

NOT MEASUREMENT SENSITIVE

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SUPERSEDING
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PERFORMANCE SPECIFICATION

CLEANING COMPOUNDS, AIRCRAFT, EXTERIOR

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

1. SCOPE

1.1 Scope. The cleaning compounds covered by this specification are used for cleaning the exterior surface of aircraft.

1.2 Classification. The cleaning compounds covered by this specification are furnished in the following types (see 6.2):

Type I	-	General purpose, aromatic solvent base
Type IA	-	General purpose, aromatic solvent base, aerosol
Type IW	-	General purpose, aromatic solvent base, pre-saturated wipe
Type II	-	General purpose, non-solvent
Type II RTU	-	General purpose, non-solvent, ready to use (RTU)
Type III	-	Abrasive spot cleaner
Type IV	-	Rubberized spot cleaner
Type V	-	Gel-type wheel well degreaser, low solvent (less than 10 percent)

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 4L8000B120-3, Highway 547, Lakehurst, NJ 08733-5100 or emailed to michael.sikora@navy.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil .

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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.

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 STANDARDS

FED-STD-595 - Colors Used in Government Procurement/
FED-STD-595 Color Numbers 17875, 36440, and 36495

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-C-1164	- Cloth, Terry, Cotton, Cotton and Polyester
MIL-G-21164	- Grease, Molybdenum Disulfide, for Low and High Temperatures, NATO Code Number G-353
MIL-PRF-23377	- Primer Coatings: Epoxy, High Solids
MIL-W-81381/11	- Wire, Electric, Fluorocarbon/Polyimide Insulated, Medium Weight, Silver Coated Copper Conductor, 600 Volts, 200 DEG C, NOMINAL 8.4 or 15.4 Mil Wall
MIL-PRF-83282	- Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537
MIL-PRF-85285	- Coating, Polyurethane, High-Solids, Aircraft and Support Equipment

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

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CODE OF FEDERAL REGULATIONS

- 29 CFR 1910.1200 - Occupational Safety and Health Standards - Hazard Communications
- 40 CFR - Protection of Environment
- 40 CFR 796.3100 - Aerobic Aquatic Biodegradation

(Copies of these documents are available online at <http://www.gpoaccess.gov> or from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

NAVAL AIR SYSTEMS COMMAND

NAVAIR 01-1A-509 - Aircraft Weapons Systems Cleaning and Corrosion Control

(This document has limited distribution. Requests for copies by U.S. Government agencies and their contractors should be made to the Naval Air Systems Command, Code 4.3.4.2, Unit 5, Building 2188, 48066 Shaw Road, Patuxent River, MD 20670.)

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 D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester. (DoD Adopted)
- ASTM D95 - Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation. (DoD Adopted)
- ASTM D523 - Standard Practice for Specular Gloss. (DoD Adopted)
- ASTM D1141 - Standard Practice for the Preparation of Substitute Ocean Water. (DoD Adopted)
- ASTM D3065 - Standard Test Methods for Flammability of Aerosol Products
- ASTM E70 - Standard Test Method for pH of Aqueous Solutions with the Glass Electrode. (DoD Adopted)
- ASTM E168 - Standard Practices For General Techniques of Infrared Quantitative Analysis. (DoD Adopted)
- ASTM F483 - Standard Practice for Total Immersion Corrosion Test for Aircraft Maintenance Chemicals. (DoD Adopted)
- ASTM F484 - Standard Test Method for Stress Cracking of Acrylic Plastics in Contact with Liquid or Semi-liquid Compounds. (DoD Adopted)
- ASTM F485 - Standard Test Method For Effects of Cleaners on Unpainted Aircraft Surfaces
- ASTM F502 - Standard Test Method for Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces. (DoD Adopted)

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| ASTM F519 | - | Standard Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating/Coating Processes and Service Environments. (DoD Adopted) |
| ASTM F1104 | - | Standard Test Method for Preparing Aircraft Cleaning Compounds, Liquid type, Water Base, for Storage Stability Testing |
| ASTM F1110 | - | Standard Test Method for Sandwich Corrosion Test. (DoD Adopted) |
| ASTM F1111 | - | Standard Test Method for Corrosion of Low-Embrittling Cadmium Plate by Aircraft Maintenance Chemicals. (DoD Adopted) |

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

SAE INTERNATIONAL

- | | | |
|---------------------|---|---------------------------------------------------------------------------------------------------------------------------------|
| SAE AMS4377 | - | Sheet and Plate, Magnesium Alloy, 3.0Al - 1.0Zn - 0.20Mn (AZ31B-H24) Cold Rolled, Partially Annealed - UNSM11311. (DoD Adopted) |
| SAE AMS4911 | - | Titanium Alloy, Sheet, Strip, and Plate 6Al - 4V Annealed - UNSR56400. (DoD Adopted) |
| SAE AMS5046 | - | Sheet Strip and Plate, Carbon Steel (SAE 1020 and 1025), Annealed. (DoD Adopted) |
| SAE AMS-M-3171 | - | Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on. (DoD Adopted) |
| SAE AMS-QQ-A-250/4 | - | Aluminum Alloy 2024, Plate and Sheet. (DoD Adopted) |
| SAE AMS-QQ-A-250/12 | - | Aluminum Alloy 7075, Plate and Sheet. (DoD Adopted) |

(Copies of these documents are available from <http://www.sae.org> or from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

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

3. REQUIREMENTS

3.1 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 4.3 and 6.3). Cleaning compounds shall meet the requirements in table I.

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TABLE I. Physical properties.

