

MIL-P-6888C

31 January 1973

SUPERSEDING

MIL-P-6888B(ASG)

13 March 1963

MILITARY SPECIFICATION

POLISH, METAL, ALUMINUM

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

1. SCOPE

1.1 Scope - This specification covers metal polish intended for use on aluminum surfaces of aircraft.

1.2 Classification - The polish shall be of the following types, as specified (see 6.2):

Type I - Liquid

Type II - Paste

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
QQ-T-425	Tinplate (Hot Dip and Electrolytic)
CCC-C-458	Cotton, Flannel, Cotton
PPP-C-96	Can, Metal, 28 Gage and Lighter

Military

MIL-C-17566	Cloth, Billiard
MIL-W-18723	Wax, Aircraft, Waterproof, Solvent Type

FSC 7930

MIL-P-6888C

STANDARDS

Federal

FED-STD-141 Paint, Varnish, Lacquer and Related Materials,
Methods of Inspection, Sampling and Testing

Military

MIL-STD-105 Sampling Procedures and Tables for Inspection
by Attributes

(Copies of specifications and standards required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials Publications

ASTM Standards - Part 17

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

3. REQUIREMENTS

3.1 Materials - The formulation of the polish shall be optional with the manufacturer, but shall be restricted by the requirements specified herein.

3.2 Toxicity - The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring activity.

3.3 Ease of removal and corrosiveness - The polish, after having been applied and dried as specified in 4.4.1, shall be easily wiped from the surface of clad aluminum alloy test panels. The polished test panels shall show no discoloration or any other evidence of corrosion after they have been wiped clean.

MIL-P-6888C

3.4 Flash point - The closed cup flash point of the polish shall be not less than 140°F (60°C) when tested as specified in 4.4.2.

3.5 Settling number (Type I only) - The settling number of the Type I polish shall be not greater than 20 when determined as specified in 4.4.3.

3.6 Viscosity (Type I only) - The Krebs-Stormer viscosity of the Type I polish shall be not less than 50 nor more than 70 krebs units when determined at $75 \pm 5^\circ\text{F}$ ($24 \pm 3^\circ\text{C}$) as specified in 4.4.4.

3.7 Low-temperature stability - After subjection to the temperature cycle specified in 4.4.5.1 the polish shall be restorable to its original appearance by vigorous shaking. In addition, the restored polish shall produce not less than 90 percent of the reflectance value produced by the low-temperature control sample polish when applied to a clad aluminum alloy panel as specified in 4.4.5.2.

3.8 Polishing properties -

3.8.1 Reflectance - The polish, when applied as specified in 4.4.6, shall produce a reflectance reading equal to or greater than that of the control formula product similarly applied.

3.8.2 Retention of reflection - A freshly polished panel, tested as specified in 4.4.6.7, shall have a reflectance reading not less than 95 percent of the reflectance of the same panel before being stored in a desiccator for 24 hours.

3.8.3 Polishing properties at low temperature (Type II only) - When the Type II polish is applied as specified in 4.4.6.5 at a temperature of 0°F (-18°C), it shall produce results conforming to the reflectance and retention of reflectance specified in 3.8.1 and 3.8.2.

3.9 Abrasive number - When the polish is tested as specified in 4.4.7 the abrasive number shall not exceed that of the control formula.

3.10 Suitability of polished aluminum surfaces for waxing (Type I only) - A section of a prepared clad aluminum surface, after being treated with the Type I polish and coated with a control formula waterproof liquid wax as specified in 4.4.8, shall resist exposure to water and salt spray equal to or better than a polished and cleaned (for removal of polish) section of the panel that had similarly been coated with wax.

MIL-P-6888C

3.11 Storage stability - The manufacturer shall certify that:

- (1) The polish, during storage as specified in 4.4.9, shows no visible evidence of deterioration,
- (2) the tinplate strips stored in the polish show no evidence of corrosion,
- (3) after storage, the polish conforms to all the applicable requirements of this specification except reflectance and viscosity,
- (4) when tested for reflectance, the stored polish produces a reflectance reading not less than 90 on a clad aluminum alloy panel having an original reflectance of not less than 10 nor greater than 30,
- (5) the viscosity of the stored polish is within 5 Krebs units of the recorded viscosity.

