STANDARD OVERHAUL PRACTICES MANUAL

ANODIZING OF MAGNESIUM ALLOYS

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STANDARD OVERHAUL PRACTICES MANUAL

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To: All holders of ANODIZING OF MAGNESIUM ALLOYS 20-43-02.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

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Location of Change	Description of Change
	NO HIGHLIGHTS

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

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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.

ANODIZING OF MAGNESIUM ALLOYS

1. INTRODUCTION

A. The data in this subject comes from Boeing Process Specifications BAC5734 and 5742. 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. The Dow 17 process makes a coating upon magnesium alloys by electrolytic treatment in a chromic acid-phosphoric acid solution. This coating has types and classes which are equivalent to MIL-M-45202 types and classes: Type 1, Class C, which is a thin light green coating, and Type 2, Class D, which is a heavy dark green coating. If the type or class is not specified by the overhaul instructions, use Type 1, Class C. Equivalent procedures that agree with MIL-M-45202, Type 1, Class C, or Type 2, Class D, can be used unless the parts are to be adhesive bonded.

D. The Dow 19 process is a manually applied anodize that uses a solution of chromic acid and calcium sulfate. The BMC process is an immersion applied anodize.

E. These coatings are used as a base for paints and adhesives.

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

2. MATERIALS

A. Dow 17 Process

(1) Ammonium Bifluoride, Technical Grade

(2) Sodium Dichromate Dihydrate, Technical, O-S-595

(3) Phosphoric Acid (Orthophosphoric Acid) Technical, O-O-670

(4) Maskants

(a) Adcoat 828, V51686

(b) Aluminum tape – Scotch No. 425, V76381

(c) Lead tape – Scotch No. 420, V76381

(d) Turco 5696, V61102

B. Dow 19 Process

(1) Chromic Acid (Chromium Trioxide), technical, O-C-303

(2) Calcium Sulfate (CaS04 2H20), technical

(3) Sodium Hydroxide, technical, O-S-598

(4) Sulfuric Acid, O-S-89

(5) Magnesium Oxide, technical, MIL-M-12036

C. BMC Dip Process

(1) Sodium Dichromate Dihydrate, technical, O-S-595

(2) Sodium Sulfate, technical

(3) Chromic Acid (Chromium Trioxide), technical, O-C-303

D. Wipers – BMS 15-5, class A or B

3. DOW 17 ANODIZING PROCESS

A. General Notes

(1) Anodize the parts after they are machined (as in repair) and before assembly and operations during installation, such as trimming and drilling.

(2) The Dow 17 coating makes a buildup that is equivalent to 2/3 of the coating thickness. For example, a 0.0015 inch thick coat makes a 0.0010 inch buildup.

(3) The procedure can be done with AC (50-70 Hz) or DC systems. For a DC system, use the steel tank as the cathode or use steel cathodes. The parts are the anode. The cathode-to-anode area ratio must be 3 to 1 or larger. For AC systems, two electrodes are necessary, with area ratios as nearly equal as possible, and no more different than 2 to 1. These electrodes could be two of the same unit or group of parts, or one part with something else as the other electrode.

(4) Automatic electrical equipment is recommended, to control current density and time that the current is on.

(5) For racks, use magnesium. As an alternative, 5000- or 6000-series aluminum racks can be used if inhibited alkaline cleaners are used. Mask all parts of the rack that will not be electrical connections to the parts.

(6) Surfaces must be water break-free after immersion or spray in a solution or rinse, but not after vapor degreasing or emulsion cleaning.

NOTE: A water break-free surface is a surface which keeps a continuous layer of water for 30 seconds after it was rinsed with clean water at a temperature below 100°F. Clean again all surfaces which are not water break-free.

(7) In the fresh water stage of double counter-current rinsing facilities, or for immersion water rinses, do not let the level of total dissolved solids become higher than 750 parts per million, when parts will stay wet in subsequent procedures, or 350 parts per million, when parts are to be dried.

B. Solution Makeup and Control

NOTE: The anodize procedure lets you use AC or DC power, but the decision must be made before you make the solution because the ammonium fluoride amounts are different.

(1) Fully clean the tank. Fill it partially with water.