Property	Requirement	Test Method	Dilution
COMPOSITION			
Composition	No carcinogens ¹ /, toxic pollutants ² / or ozone depleting substances ³ /. Type IA shall be a 1:4 dilution of a qualified type I product in an aerosol package. Type II RTU shall be a 1:4 dilution of a qualified Type II product in a 32oz pump spray or 5 gallon can.	Manufacturer Certification	
pH	7.0 to 10.0	ASTM E70	As received and ⁹ / _{As received}
Type II RTU			
Non-volatile content	Record value	4.5.9	As received
Water content	Record value	ASTM D95	As received
Infrared spectrogram	Record spectrogram of non-volatile matter	ASTM E168	
Rubber content (type IV only)	10.0 to 15.0 percent by weight particulate rubber	Manufacturer certification	
Solvent content, maximum weight percent type I, IA, and IV type II type V	10.0 percent aromatic, 32.0 percent total solvent 1.0 percent total solvent 10.0 percent total solvent, no aromatics	Manufacturer certification	As received
Net weight (Type IA)	Net weight for a 16 and 20 fluid ounce can shall be no less than 13 and 17 ounces respectively.	4.5.16	
Type II RTU	Nominal 32 ounces		
SAFETY & ENVIRONMENTAL			
Toxicity	No adverse effect on the health of personnel when used for its intended purpose	Manufacturer certification	
Flash point, Pensky-Martens	140° F (60° C), minimum	ASTM D93	As received
Biodegradability (types II and V)	85 percent in 28 days, minimum	40CFR 796.3100	
Flame extension (type IA only)	Less than 6 inches	ASTM D3065	As received
MATERIAL COMPATIBILITY			
Sandwich corrosion	Rating of 1 or less	ASTM F1110	As received and ⁹ / _{As received}
Type II RTU			
Cadmium corrosion	0.20 mg/sq. cm/24hrs wt change, maximum	ASTM F1111	As received and ⁹ / _{As received}
Type II RTU			

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TABLE I. Physical properties – Continued.

Property	Requirement	Test Method	Dilution
Total immersion corrosion Al <u>4</u> /, Ti <u>5</u> /, Steel <u>6</u> / Mg <u>7</u> / Type II RTU	No visible corrosion and 0.04 mg/sq. cm/24hrs wt. change, maximum 0.20 mg/sq. cm/24hrs wt. change, maximum	ASTM F483	As received and <u>9</u> / As received
Hydrogen embrittlement Type II RTU	No failures in less than 150 hours when specimens are loaded to 45 percent of fracture strength and immersed in cleaner.	ASTM F519, type 1A specimens. Cadmium plated in accordance with (IAW) Table II, Treatment B.	As received and <u>9</u> / As received
Unpainted surfaces, effect on	No streaks or stains	ASTM F485	<u>9</u> /
Painted surfaces, effect on	No softening in excess of 1 pencil hardness	ASTM F502	As received and <u>9</u> /
Plastics, effect on Acrylic, type A (Cleaner types I, IA,II,II RTU, III, and IV only) Acrylic, type A (type V) Acrylic, type C Type II RTU & Type III	No crazing after 8 hours No crazing after 4 hours No crazing after 8 hours	4.5.10 and ASTM F484	Diluted 1:1 with distilled water As received
Polyimide insulated wire, effect on	No dielectric leakage, no visual effect greater than that of distilled water	4.5.11	As received
Abrasiveness type III type IV	No more than 10 percent gloss reduction 0.5 increase in gloss, maximum	4.5.1	As received
PERFORMANCE			
Cleaning efficiency type I, II, and IV type II RTU type I and IV	Not less than 5% of a freshly made control formula cleaning efficiency on hydraulic fluid and grease soils Not less than 5% of a freshly made control formula cleaning efficiency on wire rope lubricant soil <u>8</u> /	4.5.4	<u>9</u> / As received
Cleaning efficiency, type IA only	Not less than 5% of a freshly made type I control formula diluted 1:4, on hydraulic fluid and grease soils <u>8</u> /	4.5.4	As Received

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TABLE I. Physical properties – Continued.

Property	Requirement	Test Method	Dilution
Embedded soil cleaning efficiency, type III	Complete removal of embedded carbon black	4.5.15	As received
Cleaning of vertical surfaces, type V	Complete removal of wire rope lubricant soil or comparable to control	4.5.5	As received
Foaming properties, type I and II	80 ml liquid after 6 minutes, maximum	4.5.7	9/
Consistency type IV type V	10 to 20 cm flow in 10 seconds 13 to 23 cm flow in 10 seconds	4.5.6	As received
Sprayability, type I and V	Uniform spray when applied from finger pump spray bottle or aerosol. Type V clings to vertical panel	Visual	As received
Service evaluation (when required)	Satisfactory	4.5.13	
Leakage, type IA only	Aerosol cans shall not leak nor become distorted	4.5.17	
STABILITY			
Appearance	Homogeneous, no foreign matter	Visual	As received
Low temperature stability	No separation	4.5.8	As received
Accelerated storage stability	No separation or effect on steel strip. Cleaning efficiency shall be no less than 5% of a freshly made control formula. 8/ Particulate matter in types III and IV shall not settle or float appreciably.	4.5.2	As received
Storage stability	<u>After one year's storage:</u> No cleaner separation, crystallization, or deterioration. No container incompatibility, corrosion, distortion, or leakage. Shall meet qualification requirements for cleaning efficiency, sandwich corrosion, cadmium corrosion, total immersion corrosion, hydrogen embrittlement, pH, foaming properties, and appearance.	4.5.14 & ASTM F1104	As received

1/ As specified by the National Toxicology Program's Annual Report on Carcinogens

2/ As specified in 40 CFR 401

3/ As specified in 40 CFR 82.

4/ Aluminum alloy: SAE AMS-QQ-A-250/12

5/ Titanium: SAE AMS4911(6Al-4V alloy)

6/ Steel: SAE AMS5046 (1020 alloy)

7/ Magnesium alloy: SAE AMS4377, Chrome Pickled: SAE AMS-M-3171, type VI

8/ Freshly made control formula is not more than six weeks old.

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- 9/ Unless otherwise specified dilute with distilled water (volume concentrate: volume water): type I (1:9), type II (1:14), type III (not diluted), type IV (not diluted), type V (not diluted)

3.2 Product identification and instructions for use. All containers of cleaning compound shall be clearly labeled with the manufacturer's name and product designation, date of manufacture, and pH of the cleaning compound. Labels containing direction for use shall be on each container. Labels shall contain the following instructions as applicable:

3.2.1 Type I.

EXTERIOR AIRCRAFT CLEANER, GENERAL PURPOSE, AROMATIC SOLVENT,
MIL-PRF-85570, TYPE I

Directions for use:

Light soils: Mix 1 part cleaner in 14 parts water
Moderate soils: Mix 1 part cleaner in 9 parts water
Heavy soils: Mix 1 part cleaner in 4 parts water

Apply with foam generator (see NAVAIR 01-1A-509, Section 2), spray, sponge, brush, or cloth. Scrub, then rinse with fresh water.