3.12 Marking - Containers shall be marked with the following information conforming to the Federal Hazardous Substances Act:

"WARNING HARMFUL IF INHALED CAUSES IRRITATION

Avoid breathing vapor
 Avoid contact with eyes, skin, clothing
 Keep container closed
 Use with adequate ventilation
 Wash thoroughly after handling"

3.13 Workmanship - The polish shall be uniform in appearance and shall be free of any irregularities which would adversely affect its appearance or serviceability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified the supplier may use his own or any other facilities suitable for the performance of inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

MIL-P-6888C

4.2 Quality conformance inspection -

4.2.1 Sampling - The quality conformance sample shall consist of a sample for tests (4.2.1.2) and a sample for examination of filled containers (4.2.1.3).

4.2.1.1 Inspection lot - An indefinite number of unit containers offered for acceptance and filled with a homogeneous mixture of material manufactured in a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient materials.

4.2.1.2 Sample for tests - Two 1-quart samples shall be selected at random from each inspection lot. Each sample shall be subjected to all the tests in Section 3. The lot shall be unacceptable if a sample fails to meet any of the test requirements specified.

4.2.1.3 Sample for examination of filled containers - A random sample of filled shipping containers fully prepared for delivery shall be selected from each lot in accordance with MIL-STD-105 at inspection level I and acceptance quality level (AQL)= 2.5 percent defective.

4.2.2 Inspection - Quality conformance inspection shall consist of an examination for acceptability of quality control methods used by the manufacturer, an examination of samples of filled containers (4.2.1.3) for conformance to packaging, packing and marking requirements, and examinations and tests of samples (4.2.1.2) for all the requirements specified in Section 3.

4.3 Test conditions - Unless otherwise specified, all tests shall be conducted on polish at a temperature of $77 \pm 3^{\circ}\text{F}$ ($25 \pm 2^{\circ}\text{C}$) and at a relative humidity between 45 and 55 percent.

4.4 Test methods -

4.4.1 Ease of removal and corrosiveness - The Gardner Washability Machine or equivalent shall be used for this test. Replace the brush with a wooden block faced with billiard cloth pulled tightly against bottom surface of block. The block and holder (polishing assembly) shall be weighted to produce a total weight of 2200 ± 10 grams. Spread 6 grams of polish evenly over the billiard cloth. Place a .05 by 3 by 6 inch aluminum panel tarnished in accordance with 4.4.6.3.2 in the template and subject the panel to 100 cycles of polishing. The panel with the "spent" polish shall then be dried under an infrared reflector drying lamp. The temperature at the panel shall be maintained at 120 to 140°F (49 to 60°C) for 30 minutes. The panel shall again be placed in the washability machine and wiped for ten cycles with a clean piece of billiard cloth on the wooden block. The wiped surface shall be examined visually for evidence of residual polish and corrosion.

MIL-P-6888C

4.4.2 Flash point - The flash point shall be determined as specified in ASTM Method D56.

4.4.3 Settling number (Type I only) - Place 50 ml of the well mixed Type I polish in a test tube (1 by 6 inches). Cap and allow test tube to remain undisturbed in an upright position for 24 hours. After the settling period, invert the test tube repeatedly until the solid matter is dislodged and begins to disperse evenly. Record the number of inversions as the settling number.

4.4.4 Viscosity (Type I only) - The viscosity of the Type I polish shall be determined as specified in Method 4281 of Federal Test Method No. 141, using a Krebs-Stormer viscosimeter.

4.4.5 Low temperature stability -

4.4.5.1 Low temperature exposure - Approximately 100 ml. of the Type I polish or 100 grams of the Type II polish shall be placed in each of two 125 ml. wide mouth pyrex jars which shall then be stoppered. One of the jars containing material, hereinafter called the low temperature control sample, shall be set aside and maintained at a temperature of 70 to 77°F (21 to 25°C) for the duration of the test period. The other jar containing material, hereinafter called the sample, shall be placed for 2 hours in a cold box maintained at $14 \pm 4^\circ\text{F}$ ($-10 \pm 2^\circ\text{C}$). At the end of the 2 hour period, the jar containing the sample shall be removed and immersed in a water bath maintained at $117 \pm 2^\circ\text{F}$ ($47 \pm 1^\circ\text{C}$) for 1 hour. The jar shall be removed from the bath, dried, and again placed in the cold box at $14 \pm 4^\circ\text{F}$ ($-10 \pm 2^\circ\text{C}$) for 2 hours. At the end of this second 2-hour period, the jar shall again be removed from the cold box; immersed in the water bath maintained at $117 \pm 2^\circ\text{F}$ ($47 \pm 1^\circ\text{C}$) for 1 hour; removed from the bath; and dried. The jar shall be placed for a third 2-hour period in the cold box at $14 \pm 4^\circ\text{F}$ ($-10 \pm 2^\circ\text{C}$) and at the end of this period, the jar shall be removed from the cold box and be permitted to remain at room temperature for 16 hours. The jar containing the sample shall, when Type I is involved, be shaken vigorously by hand; where Type II material is concerned, the contents of the jar should be stirred. Then the appearance of the sample shall be compared with that of the low-temperature control sample.

