METRIC

MIL-STD-1503B(USAF)
13 November 1989
SUPERSEDING
MIL-STD-1503A(USAF)
23 March 1979

MILITARY STANDARD

PREPARATION OF ALUMINUM ALLOYS FOR SURFACE TREATMENTS AND INORGANIC COATING

AMSC N/A FSC MFFP

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CONTENTS

1. SCOPE

1.1 Purpose. This standard describes the cleaning, activation and underplating process, and material required for aluminum and aluminum alloys prior to applying inorganic coatings. It is intended that this standard be used in conjunction with other process documents where the technical requirements are for the application of surface treatments and inorganic coatings on aluminum and aluminum alloys.

1.2 Classification. This specification covers the following cleaning methods and surface pretreatment process:

1.2.1 Surface cleaning. Surface cleaning shall be in accordance with 5.1.

1.2.2 Surface preparation. Surface preparation for anodizing and conversion coating shall be in accordance with 5.2.

1.2.3 Preparation for plating. Preparation for plating shall be in accordance with 5.3.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications. Unless otherwise specified, the following specifications of the issue listed in that issue of the Department of Defense Index of Specifications and Standards DoDISS) specified in the solicitation form a part of this standard to the extent specified herein.

SPECIFICATIONS

Federal

O-N-350	Nitric Acid, Technical
O-S-571	Sodium Carbonate, Anhydrous Technical
O-S-598	Sodium Hydroxide, Technical
O-S-604	Sodium Matasilicate, Technical
O-S-809	Sulfuric Acid, Technical

Military

MIL-Z-291	Zinc Oxide, Technical
MIL-F-14580	Ferric Chloride, Anhydrous, Crystalline, Technical
MIL-A-24641	Acid Hydroflouric, Technical

STANDARDS

Military

MIL-STD-871	Electro-Chemical Stripping of Inorganic Finishes
MIL-STD-1504	Abrasive Blasting

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement requirements should be obtained from the procuring acitivity or as directed by the contracting officer)

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

3. DEFINITIONS (Not applicable)

4. GENERAL REQUIREMENTS

4.1 Materials and equipment

4.1.1 Materials. Materials used in preparing aluminum alloys for surface treatiments and inorganic coating:

a. Ammonium Biflouride

b. Chromium Tiroxide, (O-C-303)

c. Copper Cyanide

d. Ferric Chloride (MIL-F-14580)

e. Hydroflouric Acid (MIL-A-24641)

f. Nitric Acid (O-N-350)

g. Rochelle Salt

h. Sodium Bisulfate

i. Sodium Carbonate (O-S-571)

j. Sodium Cyanide

k. Sodium Fluorosilicate

l. Sodium Gluconate

m. Sodium Hydroxide (O-S-598)

n. Sodium Metasilicate (O-S-604)

o. Sulphuric Acid (O-S-809)

p. Trisodium Phosphate

q. Zinc Oxide (MIL-Z-291)

4.1.2 Equipment.

a. Power Source. Either generated or rectified D.C. current may be used. Ripple value shall not exceed 10 percent as measured by dividing the root mean square of the A.C. voltage component by the D.C. voltage. This can be measured by using an RMS A.C. voltage meter and dividing this value by the D.C. voltage. These measurements are to be taken across the anode and cathode bus at the tank.

b. Tanks. Tanks should be resistant to the operating temperature and the chemical environment. Tanks in which any electrolytic action takes place must be free of short circuits.

c. Termperature control. Plating tanks to be operated at temperature other than room temperature shall be equiped with automatic termperature indicating and regulating devices.

d. Instrumentation. An ammeter shall be placed in series with the plating tank cathode. The ammeter shall have sufficient shunts and switches to provide a full-scale reading equal to the maximum capacity of the power source, and an accuracy of plus or minus 10 percent of the current being measured.

e. Blast equipment. A blast cabinet shall be loacted near the finishing line. Size of the cabinet shall be adequate to enclose the parts to be finished. Air lines shall be suitably trapped and filtered to prevent in-process contamination of the parts to be cleaned.

f. Bake oven. A bake oven, if required, shall be located near the finishing line. The size of the oven shall be adequate to enclose the parts to be finished. The oven shall be equipped with temperature indicating and regulating devices.