3.2.2 Type IA.

EXTERIOR AIRCRAFT CLEANER, GENERAL PURPOSE, AROMATIC SOLVENT,
AEROSOL, MIL-PRF-85570, TYPE IA

Directions for use: Spray cleaner onto surface to be cleaned.
 Allow up to 3 minutes dwell time.
 Scrub with a brush or rub with a clean cloth.
 Rinse with fresh water, if available, or wipe dry.

3.2.3 Type IW.

EXTERIOR AIRCRAFT CLEANER, GENERAL PURPOSE, AROMATIC SOLVENT,
PRE-SATURATED WIPE, MIL-PRF-85570, TYPE IW

Directions for use: Open package and remove pre-saturated cloth.
 Wipe surface to be cleaned.
 Allow up to 3 minutes dwell time and re-wipe.
 Rinse with fresh water, if available, or wipe dry.

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3.2.4 Type II.

EXTERIOR AIRCRAFT CLEANER, GENERAL PURPOSE, NON-SOLVENT,
MIL-PRF-85570, TYPE II

Directions for use:

Light soils: Mix 1 part cleaner in 14 parts water
Moderate soils: Mix 1 part cleaner in 9 parts water
Heavy soils: Mix 1 part cleaner in 4 parts water

Apply with foam generator (see NAVAIR 01-1A-509, Section 2), spray, sponge, brush, or cloth. Scrub, then rinse with fresh water.

3.2.5 Type II RTU.

EXTERIOR AIRCRAFT CLEANER, GENERAL PURPOSE, NON-SOLVENT,
MIL-PRF-85570, TYPE II READY TO USE

Directions for use: Spray cleaner onto surface to be cleaned.
 Allow up to 3 minutes dwell time.
 Scrub with a brush or rub with a clean cloth.
 Rinse with fresh water, if available, or wipe dry.

3.2.6 Type III.

EXTERIOR AIRCRAFT CLEANER, ABRASIVE SPOT CLEANER (FOR GLOSS PAINT
SURFACES ONLY), MIL-PRF-85570, TYPE III

Directions for use: Apply full strength with damp cloth.
 Rub with a circular motion.
 Rinse thoroughly, then dry with a clean cloth.
 Do not allow cleaner to dry on surface.

3.2.7 Type IV.

EXTERIOR AIRCRAFT CLEANER, RUBBERIZED SPOT CLEANER,
MIL-PRF-85570, TYPE IV

Directions for use: Apply full strength with a non-abrasive cleaning pad.
 Allow 1 to 3 minutes dwell time.
 Rub with a circular motion.
 Rinse thoroughly, then dry with a clean cloth.
 Do not allow cleaner to dry on surface.

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3.2.8 Type V.

EXTERIOR AIRCRAFT CLEANER, GEL-TYPE WHEEL WELL DEGREASER,
LOW SOLVENT, MIL-PRF-85570, TYPE V

Directions for use: Apply full strength with brush or pump spray device.
 Allow 5 minutes dwell time.
 Brush if necessary, then spray with fresh water to rinse.

4. VERIFICATION

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

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

4.2 Inspection conditions. Unless otherwise stated in the test method or paragraph herein, standard conditions shall be a room temperature of $22 \pm 2^{\circ} \text{C}$ ($72 \pm 4^{\circ} \text{F}$) and relative humidity of 50 ± 10 percent.

4.3 Qualification inspection. The qualification inspection (see 6.3) shall consist of all tests and examinations of this specification.

4.3.1 Qualification samples.

4.3.1.1 Laboratory test samples. Each laboratory qualification sample shall consist of three 1-gallon (3.785 liters) containers of cleaning compound. Storage gallon samples shall be constructed of the same material as those in which the manufacturer intends to supply contract quantities of the cleaner. One gallon of each sample shall be used for the storage stability test. Samples submitted under Type IA and Type IW shall consist of six individual units of issue. Type II RTU samples shall consist of twelve 32 oz pump spray bottles. The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

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Sample for qualification inspection
CLEANING COMPOUND, AIRCRAFT, EXTERIOR
Type
Name of manufacturer
Product code number
Batch or lot number
Date of manufacture

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Submitted by (name) (date) for qualification inspection in accordance with the requirements of MIL-PRF-85570E.

4.3.1.2 Service test samples. When a service evaluation (see 4.5.13) is required by the qualifying activity, test samples shall consist of a 5-gallon pail for types I, II, IV, and V, and one case of twelve individual units for types IA, Type IW and Type II RTU. The cleaning compound shall be packaged in containers that provide protection during shipment. Samples shall be forwarded in accordance with instructions contained in the letter requesting the service evaluation.

4.4 Conformance inspection. The conformance inspection of the cleaning compound shall consist of all the examinations and tests specified in table II.

TABLE II. Conformance inspection.

Inspection	Requirement	Test Method
Appearance	Homogeneous	Visual
Cadmium corrosion <u>1/</u>	Table I	ASTM F1111
Cleaning efficiency	No less than 5% of control	4.5.4
Flash point	Table I	ASTM D93
Non-volatile content	±2 percent <u>2/</u>	4.5.9
pH	<u>2/</u> ±0.5	ASTM E70
Plastics, effect on	Table I	ASTM F484
Total immersion corrosion <u>1/</u>	Table I	ASTM F483
Water content	±2 percent <u>2/</u>	ASTM D95

1/ 24 hour test duration for conformance testing

2/ Permitted variance from recorded qualification value.

4.4.1 Conformance test samples. Conformance test samples shall be selected in accordance with table III. Unless otherwise specified (see 6.2), two 1-gallon (3.785 liters) composite samples shall be subjected to the tests specified in table II.

TABLE III. Conformance samples.

Lot Size (Units)	Sample Size (Units)
Up to 50	5
51 to 500	7
501 to 35,000	8
over 35,000	11

4.4.1.1 Net content. The sample unit for this examination shall be one filled container. The sample size shall be as specified in table III. A lot (see 6.4) shall be unacceptable if the average net content per container for all units examined is less than specified.

