STANDARD OVERHAUL PRACTICES MANUAL

CHROMIC ACID ANODIZING

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STANDARD OVERHAUL PRACTICES MANUAL

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To: All holders of CHROMIC ACID ANODIZING 20-43-01.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

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STANDARD OVERHAUL PRACTICES MANUAL

A = Added, R = Revised, D = Deleted, O = Overflow

TABLE OF CONTENTS

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Revision		Filed		Revision		Filed	
Number	Date	Date	Initials	Number	Date	Date	Initials

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Temporary Revision		Inserted		Removed	
Number	Date	Date	Initials	Date	Initials

Temporary Revision		Inserted		Removed	
Date	Initials	Number	Date	Date	Initials

Temporary Revision		Inserted		Removed	
Number	Date	Date	Initials	Date	Initials

Temporary Revision		Inserted		Removed	
Date	Initials	Number	Date	Date	Initials

INTRODUCTION

1. General

A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.

B. This manual is divided into separate sections:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) Effective Pages

(5) Contents

(6) Revision Record

(7) Record of Temporary Revisions

(8) Introduction

(9) Procedures

C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.

D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.

E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

CHROMIC ACID ANODIZING

1. INTRODUCTION

A. The data in this subject comes from Boeing Process Specification BAC5019. The airline has a copy of the Boeing Process Specification Manual.

B. The data is general. It is not about all situations or specific installations. Use this data as a guide to help you write minimum standards.

C. Class 1 thru 4 of this procedure will make chromic acid anodizing that agrees with MIL-A-8625, Type 1. Class 5 does not. Classes 1 thru 4 procedures can also be used when MIL-A-8625, Type 1 is specified by the overhaul instructions. But the opposite is not true. If BAC5019 is specified, do not use other procedures.

D. BAC5019 puts chromic acid anodizing into 5 classes:

(1) Class 1 is a nondyed coating for general service with or without a layer of paint. This also agrees with MIL-A-8625, Type 1. Use Class 1 if MIL-A-8625, Type 1 (or Type 1, Class 1) is specified by the overhaul instructions.

(2) Class 2 is a dyed coating which is now obsolete. If Class 2 is specified by the overhaul instructions, use the procedures of BAC5716.

(3) Class 3 is a nondyed coating to use when the bond of a subsequent layer of paint is very important. If BAC5019 is specified without a Class, use Class 3.

(4) Class 4 is a natural-colored anodic coating when surfaces are not painted but must have a smooth anodized quality that does not change when sealed.

(5) Class 5 is a nondyed, unsealed coating. Organic coatings applied on Class 5 anodizes have the strongest bonds.

E. As a alternative, unless Class 4 or only BAC5019 is specified, you can boric-sulfuric acid anodize the parts per BAC5632.

F. If the overhaul instructions are different than these procedures, use the overhaul instructions.

G. Refer to SOPM 20-00-00 for a list of all the vendor names and addresses.

2. MATERIALS

A. Anti-Misting Agents – Fumetrol 101, V27201 or V76323

(1) Type 1 - Surface tension reducing materials

(a) FC 99, V76381

(b) Fumetrol 140, V27201 or V76323

(c) MST-ST, V0HMR8

(2) Type 2 - Protective blanket materials

(a) Fumetrol 101, V27201 or V76323

B. Barium carbonate ($BaCO_3$), technical

C. Cheesecloth - BMS 15-5, Class A (Ref SOPM 20-60-04)

D. Chromic acid (chromium trioxide, CrO_3), technical, O-C-303

E. Chromic acid, liquid concentrate, 12.0-12.3lb./gal CrO_3, O-C-303

F. Magnesium chromate pentahydrate ($MgCrO_4$ $5H_2O$)

G. Phosphoric acid (H_3PO_4), 75 or 85%, technical, O-O-670

H. Polyballs, polythylene, linear high density solid spherical, 1 inch diameter minimum

I. Sodium chromate (Na2CrO4), technical, O-S-588

J. Sodium hydroxide (NaOH), flake or granular, O-S-598

3. SOLUTION PREPARATION

A. Chromic Acid Anodizing Solution

(1) Make up the chromic acid solution at a nominal concentration of 40.0 grams/liter chromic acid in water unless anti-misting agents are used. If they are, make up the solution at 45.0 grams/liter chromic acid in water.

