3120 (Sealed-vessel Carbon Dioxide Production Test).

4.4.12 Aquatic toxicity. The aquatic toxicity of the cleaning compound shall be determined by 40 CFR 797 Subpart B.

4.4.13 Shipboard appearance and performance. A service test of the cleaning compound shall be conducted on a flight deck of a CV, CVN, LHA or LHD class ship. First, coefficient of friction determination (see 4.4.7.4) shall be performed on the area to be tested (F_0). The cleaning compound shall be applied according to the instructions furnished by the manufacturer. After the cleaning compound has been removed or allowed to dry per manufacturer's instructions, the coefficient of friction value shall be re-measured per 4.4.7.4 (F_{C1}). The cleaning efficiency of the cleaning compound will then be determined using the calculation shown in 4.4.7.3.1. In addition, the cleaned area shall be inspected visually. If there are any visual signs of deterioration of the test area or flight deck equipment, or aircraft launch or recovery equipment due to the cleaning compound, service testing will halt immediately and the product disapproved for use.

4.4.14 Hydrogen embrittlement. The hydrogen embrittlement caused by the cleaning compound shall be determined by ASTM F 519.

4.4.14.1 Test specimens. Type 1d (notched C-ring) cadmium plated, in accordance with ASTM F 519 Table 1 treatment B, test specimens shall be used. After cadmium plating the test specimens, rinse in tap water and then rinse by immersing and swirling for 15 seconds in a solution with a concentration equivalent to one containing 2.3 kg of chromic acid to 38 L of water. Remove the chromic acid from the specimens by rinsing in cold tap water followed by hot tap water, rinse, and dry. Place the specimens in an oven at 191 ± 14 °C for 23 hours.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or

MIL-PRF-32177

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 which may be helpful, but is not mandatory.)

6.1 Intended use. The cleaning compound covered by this document is intended for use in cleaning non-skid surfaces of flight decks on aircraft carriers and on other air-capable ships.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type (see 1.2).
- c. Inspection conditions (see 4.1.1).
- d. Packaging requirements (see 5.1).
- e. Is Material Safety Data Sheet (MSDS) required? (see 6.4)
- f. Toxicity conformance (see 3.2.3 and 6.5).

6.3 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 No. 32177 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 the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160.

6.4 Material safety data sheets. Contracting officers will identify those activities requiring companies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

6.5 Toxicity evaluation. The NAVENVIRHLTHCEN requires sufficient information to permit a HHA of the product. Any questions concerning toxicity and requests for HHA should be addressed to the Commanding Officer, Navy Environmental Health Center, ATTN: Hazardous Materials Department, Industrial Hygiene Directorate, 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA 20378-2103. Upon receipt of the HHA, a copy should be provided to Commander, Naval Sea Systems Command, ATTN: SEA 05Z9, 1333 Isaac Hull Ave., SE, Stop 5133, Washington Navy Yard, DC 20376-5160.

6.6 For the purposes of this specification, potable (fresh) water is water that meets U.S. Environmental Protection Agency (EPA) definition in 40CFR141 and 40 CFR131.36 or is water supplied by a municipal water system or other source for human consumption.

6.7 For the purposes of this specification, seawater is water that meets requirements of ASTM D 1141 or is drawn from an undiluted ocean source and has a salinity of at least 33 ppm (chloride).

6.8 Shelf life. This specification covers items where shelf life is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order. The shelf-life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from *DoD 4140.27-M, Shelf-life Management Manual*, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points (ICPs), and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: <http://www.shelflife.hq.dla.mil/>.

MIL-PRF-32177

6.9 Subject term (key word) listing.

Detergent

Custodians:

Army - EA

Navy - SH

Air Force - 68

Preparing Activity:

Navy - SH

(Project 7930-0443)

Review activities:

Army - MR

Navy - AS

Air Force - 50

DLA - GS

Civil Agency:

GSA - FSS

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.