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4.5 Test methods. Tests shall be conducted in accordance with the conditions specified in 4.2. Control formulations for comparison purposes shall be as specified in tables IV through VII.

TABLE IV. Type I control formulation.

Component	Parts by Weight	Supplier (see 6.6)
Igepal CO-630	10.0	Rhone Poulenc
Igepal CO-730	10.0	Rhone Poulenc
Monamid 150-CW	5.0	Uniqema
Dipropylene Glycol Methyl Ether	10.0	Fisher
Hexylene Glycol	8.0	Fisher
Aromatic 150	10.0	Exxon Chemical
Deionized Water	43.5	N/A
Benzotriazole	0.5	Fisher
Hostacor 2098	2.0	Clariant
Morpholine	1.0	Fisher
Total	100.0	

Directions: Blend first eight components in the order given. Reduce pH to 8.0 with glacial acetic acid. Add Hostacor 2098 and Morpholine. Blend until homogeneous.

TABLE V. Type II control formulation.

Component	Parts by Weight	Supplier (see 6.6)
Tomadol 91-2.5	8.5	Tomah
Tomadol 91-6	18.4	Tomah
Monamid 150-CW	15.0	Uniqema
Monateric 1000	1.0	Uniqema
Elfugin AKT	0.7	Clariant
Benzotriazole	0.7	Fisher
Hostacor 2098	0.7	Clariant
Deionized water	55.0	N/A
Total	100.0	

Directions: Blend components in the order given until homogeneous. Reduce pH with glacial acetic acid to be in the range 9.0 to 10.0.

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TABLE VI. Type IV control formulation.

Component	Parts by Weight	Supplier (see 6.6)
<u>Part A:</u>		
Monamulse 653-C	7.10	Uniqema
Monamine 1-76	2.70	Uniqema
Aromatic 150	7.50	Exxon
Isopar M	7.50	Exxon
Diethylene Glycol Butyl Ether	3.55	Fisher
Decanol	1.55	Fisher
<u>Part B:</u>		
Trisodium Phosphate Dodecahydrate	2.7	Fisher
Deionized water	55.0	N/A
Pluronic F98	1.8	BASF
Hycar 1422	10.6	BF Goodrich
Total	100.0	

Directions: Blend Part A and Part B separately in the order given. Combine the two and blend until homogeneous. After 48 hours, reduce pH to 9.5 with glacial acetic acid and blend until homogeneous. Consistency may be adjusted to comply with the requirements of table I by adding single drops of decanol to increase viscosity or diethylene glycol butyl ether to decrease viscosity.

TABLE VII. Type V control formulation.

Component	Parts by Weight	Supplier (see 6.6)
<u>Part A:</u>		
Tomadol 23-1	5.0	Tomah
Tomadol 91-2.5	5.7	Tomah
Tomadol 91-6	10.6	Tomah
Tomadol 91-8	10.7	Tomah
Monateric 1000	4.9	Uniqema
Prep-solve 1/	6.7	Glidco
Isopar M	2.9	Exxon
Dipropylene Glycol	9.0	Fisher
Benzotriazole	0.5	Fisher
<u>Part B:</u>		
Sodium Bicarbonate	1.0	Fisher
Deionized water	43.0	N/A
Total	100.0	

1/ D-limonene with proprietary stabilizer.

Directions: Blend part A and part B separately until homogeneous. Gradually add part B to part A, while blending, until homogeneous. Product may thin slightly in the first 24 hours following

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preparation. Consistency can be adjusted to conform to the requirements of table I by adding single drops of Tomadol 91-2.5 to increase viscosity or dipropylene glycol to decrease viscosity.

4.5.1 Abrasiveness (type III and IV only). A heavy duty wear tester (see 6.6, table IX) shall be used for this test. A block fitted with a white cotton terry cloth conforming to MIL-C-1164 shall be inserted in the instrument holder. The combined weight of the block, cloth, and holder shall be $1,360 \pm 20$ grams. The area of contact with the specimen shall be 1.5 square inches. Type III and IV cleaning compounds shall be tested using panels conforming to designation A and B in table VIII respectively. Test panel gloss shall be measured using a 60 degree calibrated glossmeter conforming to ASTM D523. The panel shall then be placed on the wear tester. Pour 10 ml of the concentrate onto the last panel and 15 ml onto the terry cloth attached to the cleaning block in the instrument holder. After three minutes, place the terry cloth on the cleaning block in contact with the panel and start the tester. The cleaning block shall travel completely across the panel and return (one cycle) at a speed of two seconds per cycle. After 50 cycles, the test panel shall be removed and rinsed under cold, running tap water and blotted dry with terry cloth. Repeat this procedure four times using the same panel. Each time the procedure is repeated, a new terry cloth and additional cleaning compound shall be used. At the completion of the fifth run, the gloss shall again be measured for conformance to table I. When rinsing the test panel, the paint surface shall be observed for the presence of a water break.

4.5.2 Accelerated storage stability.

4.5.2.1 Preparation of test sample. A 5 oz (41.9 ml) portion of a well-shaken cleaning compound shall be poured into a clean 12 oz (254.9 ml) pressure resistant clear glass bottle approximately 9.5 in. (24.1 cm) in height and 2.5 in. (6.4 cm) in outside diameter. A strip of steel 6 x 0.5 x 0.02 in. (5.2 x 1.27 x 0.05 cm) conforming to SAE AMS5046 shall be polished with 280-grit silicon carbide paper to remove surface contamination and then cleaned by boiling for one minute in mineral spirits and one minute in isopropyl alcohol. The steel strip shall be placed in the test bottle and the bottle capped. The bottle shall then be inverted to completely coat the steel strip.

4.5.2.2 Procedure. The capped bottle containing the steel strip shall be placed in a hot water bath held at $140 \pm 4^\circ \text{F}$ ($60 \pm 2^\circ \text{C}$) for 8 hours. The bath and the bottle shall then be allowed to cool for 16 hours and the 24 hour cycle repeated each day for a total of seven days. On the eighth day, the bottle shall be removed from the bath, uncapped, examined for separation, and the steel strip withdrawn and examined for corrosion. The aged sample shall be tested for cleaning efficiency in accordance with 4.5.4 or 4.5.5, as applicable.