(2) Control the solution in these limits:

(a) Free chromic acid as CrO3: 30.5-52.0 grams/liter (40.5-52.0 grams/liter if anti-misting agents are used).

(b) Total hexavalent chromate as CrO3: 30.5-107.5 grams/liter (40.5-107.5 grams/liter if anti-misting agents are used).

(c) Chlorides as NaCl, 0.2g/liter maximum

(d) Sulfates as SO4, 0.5 g/liter maximum

NOTE: Regular analyses are not necessary for chlorides or sulfates. But if there are problems with coating quality or corrosion resistance, the cause could be chloride or sulfate contamination.

(3) Operate the solution at 90-100°F, optional 100-110°F.

(4) Anti-misting agents can be used to reduce chromium in the air. The agents reduce the surface tension of the solution. Add the agent as indicated below, mix well, and then let the solution stabilize for 24 hours at the operating temperature.

(a) FC 99: Add 0.04 gallon (5 fl.oz or 150ml) per 100 gallons of solution. During anodizing, add more as necessary to control surface tension at 20-45 dynes/cm.

(b) Fumetrol 140: Add 0.3 gallon per 100 gallons of solution. During anodizing, add more as necessary to control the surface tension at 26-40 dynes/cm.

(c) MSP-ST: Add 0.2 gallon per 100 gallons of solution. During anodizing, add more as necessary to control the surface tension at 40-50 dynes/cm.

(d) Fumetrol 101: Add 1 gallon per 20 sq. ft. of surface. During anodizing, add more as necessary to keep a layer over anode racks and the cathode. When you agitate the solution, do not break up the layer over the electrode areas.

B. Dilute chromate seal solution

(1) For each 100 gallons of solution, add 26 grams chromic acid and 26 grams sodium chromate or magnesium chromate to deionized water.

(2) Control the solution in these limits:

(a) Hexavalent chromium, 45 ppm minimum

(b) PH, 3.2-3.8

(c) Silicates as SiO2, 10 ppm maximum

(d) Total dissolved solids, 250 ppm maximum.

(3) Control the pH and hexavalent chromium with chromic acid, sodium or magnesium chromate or sodium hydroxide. Discard or purify the solution when silicates or total dissolved solids get to the limits.

(4) Operate the solution at these temperatures:

(a) For 95°F anodizing at 22 volts: 190-200°F

(b) For 95°F anodizing at 40 volts: 195-205°F

(c) For 105°F anodizing at 22 or 40 volts: 180-190°F

(5) Keep the solution clear and without visible sediment, floating contamination or oils.

(6) This solution can be used as water to add to the anodizing bath.

C. Deionized water seal

(1) Contamination of this seal water must not be more than 12 ppm total dissolved solids. Not more than 4 ppm of this can be silicates (SiO2).

(2) Control the seal water temperature at 150°F minimum.

(3) Make analyses of the seal water as necessary to control it with the above limits. Water will not make a seal as easily when the contamination increases.

(4) Do the gravimetric test procedure (Paragraph 6.F.) at least once each day that you use the deionized water seal procedure.

D. Rinse Water

(1) Incoming water for solutions and rinse water must be in these limits:

(a) Total solids, 550 ppm maximum

(b) Chloride, 25 ppm maximum

(c) Fluoride, 1.7 ppm maximum

(d) pH, 5.5-8.0

(2) Final immersion rinse water must have 1000 ppm or less total dissolved solids, and the pH must be controlled to 2.5-8.0. If a double immersion rinse is used, the water in the first rinse must have no more than 500 ppm total dissolved solids.

4. REMOVAL OF SULFATES FROM ANODIZING SOLUTION

A. Before you add the barium carbonate, stir the solution with much force for a minimum of 1 minute with air or mechanically.