4.2 Racking. Sufficient contact area and pressure shall be provided to carry the current without overheating. Racking should be performed at the most convenient step prior to plating.

4.3 Masking. Sections or areas of a part that are not to be finished will be masked off. Plug and masking materials which do not contaminat the finishing bath shall be used. Masking should be performed at the most convenient step prior to finishing.

4.4 Handling of parts. After the parts have been cleaned, they will be handled in such a manner (white gloves, etc) that will ensure a minimum of contamination.

4.5 Finish. The finish of the part shall be controlled by the application specification.

4.6 Reprocessing. Parts rejected for defective finish and require stripping and recoating, shall include all the steps of this specification. Parts shall be stripped in accordance with MIL-STD-871.

5. DETAILED REQUIREMENTS

5.1 Surface cleaning.

5.1.1 Alkaline cleaners. Alkaline clean in one of the following solutions or equivalent.

5.1.1.1 Alkaline cleaner number 1

a. Sodium Hydroxide - 3.75-11.25 g/l (3-5 oz/gal)

b. Trisodium Phosphate - 7.5-22.5 g/l (1-3 oz/gal)

c. Sodium Matasilicate - 22.5-37.5 g/l (3-5 oz/gal)

d. Temperature - 52-57°C (125-135°F)

e. Time - one to two minutes

5.1.1.2 Alkaline cleaner number 2

a. Trisodium Phosphate - 22.5-37.5 g/l (3-5 oz/gal)

b. Sodium Carbonate - 7.5-22.5 g/l (1-3 oz/gal)

c. Temperature - 52-57°C (125-135°F)

d. Time - one to two minutes

5.1.2 Alkaline Etch. Remove scale, corrosion, carbon, etc. in the following inhibited alkaline etch or equivalent.

5.1.2.1 Etching Solution.

a. Sodium Hydroxide - 3.75-11.25 (0.5-1.5 oz/gal)

b. Trisodium Phosphate - 30.0-90.00 (4-12 oz/gal)

c. Sodium Carbonate - 7.5-45.0 (1-6 oz/gal)

d. Sodium Gluconate - 22.5 g/l (30.0 oz/gal) minimum

e. Temperature - 52-57°C (125-135°F)

f. Time - two minutes maximum

5.1.3 Smut removal. Remove smut in on of the following solutions or equivalent.

5.1.3.1 De Smut number 1

a. Nitric Acid - 60-80% by volume

b. Hydroflouric Acid - 15-20% by volume

c. Temperature - ambient

d. Time - 30 seconds approximately

5.1.3.2 De Smut number 2

a. Nitric Acid - 40-60% by volume

b. Temperature - ambient

c. Time - 30 seconds approximately

5.1.3.3 De Smut number 3

a. Nitric Acid - 40-60% by volume

b. Sulphuric Acid - 20-30% by volume

c. Ammonium Biflouride - 105-135 g/l (14-18 oz/gal)

d. Temperature - ambient

e. Time - 30 seconds approximately

5.1.3.4 De Smut number 4

a. Chromic Acid - 4.5-7.5 g/l (0.7-1.0 oz/gal)

b. Sodium Bisulfate - 120-128 g/l (16-17 oz/gal)

c. Sodium Fluorosilicate - 7.5-10 g/l (1.0-1.25 oz/gal)

d. Temperature - Ambient

e. Time - ten to fifteen minutes

5.2 Surface preparation for anodizing/conversion coating.

5.2.1 Step number 1. Vapor degrease

5.2.2 Step number 2. Alkaline clean.

5.2.3 Step number 3. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.2.4 Step number 4. (Optional) Alkaline etch.

5.2.5 Step number 5. (Omit if Step number 4 was not performed). Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.2.6 Step number 6. Remove smut.

5.2.7 Step number 7. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.2.8 Step number 8. Anodize or conversion coat immediately.

5.3 Surface preparation for plating.

5.3.1 Step number 1. Parts shall be vapor degreased. No minimum elasped time shall elapse between this operation and the cleaning operation.