4.4.5.2 Measurement of stability - In this test, the preparation, tarnishing, and polishing of panels and measurement of reflectance shall be as specified in 4.4.6. Two 3 by 6 by .05 inch panels of clad aluminum alloy conforming to QQ-A-250/5, having reflectances (averaged from readings over five distinct areas) that do not vary from each other by more than 5 reflectance units. One panel shall be polished with the low-temperature control sample and the reflectance shall be determined by

MIL-P-6888C

taking the average of five readings in the area. The second panel shall be polished with the test sample specified in 4.4.5.1 which has been exposed to the temperature cycle and the reflectance shall be determined by taking the average of five readings in the area. The reflectance produced with the exposed test sample expressed as a percentage of the reflectance produced with the low-temperature control sample shall be calculated in accordance with the following formula:

$$X = \frac{Y}{Z} \times 100$$

Where X = The reflectance produced with the exposed test sample expressed as a percentage of the reflectance produced with the low-temperature control.

Y = The reflectance produced by polishing a tarnished panel with the test sample which has been exposed to the temperature cycle.

Z = The reflectance produced by polishing a tarnished panel with the low-temperature control sample.

4.4.6 Polishing properties -

4.4.6.1 Selection of panels - The reflectance of each panel shall be measured as specified in 4.4.6.2. If the reflectance reading is less than 40 the panel shall be discarded. If the reflectance is greater than 40, the panel shall be cleaned with flannel soaked in CP isopropyl alcohol and tarnished as specified in 4.4.6.3.2 until a reflectance reading of not less than 10 nor more than 30 is obtained.

4.4.6.2 Reflectance measurements - The reflectance measurement shall be similar to that obtained by the method involving the use of search unit Model 660M for 45 degrees gloss in conjunction with Model 610 Photovolt reflectometer which is calibrated to a setting of 7 against polished black glass, having a refractive index of 1.52. Check settings on the reference standard at sufficiently brief intervals to insure accuracy of the results within 2 percent. Five different portions of the surface of the panel shall be measured to obtain the average reflectance reading.

4.4.6.3 Tarnishing -

4.4.6.3.1 Tarnishing agents -

Flint powder 325 (mesh)	21 grams
Water	20 grams
Carboxy methyl cellulose (5 percent aqueous solution)	17 grams
Triton X-100 <u>1</u> /	0.8 grams

MIL-P-6888C

1/ Made by Rohm and Haas Co. Phila., PA 19105

4.4.6.3.2 Tarnishing procedure - Place a cleaned 3 by 6 inch aluminum panel conforming to QQ-A-250/5 on the washability apparatus. Weigh the holder assembly to a total weight of 2200 ± 10 grams. Place six grams of the above mixture and distribute equally over the entire surface of the polishing pad and polish the panel for 100 cycles. Rinse the panel with tap water and wipe with a water-soaked flannel with unidirectional strokes. Then wipe the panel with a piece of flannel cloth folded to form a pad and saturated with 99 percent isopropyl alcohol. Wipe with uniform unidirectional strokes. Dry the panel immediately with oil-free compressed air. The reflectance shall be in the 10-30 range.