4.5.3 Aerosol container (type IA only).

4.5.3.1 Leakage. A pressurized can of cleaning compound shall be immersed completely for five minutes in water maintained at $130 \pm 3^\circ \text{F}$ ($54 \pm 2^\circ \text{C}$). The can shall be observed for emission of bubbles or distortion during this period.

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4.5.3.2 Net weight. A pressurized can of cleaning compound shall be weighed to the nearest gram. The can shall spray for three minutes, followed by a one minute pause. This procedure shall be repeated until the can is empty. The empty can shall then be reweighed and the weight of the contents calculated.

4.5.4 Cleaning efficiency (types I, II, II RTU and IV).

4.5.4.1 Panel preparation. Aluminum alloy panels measuring 6 x 2.5 x 0.02 inches (15.2 x 6.4 x 0.05 cm) shall be prepared in accordance with panel B of table VIII. At least three panels shall be used for each product tested and the control formulation. The set of panels used in one test run shall have the same gloss readings (± 0.1 gloss units) as those used for the control run. The gloss shall be measured by 85 degree reflectance and shall be in the range of 2-5 gloss units. The lightness value (L value in a L-a-b color system) shall be measured using a Colorimeter (illuminant C) or equivalent as approved by the qualifying activity. Record the initial lightness value as L_i .

4.5.4.2 Soil preparation. Hydraulic fluid soil shall be prepared by blending 50 grams of carbon black (see 6.6) and 500 grams of MIL-PRF-83282 fluid first by hand, then with a high speed Cowles type dispersator or other high shear mixer for 15 minutes. Molybdenum disulfide grease soil shall be prepared by blending 50 grams of carbon black and 500 grams of MIL-G-21164 grease, first by hand, then with a mechanical grease worker for 15 minutes.

4.5.4.3 Application of hydraulic fluid and grease soils. Thoroughly mix hydraulic fluid before using. Using a soft bristle brush, gently paint the coated surface of a test panel with the test soil. Remove excess hydraulic fluid soil by covering the test panel with folded absorbent tissue and exerting pressure by rolling over the tissue with a five-pound rubber cylinder. Repeat this blotting procedure twice. Using a 0.5 inch bristle acid brush, apply 0.12 gram of grease soil centered across the panel in a band 1.5 inches wide and perpendicular to the long dimension of the panel. The soil is then brushed the long dimension of the panel for 12 cycles (up and down being one cycle) with a hog bristle brush (see 6.6, table IX). Typical force applied when brushing is equivalent to approximately 1000 grams. The brush shall be rubbed on a clean tissue or towel in three separate places to remove excess soil before brushing the next panel. Each freshly soiled panel shall be baked at $221 \pm 2^\circ \text{F}$ ($105 \pm 1^\circ \text{C}$) for 60 minutes, then cooled to room temperature, and used within four hours. Record the soiled lightness value as L_s . The soiled lightness values shall be in the range of 20.0 to 25.0.

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TABLE VIII. Test panel preparation.

Panel Letter	Step	Material	Number of Coats	Thickness per Coat, mil	Drying Time Between Coats	Drying Time After Final Coat
A	1	Primer, coating conforming to MIL-PRF-23377	1	0.6 - 0.9	1 - 2 hours at room temperature	---
	2	MIL-PRF-85285 (Color No. 17875)	mist coat	---	15 minutes at room temperature	---
	3	MIL-PRF-85285 (Color No. 17875)	wet coat	1.5 - 2.5	---	Air dry one week at room temperature plus one week at 150° F.
B	1	MIL-PRF-23377	1	0.6 - 0.9	1 - 2 hours at room temperature	---
	2	MIL-PRF-85285 (Color No. 36440 or No. 36495)	mist coat	---	15 minutes at room temperature	---
	3	MIL-PRF-85285 (Color No. 36440 or No. 36495)	wet coat	1.5 - 2.5	---	Air dry one week at room temperature plus one week at 150° F.

4.5.4.4 Application of wire rope lubricant. Spray wire rope lubricant (see 6.6) onto a test panel and immediately wipe back and forth using a piece of non-abrasive cleaning pad to achieve a uniform soil in the center of the panel. Bake the soiled test panels at $221 \pm 2^\circ \text{F}$ ($105 \pm 1^\circ \text{C}$) for 60 minutes then cool to room temperature.

4.5.4.5 Preparation of 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 monohydrate and 0.14 ± 0.005 gram of analytical reagent grade magnesium sulfate heptahydrate in one liter of distilled water.

4.5.4.6 Cleaning. The test panel shall be cleaned using a heavy duty wear tester (see 6.6, table IX), fitted with a cellulose sponge (see 6.6) at speed setting of 5. The sponge shall be cut such that the dimension parallel to the cleaning stroke is 3.5 inches (9 cm) and the width is 2.75 inches (7 cm). The cleaning head with the dry sponge attached shall be weighed to a mass of 600 ± 10 grams. Type I cleaning compound shall be prepared by diluting 1 part cleaner with 9 parts

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10-grain hard water (4.5.4.5). Type IA shall be applied from aerosol can and compared to control formula diluted as specified in Table I. Type II cleaning compound shall be prepared by diluting 1 part cleaner with 14 parts 10-grain water (4.5.4.5). Type IV cleaning compound shall be tested as received. After placing a soiled test panel in the template at +45 degrees (see figure 1), the cleaning solution shall be applied to the sponge. A typical amount of diluted cleaner applied to the sponge for wetting is 40 ml. Twenty ml of the cleaner solution is applied over each individual test panel so that it is completely covered. To avoid cross-contamination, the apparatus is cleaned for each new cleaner and a new sponge is used. After allowing a 30-second dwell time, the test panel shall be cleaned using 5 cycles of the wear tester, then turned 90 degrees and cleaned for an additional 5 cycles. The panel shall then be rinsed under cold running tap water and allowed to dry.