5.3.2 Step number 2. Clean by abrasive blasting per MIL-STD-1504. Using 80-180 grit aluminum oxide, vapor blast, or garnet abrasive blast. Elapsed time between this step and step number 3 not to exceed sixty minutes.

5.3.3 Step number 3. Alkaline clean.

5.3.4 Step number 4. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.3.5 Step number 5. Remove smut.

5.3.6 Step number 6. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.3.7 Step number 7. Zinc immersion plate with moderate part agitation in the following solution:

a. Sodium Hydroxide - 450-525 g/l (60-70 oz/gal)

b. Zinc Oxide - 75-97.5 g/l (10-13 oz/gal)

c. Ferric Chloride Hexahydrate - 0.75-0.97 g/l (0.10-0.13 oz/gal)

d. Rochelle Salt - 7.5-9.75 g/l (1.0-1.3 oz/gal)

e. Temperature - 21-27°C (70-80°F)

f. Time - 30-60 seconds

5.3.8 Step number 8. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.3.9 Step number 9. Remove zincate using solution 5.2.5.2 (De Smut number 2) or equivalent.

5.3.10 Step number 10. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.3.11 Step number 11. Zinc immersion plate in the zinc immersion solution, 5.2.7 for 30 to 45 seconds. It is essential that the immersion time in the zincate solution be closely controlled to prevent formation of an extremely heavy coating. The proper coating will be smooth and continous and, in some cases, can be achieved without the use of Step number 7 through 10. Repeat Steps 7 through 10 until the desired coating is obtained.

5.3.12 Step number 12. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.3.13 Step number 13. (Optional) Copper strike at 2.5A/dm^2 (24A/ft^2) for approximately 3 minutes then reduce the current to 1.25A/dm^2 (12A/ft^2) for 10 to 15 minutes. Apply voltage so that current will flow upon the immersion of parts. Copper strike in the following solution:

a. Copper Cyanide - 37.5-45 g/l (5-6 oz/gal)

b. Sodium Cyanide - 45-52.5 g/l (6-7 oz/gal)

c. Sodium Carbonate - 30-60 g/l (4-8 oz/gal)

d. Rochelle Salt - 30-60 g/l (4-8 oz/gal)

e. Free Sodium Cyanide - 1.3-3.75 g/l (0.2-0.5 oz/gal)

f. Temperature - 38-54°C (100-130°F)

NOTE: Optional low pH (10.2-10.5) bath solutions may also be used.

5.3.14 Step number 14. Rinse thoroughly in clean water. The rinse water temperature should be ambient.

5.3.15 Step number 15. Immediately immerse in the plating bath and plate per the application specification. Make electrical connections to the part outside the plating tank. Apply voltage so that the current will flow upon the immersion of parts.

NOTE: Some plating deposits such as silver and gold will require an immediate deposit of nickel between the plating strike and the plating deposit to prevent migration.

5.3.16 Inspection. Inspection shall be in accordance with the applicable plating specification and the requirements of the process standard.

5.4 Quality control

5.4.1 Quality control responsibility. The responsible quality control department shall enforce all requirements of this standard. Inspection to

meet requirements shall be performed with such frequency as deemed necessary by the quality control department to assure compliance with the standard.

5.4.2 Process controls. Solutions and equipment shall be checked periodically and maintained in accordance with the requirements of this process standard.

5.4.3 Adhesion. Parts can be tested for adhesion by placing them in boiling water for one hour. The parts shall show no blisters or separation of the undercoat from the base material at their common interface(s).

5.4.4 Castings. All sealed castings shall be pressure checked after plating. Parts which are found to leak shall be resealed.

5.5 Caution (or warning). The procedures specified herein utilize materials listed in the Department of Labor (DOL) Occupational Safety and Health Standards as "Toxic and Hazardous Substances." Personnel exposure to these materials must be limited to those values specified in Section 2.1.2 of CFR 1910.1000 (OSHA Standard).

6. NOTES

6.1 Changes from previous issue. Marginal notations are not used in this revision to identify changes with repect to the previous issue due to the extensiveness of the changes.

Custodian:
Air Force - 99

Preparing Acitivity:
Air Force - 70

Project Number: MFFP-F424