4.4.6.4 Polishing procedure at $77 \pm 3^\circ\text{F}$ ($25 \pm 2^\circ\text{C}$) - Place the tarnished panel in the template of the Gardner Washability machine. Cover the wooden block with billiard cloth conforming to MIL-C-17566. Weight the polishing assembly to a total weight of 2200 ± 10 grams. This test is to be run at a temperature of $77 \pm 3^\circ\text{F}$ ($25 \pm 2^\circ\text{C}$). Place six grams of polish on the panel and spread evenly over the effective area. Polish the panel for 200 cycles. Remove the "spent" polish with clean flannel conforming with CCC-C-458 dampened with tap water. Dry with oil-free compressed air. Wipe away any residual polish with a clean piece of flannel. Measure the reflectance.

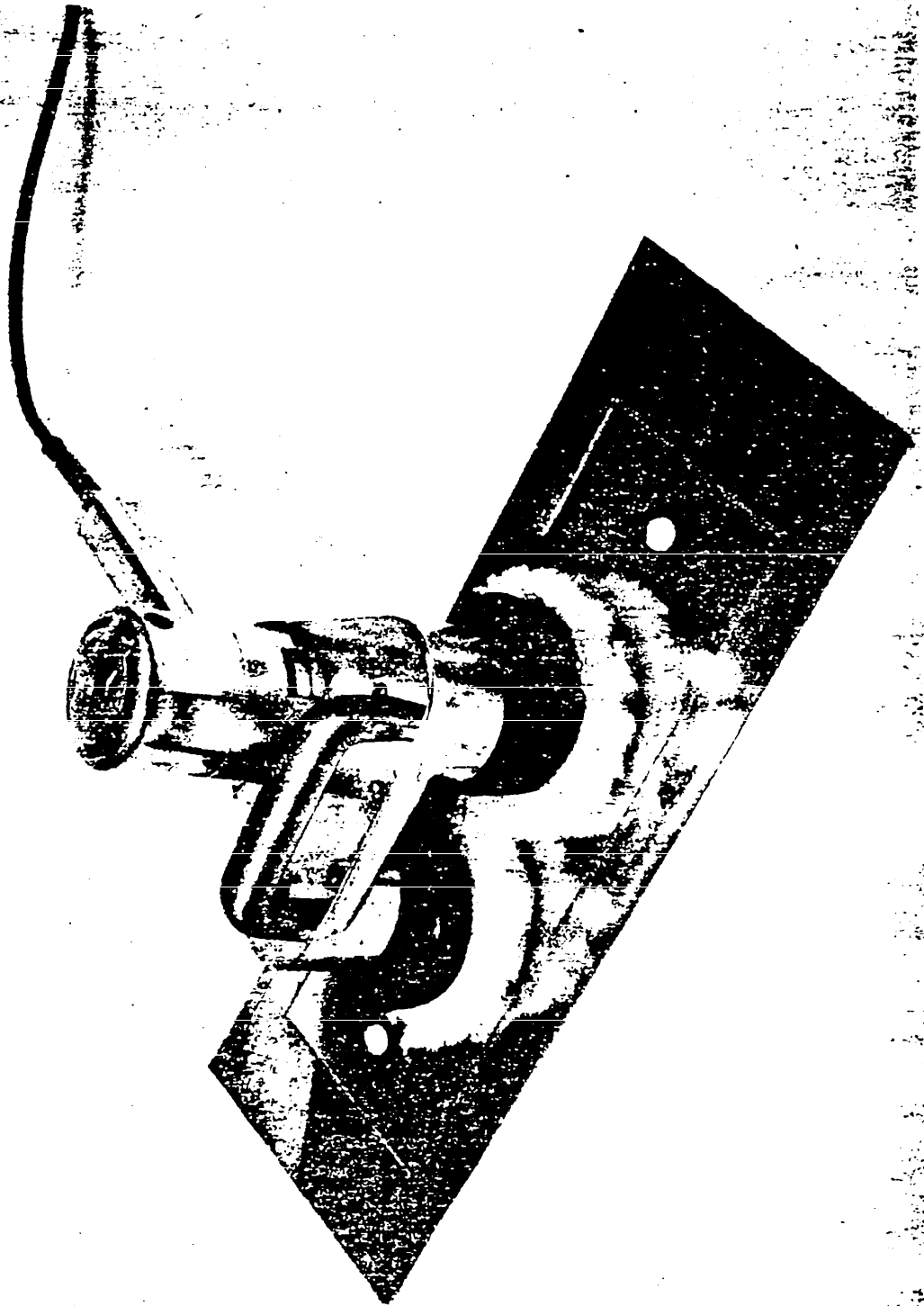
4.4.6.5 Polishing procedure at 0°F (-18°C) - Type II only -

4.4.6.5.1 Polishing apparatus Type II only - Polishing of the type II polish shall be done with a cyclo Polisher Sander, Model C-3E-2, manufactured by Cyclo Manufacturing Company, Denver, Colorado, as shown in figure 1, or equivalent. A smooth, lined, horizontal polishing table, having a 0.05-inch deep recess measuring 5 by 16 inches to hold the panel, shall be furnished.