B. Slowly add the barium carbonate powder all over the surface of the solution, and continue to stir the solution for a minimum of 30 minutes. Do not add too much barium carbonate. One part of barium carbonate by weight will remove 0.3 parts by weight of the sulfate ion (SO4) as barium sulfate.

C. Stop the agitation and let the barium sulfate go to the bottom for a minimum of 4 hours.

D. With a pump, carefully remove only the liquid layer of the solution and put it into a clean rinse-water tank. Do not stir up the precipitate layer at the bottom, or let the pump remove any of the precipitate along with the liquid layer.

E. When all of the liquid layer is removed, discard the precipitate layer and fully clean the tank.

F. Send the chromic acid solution back into the cleaned tank through a filter to remove remaining barium sulfate.

G. Make analyses of the solution. Adjust the chromic acid concentration as necessary. Anodize some test panels of 2024-T3 or 2024-T4 aluminum and measure the coating weight. The coating weight must be a minimum of 200 mg/sq. ft. before you continue to anodize airplane parts. Refer to BAC 5019.

5. ANODIZING PROCEDURE

A. General

(1) Anodize parts after surfaces are machined and before assembly, except for operations done during installation, such as trimming or drilling. Close-toleranced holes can be chemical treated per BAC5719, Type 2, Class A (Ref SOPM 20-43-03) or BAC5626, Type 2 Class A.

(2) Remove nonaluminum metal parts, such as inserts, before anodizing, if you can. If removal is not possible, be sure to mask off areas not to be anodized, such as thermal spray coatings or inserts of a different metal. Plug the ends of oxygen tubing.

(3) Do not tumble, sand, scrape or do other operations on anodized parts that could damage the anodic film.

(4) When the interior surfaces of hollow members must be anodized, use special internal cathodes if the ratio of the length to the diameter is greater than 8 to 1.

(5) Use racks made from aluminum alloy, titanium alloy, or aluminum with titanium tips and that hold the parts with good, forced, stable electrical contact and a minimum of contact area. Put the parts in the racks to prevent caught gases and permit good drainage.

(6) For rivets and small parts which will not nest, use perforated aluminum or titanium alloy baskets or tubes, not racks. Push a perforated top down into the container to hold the parts for good electrical contact.

(7) When it is necessary to touch or move wet parts, use clean latex rubber gloves. After anodized parts dry, use only clean fabric gloves.

(8) Keep the parts down in the solution. Do the procedure without delays between steps, and do not let the parts dry.

(9) Do not anodize parts while they are held in a stressed condition, such as if clamped in a twisted or bent position.

B. Part preparation

(1) If the parts have grease or oil on them, vapor degrease, emulsion clean, or solvent clean them per SOPM 20-30-03. Then, if these parts have open mating surfaces or spot-welded joints that could catch solvent, soak them in cold water (or hot then cold water) for a minimum of 2 minutes.

(2) Mask the parts if necessary, then put them in the racks.

(3) Unless the parts could catch solutions,

(a) Alkaline clean the rinse, or alkaline etch them, per SOPM 20-30-03.

(b) Deoxidize and rinse per BAC 5765. This step is optional if a non-directional sanded finish is specified.

C. Anodizing

(1) Lower the part into the anodizing solution with the current energized, or apply current within 2 minutes after start of immersion.

(2) Start at 5 volts maximum and increase the voltage at a rate of 7 volts/min. maximum. Increase to 20-24 volts dc (optional 38-42 volts dc). Anodize at 22 volts for alloys 2019, 2090, 2091, 2219, 7075-T73, 7178, and for Class 4 sealed parts. Special conditions are applicable to alloys 7050-T7 and 7050-T77. Refer to BAC5019 for details.

(3) Anodize for 35-60 minutes after you get to the final operating voltage. Agitate the solution with air or mechanically during the anodizing cycle.

(a) If no anti-misting agents are used, anodize for 30-60 minutes.

(b) If Type 1 anti-misting agents are used, anodize for 30-60 minutes, and control the agitation to keep the foam down from the racks of parts. Do not let the foam go over the edge or into the fume exhaust system.