4.5.4.7 Evaluation. The percent cleaning efficiency for each panel shall be determined as follows:

$$\text{Percent CE} = \frac{L_c - L_s}{L_i - L_s}$$

where: Percent CE = Cleaning efficiency

L_i = Initial lightness

L_c = Cleaned lightness

L_s = Soiled lightness

The average of the three panels tested shall be recorded.

4.5.5 Cleaning efficiency on vertical surfaces (type V).

4.5.5.1 Panel preparation. Panel shall be at least 5 by 16 inches (12 by 40 cm) in size and prepared as in panel A, table VIII. Spray wire rope lubricant (Sprayon No. 201, or equivalent) onto an aluminum test panel. Immediately wipe back and forth using a non-abrasive cleaning pad to achieve a uniform soil. Allow the soil to dry at room temperature for a minimum of 15 minutes.

4.5.5.2 Cleaning. Position the soiled test panel such that the short dimension is vertical and the long dimension is horizontal. Apply the product to the panel using a pump-spray applicator. After 5 minutes, rinse the test panel by spraying with distilled water using the same pump-spray applicator.

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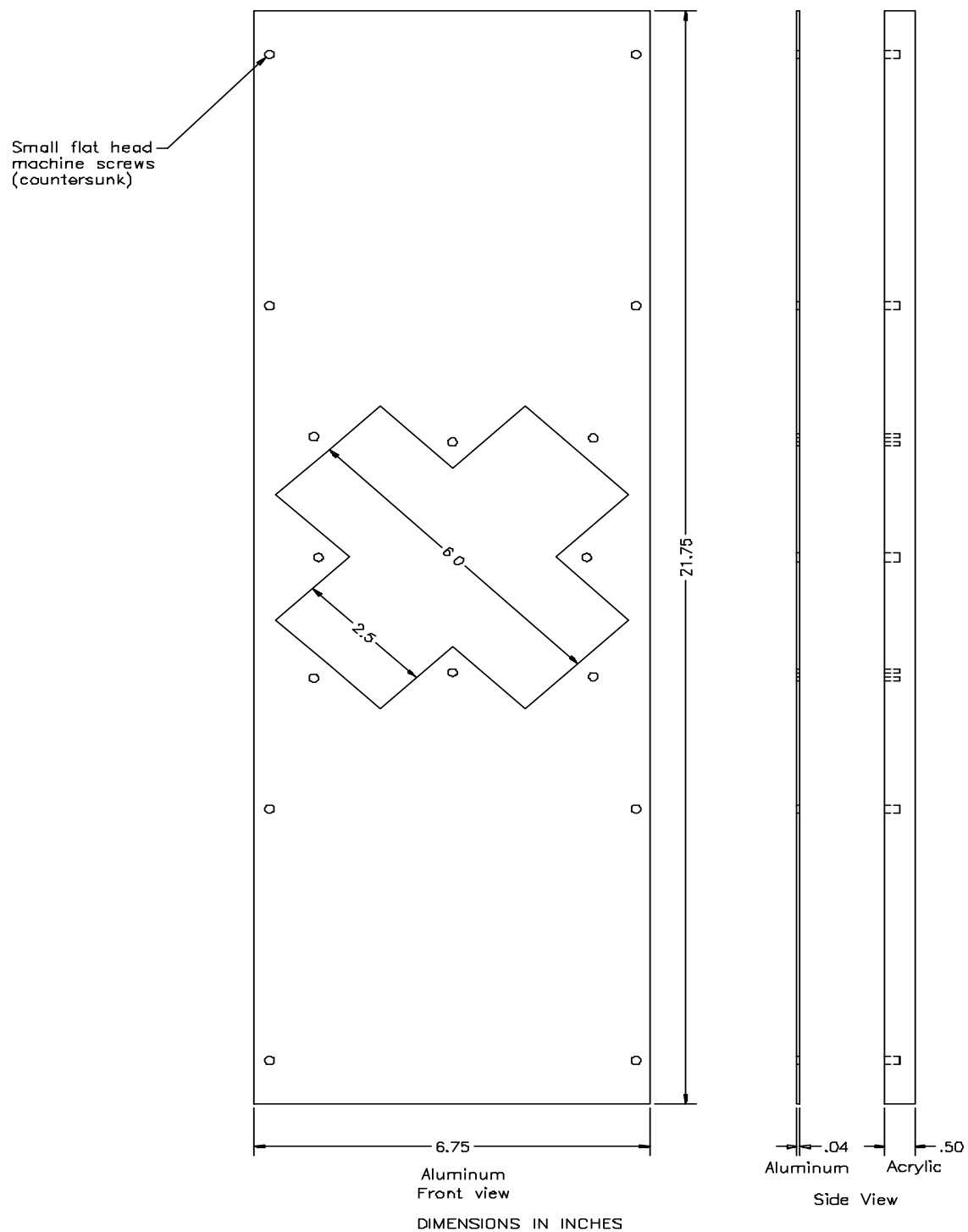


FIGURE 1. Template.

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4.5.6 Consistency (type IV, V). A consistometer (see 6.6, table IX) shall be used as follows: Shake the container of cleaning compound by hand for 10 seconds. Fill the well of the consistometer completely with the compound. Release the gate and determine the extent of flow in 10 seconds.

4.5.7 Foaming properties (type I and II). One part of the undiluted compound shall be mixed with 9 parts 10-grain hard water (see 4.5.4.5) for type I and 14 parts 10-grain hard water for type II. One hundred ml of this mixture shall be placed in a 500 ml capacity blender with a maximum 3.15 inch (9.5 cm) outside diameter. The blender shall be turned on and run for 2 minutes at $8,000 \pm 1,000$ rpm. The blender shall be turned off after 2 minutes and the mixture allowed to stand undisturbed for 6 minutes. The compound shall be observed for conformance to table I.

4.5.8 Low temperature stability. Approximately 50 ml of the cleaning compound shall be poured into a test tube and cooled to $0 \pm 9^\circ \text{F}$ ($-18 \pm 5^\circ \text{C}$) in a cold box. The sample shall be held at this temperature for one hour. The sample shall then be removed from the cold box and the temperature allowed to rise to standard room temperature. Invert the test tube five times and examine the content for homogeneity.