4.4.6.5.2 Procedure - The tarnished panel shall be set in the recess of the polishing table. 25 grams of the Type II polish shall be spread evenly over each of two polishing bonnets. The bonnets and the polishing table shall be placed in temperature-controlled box where a temperature of 0°F (-18°C) can be attained. After the bonnets and polishing table have reached the set temperature, the two rubbing heads shall be lowered onto the panel to facilitate transfer of polish from bonnets to panel. The polishing machine shall be set in motion and passed over the tarnished panel 15 times during an interval of 1 minute. At the end of this polish phase, the panel shall be wiped clean with a cloth of flannel conforming to CCC-F-458 at a pressure not exceeding 4.5 pounds. The reflectance readings shall be averaged. The polishing procedure shall be performed and

MIL-P-6888C

Figure 1 "POLISHING APPARATUS"



MIL-P-6888C

reflectance measured on each of three panels. The reflectance measurement shall be made at room temperature. Comparison shall be made with the reflectances gotten with the control formula applied at room temperature in accordance with the apparatus described in 4.4.6.5.1.

4.4.6.6 Control formula product -

4.4.6.6.1 Component parts - The polish consists essentially of four parts.

Part A - aqueous portion
Part B - oleo portion
Part C - thickener
Part D - anti-foam agent

4.4.6.6.2 Ingredients -

Part	Ingredient		Parts by Weight
A	Water		233.0
	Triethanolamine		7.2
	Celite White Mist	(1)	28.0
B	Solvent "G"	(2)	93.2
	Oleic Acid		14.4
	Pine Oil		2.0
	Methyl Silicone Oil SF 96		2.0
	(350CS)	(3)	
	Triton X-100	(4)	5.6
C	Cab-O-Sil (M5)	(5)	14.0
D	Anti-Foam "A"	(6)	0.8

<u>Ingredient</u>	<u>Source of Supply</u>
(1) Celite White Mist	Johns Manville The Mall Bld. 4th and Chestnut Sts. Phila., PA 19106
(2) Solvent "G"	Dunlap Mellor and Co., James Good Co. Div. 15th and Susquehanna Ave. Phila., PA 19125
(3) Methyl Silicone SF 96 (350CS)	General Electric Co., Silicone Prod. Dept. Mechanicville Rd. Waterford, NY 12188

MIL-P-6888C

<u>Ingredient</u>	<u>Source of Supply</u>
(4) Triton X-100	Rohm and Haas Co., Independence Mall Phila., PA 19105
(5) Cab-O-Sil (M-5)	Cabot Corp., 125 High St. Boston, MA 02110
(6) Anti-Foam "A"	Dow-Corning Corp., Midland, MI 48640

4.4.6.6.3 Preparation -

- (1) Combine Part A materials in the order listed. Stir gently while Part B is prepared.
- (2) Weigh and mix Part B materials in the order listed. Add Part B slowly to Part A while stirring rapidly.
- (3) Add Part C slowly.
- (4) Add Part D slowly for foam control during the above mixing steps as required.
- (5) Continue mixing at slow rate for 15 minutes.
- (6) Allow the mixture to stand undisturbed for 48 hours before testing. Maximum viscosity is reached between 24 and 48 hours after mixing.

4.4.6.7 Retention of reflectance - The panel polished as specified in 4.4.6.3 shall be allowed to stand in a desiccator for 24 hours. The reflectance shall be measured and the retention of reflectance calculated by the following formula:

$$\text{Percent retention of reflection} = \frac{\text{Reflectance reading after aging}}{\text{Reflectance reading before aging}} \times 100$$

4.4.7 Abrasive number - Clean and weigh a 3 by 6 by .05 inch aluminum panel conforming to QQ-A-250/5. Subject the panel to the polishing procedure as specified in 4.4.6.4. Reweigh and determine the weight loss. Report the milligrams of weight loss as the abrasive number.