(2) For AC operations, add 2 pounds ammonium bifluoride per gallon of tank values. For DC operations, use 2.5 pounds per gallon. Mix fully.

(3) Add 0.83 pound sodium dichromate per gallon of tank volume. Add this smoothly all over the surface. Mix fully.

(4) Add 0.11 gallon phosphoric acid per gallon of tank volume.

(5) Fill the tank with water. Dissolve and fully mix all chemicals.

(6) Control fluorides at 20-23 oz/gal (AC operation) or 25-30 oz/gal (DC operation). Control sodium dichromate at 8-14 oz/gal, as Na2Cr2O7.2H2O. Control phosphoric acid at 14-18 oz/gal as H3PO4.

(7) Control the solution temperature at 160-180°F.

C. Parts Preparation

(1) If the parts are oily or greasy, vapor degrease or solvent clean them per SOPM 20-30-03.

(2) Remove or mask off all metals that are not magnesium. Make sure the masks are resistant to the solutions used in the procedure.

(3) Put the parts in the racks. Make sure the electrical connections are good.

(4) Remove oxides, scale, and contamination per BAC5769, Type 2.

D. Anodize with this procedure:

(1) Set the electrical controls to zero.

(2) Put the parts into the solution with the power off.

(3) Within 30 seconds, adjust the controls to 20 amps/sq. ft. (or the value found by tests for the alloy).

(4) As the coating forms, increase the voltage to keep the current density constant, until you get to the minimum cut-off voltage specified in Table 1. Then let the current decrease until the specified amp-minute/sq. ft. value is reached. The approximate total time at 20 amps/sq. ft. is 4-5 minutes (Type 1, Class C) or 20-25 minutes (Type 2, Class D).

(5) Turn the current off at the correct time.

(6) Remove the part from the solution within 45 seconds. Let the part drain into the anodizing tank for 1 minute before you move the part to the rinse tank.

(7) Rinse with a cold water spray for 5-10 minutes. Or immersion rinse for 5-8 minutes. If you spray rinse the parts, make sure you hit all of the anodized surfaces and let the parts fully drain. Also, to prevent streaks, make sure you lower the load of parts fully into the rinse water before you start the spray.

(8) As an option to help dry the parts, rinse them in hot (120-160°F) water for a maximum of 3 minutes.

(9) Dry in air from room temperature to 180°F.

(10) Examine the anodize coating per Paragraph 4.C. Use only clean white gloves.

(11) Paint the part, or adhesive bond it, as specified by overhaul instructions, as quickly as possible. Keep the part clean and dry until painted or bonded.

Table 1: Dow 17 Anodize Electrical Data

	Magnesium Alloy	Coating		Final Voltage (Cut off) (Volts)		Quantity of Electricity Amp-min/sq. ft	
		Type	Class	AC	DC	AC	DC
Parts for adhesive bonding	All	1	C	60-75	70	15-45	15-35
All other parts	All	1	C	70	75	80-100	50-60
		2	D	90	95	450 Min	300 Min

E. Quality Control

(1) The coating must be continuous over all the surface and have no powder, scratches, burrs or breaks (other than at electrical contact points). If you find defects, see Table 2.

(2) The coating thickness on all parts which are to be adhesive bonded must be 0.0001-0.0002 inch. On other parts, thickness must be 0.00015-0.00070 inch (Type 1, Class C) or 0.00090-0.00160 inch (Type 2, Class D).

Table 2: Defect Correction Data

Problem	Solution
Areas not coated (not areas specified to be bare).	*[1]
Areas not coated because of air pockets	*[1]
Off-color areas such as streaks or blotches because of incorrect procedures (cleaning, etching, or anodizing)	*[1]
Pits	*[2]
Scratches in the anodize coating	*[1]
Powder	*[1]
Burned areas	*[1]
Incorrect thickness	*[1]

*[1] Put the part through the anodize procedure again. (Removal of the anodize is not necessary.)

*[2] Reject the part if the pits will make the part unserviceable.

4. DOW 19 TOUCH-UP PROCESS

A. General

(1) Until it dries, the coating is soft and easily rubbed off or damaged by swabs used to apply the coating, high pressure spray, or the full force of compressed air blast used to dry the parts.