4.5.9 Nonvolatile content. Place approximately 0.5 gram of cleaning compound into each of three weighing dishes and record weight to within ± 0.0001 gram. Place the dishes in a forced draft oven for 1 hour at $100 \pm 4^\circ \text{F}$ ($38 \pm 2^\circ \text{C}$). Cool the dishes to room temperature in a dessicator and reweigh to determine the percent non-volatiles.

4.5.10 Plastics, effect on. Cleaning compound shall be tested in accordance with ASTM F484 as follows:

Types I, II, IV, V	- Diluted 1:1 with distilled water
Type II RTU	- As received
Type III	- As received
Type IA	- As received (see below)

Type IA products shall be sprayed onto the flannel patch through a metal panel with a 0.5 by 0.5 inch window which is placed directly on the patch prior to spraying. (This prevents edge contamination which can lead to premature failures.) The edges may be taped. The amount of cleaner applied to the patch shall be equivalent to that used for testing bulk packaged products.

4.5.11 Polyimide insulated wire, effect on. Approximately 24 inches (61 cm) of wire conforming to MIL-W-81381/11 shall be formed into a coil. Place the coil in a 4 ounce (118 ml) wide mouth jar. Add enough concentrated cleaning compound in the jar to completely cover the coil of wire. Cap the jar and store it at room temperature for 14 days. Repeat this procedure using distilled water as the test medium. At the end of the storage period, remove the coil and rinse thoroughly with tap water at room temperature. Suspend the coil and allow it to drain until completely dry. Each wire shall be wrapped tightly around a 0.125 inch (3 cm) mandrel and then unwrapped slowly, noting the appearance and number of any cracks in the insulation. The wire shall meet the requirements specified in table I. The wire shall be immersed in a 5 percent by

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weight sodium chloride solution and subjected to a one minute dielectric test of 2,500 volts (rms).

4.5.12 Salt-coated surfaces, effect on. A test shall be conducted in accordance with ASTM F502, with the addition that panels shall be sprayed with ASTM D1141 synthetic ocean water and dried in a $70 \pm 4^\circ \text{F}$ ($38 \pm 2^\circ \text{C}$) convection oven prior to testing.

4.5.13 Service evaluation. The service evaluation tests, performed by an activity designated by the qualifying activity, shall consist of cleaning of two or more aircraft under actual service conditions. Test results shall be compared to the results obtained with the control formula.

4.5.14 Storage stability. A steel strip conforming to SAE AMS5046 shall be added to the one gallon (3.785 liters) container of cleaning compound furnished for storage stability (see 4.3.1.1). The total surface area of the steel strip shall be 6 ± 0.5 sq. inches (30.7 sq. cm). The sample shall be stored for one year at $70 \pm 5^\circ \text{F}$ ($21 \pm 3^\circ \text{C}$). After the one year storage period, the sample shall be examined for evidence of separation, crystallization, deterioration, corrosion of the steel strip, container incompatibility, distortion, leakage, or container corrosion. Type IA containers of cleaning compound shall be exhausted or emptied, cut open, and examined for container incompatibility and corrosion. Type II RTU samples shall be examined for evidence of separation, crystallization, deterioration, container incompatibility, distortion and leakage. In addition, Type II RTU samples shall meet the qualification requirements for cleaning efficiency, sandwich corrosion, cadmium corrosion, total immersion corrosion, hydrogen embrittlement, pH and appearance. Type IW shall be examined for conformance to 4.5.18.

4.5.15 Embedded soil cleaning efficiency (type III only) Lightly abrade the surface of a designation A (table VIII) test panel with 240 grit abrasive paper or cloth, then sprinkle on a small amount of carbon black and rub it into the surface using MIL-C-1164 terry cloth, or equivalent. If the test panel can be completely cleaned of all carbon using a non-abrasive eraser, repeat the panel preparation using more hand pressure on the abrasive. If the test panel can not be completely cleaned using the eraser, the above method is to be used for making test panels. Using soiled test panels, apply undiluted type III cleaner using terry cloth. Rub the cleaner over the soiled area for 30 seconds using moderate hand pressure and rinse thoroughly with cold tap water. Examine for soil residue.

4.5.16 Net weight (type IA). A pressurized can of cleaning compound shall be weighed to the nearest gram. The can shall spray for three minutes, followed by a one minute pause. This procedure shall be repeated until the can is empty. The empty can shall then be re-weighed and the weight of the contents calculated.

4.5.17 Leakage (type IA). A pressurized can of cleaning compound shall be immersed completely for five minutes in water maintained at $130 \pm 3^\circ \text{F}$ ($54 \pm 2^\circ \text{C}$). The can shall be observed for emission of bubbles or distortion during this period.

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4.5.18 Appearance and workmanship (Type IW). (Initial qualification and storage stability)

All pre-saturated wipes shall be free of visible contamination and show no signs of degradation, discoloration, fiber deterioration or any odor not consistent with the bulk Type I product. Flexible foil packages shall show no signs of leakage.

4.5.19 Composition.

Type IW:

Wipes shall conform to SAE AMS3819 Class II Grade A and be composed of a non-woven material consisting of 100% Rayon or Lyocell. No gauze or cheesecloth type material is acceptable.

Each foil package shall contain 25 wipes saturated with 1200 ml of a qualified MIL-PRF-85570 Type I product at 1 part cleaner to 4 parts de-ionized water.

Wipe dimensions shall be 16" x17" and be provided in an airtight flexible foil package with a tear strip for opening. The foil package shall be re-sealable with a press type seal or rubber band to prevent loss of volatile and fluid components. The length of the foil package should be long enough to allow for adequate sealing of the unused portion after opening.

Samples submitted for qualification shall be accompanied by written correspondence on company letterhead showing qualification to 4.5.19.

Type II RTU:

The manufacturer shall have a bulk Type II product qualified prior to qualification of a RTU product. The manufacturer is to certify the RTU product is diluted at a ratio of one part cleaner to four parts de-ionized water (1:4).

4.5.20 Labeling (Type IW). Re-sealable foil packages should be stored at a temperature less than 120° F (49° C) and not exposed to direct sunlight for extended periods. Do not store in enclosed areas with minimum ventilation and a possibility of exceeding the temperature limits. Do not freeze. Opened packages shall be used within 6 weeks.