(c) If Type 2 anti-misting agents are used, anodize for 45-60 minutes. Make sure the agitation keeps the electrodes and racks of parts covered during the operation.

(4) Remove the parts from the anodizing tank within 2 minutes after current is stopped.

(5) Rinse with cold water (95°F maximum) for 30 seconds to 15 minutes.

D. Sealing

(1) Class 1 Parts – Seal in one of these solutions:

(a) Dilute chromate solution for 23-28 minutes.

(b) Deionized water for the time necessary to get 13-17% hydration.

(2) Class 3 parts – Seal in dilute chromate solution for 23-28 minutes.

(3) Class 4 parts – Seal in deionized water solution to a hydration level of 15-25%.

(4) Class 5 parts – Do not seal.

E. Fully dry at 160°F maximum.

6. QUALITY CONTROL

A. The coating before sealing will be a light gray color. The actual color could be different because of the alloy and the condition of the surface. The color after sealing in sodium dichromate or deionized water could be golden. The color intensity or differences are not a sign of coating quality, serviceability or corrosion resistance.

B. Parts must have no burned areas or areas not anodized. Bare areas, such as from clamps, do not require touch up if they are not larger than 0.094 inch across. One bare area can be up to 0.125 inch across.

C. Extruded, cast, forged, formed or welded parts must have no surface cracks or pits in the coating. Examine the coating immediately after the procedure is complete. Chromic acid bleedout from faying surfaces is acceptable on welded assemblies only. Casting porosity could also cause chromic acid bleedout. On parts where the surface appearance is not important, chromic acid bleedout is acceptable if the base metal does not have cracks.

D. Forged, extruded, or machined parts could have dark areas or bands that could be soft spots. Examine these areas per BAC5946. Chemical treat per SOPM 20-43-03, Type 2, Class A the holes made through the coating by hardness tests.

E. Monitor coating weight and corrosion resistance as specified in BAC5019.

F. If the deionized water seal procedure is used, use the gravimetric test procedure of BSS7325 to be sure the parts are kept in the seal bath for the correct time. Because this test must be done a minimum of once each day, the procedure is given below.

(1) Anodize, but do not seal, three test panels 3 x 3 x 0.040 inches.

(2) Air dry the panels at 160°F maximum, and store in a charged desiccator for at least 15 minutes.

(3) Weigh each panel on a balance accurate to +/-0.0005 gram. This is the anodized weight (WA). Make a note of this for each panel.

(4) Seal the panels in the deionized water bath of Paragraph 3.D. Use a different seal time for each panel. Seal one panel for the time you think will give the correct hydration results. Seal the other two panels for times at equal increments above and below the time for the first panel.

(5) Air dry the sealed panels at 160°F maximum. Put them in a charged desiccator for a minimum of 15 minutes. Then weigh each panel again. This is the sealed weight (WS). Make a note of this for each panel.

(6) Strip the panels in chromate-phosphoric acid solution for 5 minutes at 200°F. To make the stripping solution, dissolve 20g of CrO_3 and 27 ml of 85% phosphoric acid per liter of water.

(7) Fully rinse the stripped panels, air dry at 160°F maximum, and put them in a charged desiccator for a minimum of 15 minutes. Then weigh the panels a third time. This will be the stripped, bare weight after you make sure all of the anodize film is removed.

(8) Do Paragraph 6.F.(6) and Paragraph 6.F.(7) again as necessary to be sure all of the anodize film is removed. The removal is complete when the weight of a panel did not decrease by more than 3 mg from the last time. Use this final value as the bare, stripped weight (WB) for the calculation of percent hydration.

(9) Calculate the percent hydration for each panel:

Percent Hydration = 100 x (WS-WA) / (WS-WB), where

WS is the weight of the sealed, anodized panel (Paragraph 6.F.(5) above)

WA is the weight of the anodized panel before sealing (Paragraph 6.F.(3) above)

WB is the weight of the bare, stripped panel (Paragraph 6.F.(8) above)

(10) If the values of percent hydration are not within the specified limits, do this test again with different times or a different bath temperature.