4.4.8 Suitability of polished aluminum surfaces for waxing (Type I only) - Take two panels from the polishing test 4.4.6.4 and divide the effective area of each panel in two with masking tape. Clean one section of each panel with a flannel cloth dampened with 99 percent isopropyl alcohol. Dry the panels with oil-free compressed air. Cover the panels with a coating of the control formula wax of MIL-W-18723. Wipe off white haze. Immerse one panel in distilled water at a temperature of

MIL-P-6888C

60 to 70°F (15.6 to 21°C) for two hours. Remove and examine for evidence of softening and breakdown when rubbed gently with the fingers. Compare the two sections. Expose the second panel to salt spray in accordance with Method 6061 of Federal Test Method Standard No. 141 for a period of 16 hours. After exposure rinse the panels using light brushing in running water which is not warmer than 100°F (38°C). Observe the panels for resistance to salt spray as evidenced by the degradation of the wax film and the condition of the panel. Compare the two sections.

4.4.9 Storage stability - One quart each of Type I and Type II polish shall be stored in a glass jar (mason jar provided with rubber washer and cap) containing some clean strips of tinplate which conform to QQ-T-425 and shall have a total surface area (both sides) of approximately 84 square inches. The jar shall be protected from the light and stored for six months at a temperature of $75 \pm 5^\circ\text{F}$ ($24 \pm 3^\circ\text{C}$). After storage for 6 months, the polish shall be subjected to all of the preceding test methods. The tinplate strips which have been stored in the polish shall be examined visually for evidence of corrosion indicated by discoloration, staining, pitting or etching. The polish shall be examined for visible evidence of deterioration indicated by discoloration, chemical decomposition, and inability to remain homogeneous after being shaken or stirred.

4.4.10 Examination of filled containers - Each sample filled container and shipping container shall be examined for defects or construction of the container and the closure, evidence of leakage, unsatisfactory markings, and net content.

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing - Unless otherwise specified by the procuring activity level A packaging and packing shall be employed. Unless otherwise specified, the Type I polish shall be furnished in rectangular 1-gallon metal cans conforming to Type V, Class 4 of PPP-C-96, having an inner seal and a metal screw cap closure, and the Type II polish shall be furnished in round, multiple-friction closure-type quart cans conforming to Type V, Class 2 of PPP-C-96. The interior packaging arrangements shall be as specified in the appendix of PPP-C-96. The size of the can shall be as specified by the procuring activity (see 6.2). As specified in the appendix to PPP-C-96, various options, choices, and alternatives may be exercised by the procuring activity.

5.2 Marking - All containers shall be marked as specified in PPP-C-96 and as follows:

5.2.1 Directions for use - The manufacturer's recommendations for application of the polish and directions for obtaining optimum results in application shall be plainly marked on each container of polish.

MIL-P-6888C

5.2.2 Precautionary markings - Each shipping container and each container of polish shall be marked with information specified in 3.12.

6. NOTES

6.1 Intended use - The products covered by this specification are intended primarily for use as polishes for aluminum surfaces. Their abrasive quality enables them to remove tarnish and to produce high lasting polish on unpainted, clad, aluminum alloy surfaces. The Type I polish can be used to polish a surface which may then be coated with a waterproof solvent-type aircraft wax conforming to MIL-W-17823. The Type II polish may be used at sub-zero temperatures.

6.1.1 These polishes shall not be used on aircraft aluminum surfaces which are to be painted with organic coating materials, unless silicone residue is removed with xylene prior to painting.

6.2 Ordering data - Procurement documents should specify the following:

- (a) Title and number of this specification
- (b) Type (see 1.2)
- (c) Quantity desired
- (d) Size of container in which polish is to be furnished
- (e) Packaging, packing, and marking data with requirements in detail, if other than as specified in section 5

Custodians:

Air Force - 11
Navy - AS
Army - GL

Preparing activity:

Navy - AS

Proj. No. 7930-0271

Review activities:

Air Force - 84
Army - AV, MD

FOLD

DEPARTMENT OF THE NAVY
Naval Air Engineering Center
Philadelphia, PA 19112

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
DEPARTMENT OF THE NAVY
DOD 316



Engineering Specifications and Standards Department Code X
Naval Air Engineering Center
Philadelphia, PA 19112

FOLD