5. PACKAGING

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

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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 compound exceeds commercially available cleaning compounds in order to provide for the cleaning of military aircraft high gloss and camouflage paint systems, low gloss tactical paint schemes, and cleaning exhaust track and gun blast soils. Specifically, the cleaning compounds are intended for use in cleaning painted or unpainted aircraft surfaces. Type I may be used in general cleaning of aircraft, provided that local regulations do not limit the use of aromatic solvents or volatile organic compounds. Type IA is a 1:4 dilution of Type I, packaged in an aerosol container. Type IW is a pre-saturated wipe consisting of a 1:4 dilution of Type I. Type II may be used in general cleaning of aircraft, for both high gloss and camouflage paint systems. Type II RTU is 1:4 dilution packaged in a 32 oz pump spray or 5 gallon can. Type III contains a very fine abrasive and is designed for cleaning exhaust track and gun blast soils from high gloss paint systems. Type IV contains non-abrasive particulate rubber and can be used on low gloss tactical paint scheme coatings to clean stubborn areas such as boot marks and smudges, as well as gun blast and exhaust track soil. Type V can be used in wheel wells, wing butts, and other areas where complete rinsing with water can be tolerated.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type of cleaning compound required (see 1.2)
- c. Quantity of cleaning compound.
- d. Conformance test sample size, if different from 4.4.1.
- e. Packaging requirements (see 5.1).

6.2.1 Unit of purchase. The unit of purchase for the cleaning compound is the U.S. gallon. A U.S. gallon of liquid occupies 231 cubic inches (3.785 liters) at 15.6° C (60° F).

6.2.2 Container size. Container size guidelines are as follows:

Types I, II, IV, V:	5, 15, or 55 gallon
Type II RTU:	32 oz pump spray, 5 gallon
Type III:	1 quart
Type IA:	16 or 20 ounce self-pressurized can
Type V:	Optional size plastic spray bottle

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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-85570) 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 the Naval Air Warfare Center Aircraft Division, Code 4.3.4.2, Bldg. 2188, 48066 Shaw Rd., Unit 5, Patuxent River, MD 20670-1908.

6.3.1 Inspection report. When authorizing the forwarding of qualification samples, the qualifying activity will request along with the qualification sample a satisfactory Material Safety Data Sheet (see 6.5) in accordance with FED-STD-313 and 29 CFR 1910.1200 and a report that includes the following information:

- a. The results of tests performed by the manufacturer.
- b. Toxicological information necessary to evaluate the safety of the compound.
- c. Weight percent of aromatic solvents, total organic solvents, water, and rubber (for type IV).
- d. Aerosol container construction and packaging company where applicable.

6.4 Definitions.

6.4.1 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process and subjected to some physical mixing operation intended to make the final product substantially uniform.

6.4.2 Lot. A lot is defined as all the cleaning compound produced by one manufacturer, at one plant, from the same materials, and under essentially the same conditions during a continuous operation not exceeding 24 hours. In the event the process is a batch (see 6.4.1) operation, each batch constitutes a lot.

6.4.3 Solvent. A solvent is defined as an organic liquid having a vapor pressure of greater than 0.1 mm Hg at 25° C.

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

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6.6 Supplier information.TABLE IX. Item supplier information.

Item	Identification	Supplier	Location
5x12 Hog bristle brush	Gardner WG2000B	Paul N. Gardner	316 NE 1 st St, Pompano Beach, FL 954-946-9454
Optical Sensor	D25A	Hunter	Reston, VA
Cellulose sponge	Cat No. 63	3M	3M Center #223-3N-05 Minneapolis, MN 651-736-3691
Consistometer	ASTM F 1080	Paul N. Gardner	316 NE 1 st St, Pompano Beach, FL 954-946-9454
Glossmeter	Novo-Gloss	Paul N. Gardner	Pompano Beach, FL
Washability / Wear Tester	Model D10V	Paul N. Gardner	Pompano Beach, FL

TABLE X. Chemical supplier information.

Component	Supplier	Address
Igepal	GAF/International Specialty Products	1361 Alps Road Wayne, NJ 07470 973-628-3000
Monamid Monateric Monamine Monamulse	Uniqema	76 E. 24th Street P.O. Box 425 Paterson, NJ 07544 973-345-8220
Dipropylene glycol methyl ether Diethylene glycol butyl ether Trisodium phosphate dodecahydrate Hexylene glycol Benzotriazole Morpholine Sodium Bicarbonate	Fisher Scientific	711 Forbes Avenue Pittsburg, PA 15219-4785 800-766-7000
Sprayon #201 Open Gear and Wire Rope Lubricant	Sprayon Products Div., Sherwin Williams Paint Co.	26300 Fargo Ave., Cleveland, OH 216-292-7400
Tomadol	Tomah	474 W. 19 th St Reserve LA 70084 608-868-6811
Hostacor 2098 Elfugin AKT	Clariant	400 Monroe Road Charlotte, NC 28205 704-331-7000
Aromatic 150 Isopar M	Exxon Chemical Co.	13501 Katy Freeway Houston, TX 281-584-7600

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TABLE X. Chemical supplier information – Continued.

Component	Supplier	Address
Pluronic F98	BASF	100 Cherry Hill Road Parsippany, NJ 07054 201-316-3000
Pylam LX-6545	Pylam Products	371 Merrick Rd., Rockville Center, NY 516-825-4939
Hycar 1422	BF Goodrich	9911 Brecksville Road Brecksville, OH 44141 800-337-1144 (216-447-5130)
Prep-solve	Glidco Organics	PO Box 389 Jacksonville, FL 32201 800-231-3728
Carbon Black (Raven 1040 Pwd)	Columbian Chemical Co.	1600 Parkwood Circle, Suite 400 Atlanta, GA 404-951-5700

6.7 Subject term (key word) listing.

Aerosol
 Degreaser
 Gel
 Hazardous air pollutant
 Pump dispenser
 Solvent
 Volatile organic compound

6.8 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 - MR
 Navy - AS
 Air Force - 68

Preparing activity:
 Navy - AS
 (Project 6850-2012-003)

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 ASSIST Online database at <https://assist.daps.dla.mil>.