(2) Use distilled or deionized water for solution makeup.

B. Solution Makeup and Control

(1) Fill a clean polyethylene or glass container to the 90 percent level with water.

(2) Slowly add 1-1/3 ounce chromic acid per gallon of final solution.

(3) Add 1 ounce calcium sulfate per gallon of final solution.

(4) Fill the task to the operating level with water.

(5) Stir with much force for 15 minutes to make sure that the solution is saturated with calcium sulfate.

(6) Control the pH at 1.2-1.6 with sodium hydroxide or sulfuric acid as necessary.

(7) Discard the solution when you are done with it.

C. Touch-Up Application

(1) Manually sand to blend the area smoothly into the adjacent good finish.

(2) Remove all loose dust and particles with a soft bristle brush or a clean wiper.

(3) Cold solvent alkaline clean per SOPM 20-30-03 to get a water break free surface. If water breaks do not go away, hand scrub with a water slurry of magnesium oxide.

(4) Apply the Dow 19 solution with a swab until the metal surface becomes dull golden to dark brown in color. Be careful, because you could rub away the coating. As you use the solution, remove suspended material from it. Frequently apply large quantities of clean new full-strength solution, and discard runoff, because the chemicals quickly become weak as they react with the magnesium surface.

(5) Rinse with cold water.

CAUTION: HIGH PRESSURE SPRAY OR THE FRICTION OF A WIPER WILL DAMAGE THE FRESH COATING.

(6) Dry with circulating air (room temperature to 180°F) or compressed air. Do not turn the full blast of the compressed air at the parts.

(7) Apply primer or other coating as specified. Give parts protection from contamination until they are painted.

D. Quality Control

(1) The coating must have no pits, striations, powder, scratches, uncoated areas or other defects.

(2) Defects which make the part unserviceable cannot be repaired.

(3) Wipe off powder with a clean cloth.

(4) Touch up uncoated areas and scratches per Paragraph 4.C., as necessary.

5. BMC DIP PROCESS

A. General

(1) Until it dries, the coating is soft and easily rubbed off or damaged by agitation of dip solution, high pressure spray, or compressed air used to dry parts.

(2) Use distilled or deionized water for solution makeup.

B. Solution Makeup and Control

(1) Fill a cleaned tank to 75 percent of operating level with water.

(2) Slowly add 5 ounces sodium dichromate dihydrate per gallon of final solution.

(3) Add 0.5 ounce sodium sulfate per gallon of fuel solution.

(4) Fill to operating level with water.

(5) Mix fully.

(6) Controls

(a) Control the pH at 1.6-1.9 with chromic acid as necessary.

(b) Agitate solution with filtered air. Keep the solution at 60-80°F.

(c) Discard the solution when the magnesium is more than 2.0 oz/gal.

C. Coating Application

(1) Vapor degrease per SOPM 20-30-03. Let the parts fully dry.

(2) If the parts have faying surfaces, without the full protection of an organic finish or sealant, do not immersion clean.

(3) Alkaline clean and rinse per SOPM 20-30-03.

(4) Soak the part in concentrated chromium-nitrate solution (BAC 5769, solution no. 2), for sufficient time to remove scale or corrosion plus one minute.

(5) Cold water rinse 8-10 minutes. Immersion rinse is preferred; spray rinse is optional.

(6) Soak the parts in the BMC solution (Paragraph 4.B.) for 3-10 minutes. Adjust this time as necessary to get a dull golden to dark brown coating.

(7) Rinse in cold water. Immersion rinse of 3 minutes is preferred; 3-5 minute spray rinse is optional.

(8) Dry with a good flow of 60-180°F air, or compressed air.

(9) Apply the primer or other coating as specified by the overhaul instructions. Give the parts protection from contamination until they are painted.

D. Quality Control

(1) The coating must have no pits, striations, powder, scratches, uncoated areas or other defects.

(2) Defects which make the part unserviceable cannot be repaired.

(3) Wipe away powder by wiping with a clean cloth.

(4) Touch up scratches and uncoated areas by the Dow 19 procedure per Paragraph 4.