STANDARD OVERHAUL PRACTICES MANUAL

SILVER PLATING

PART NUMBER NONE

PUBLISHED BY BOEING COMMERCIAL AIRPLANES GROUP, SEATTLE, WASHINGTON, USA
A DIVISION OF THE BOEING COMPANY
PAGE DATE: Jul 01/2009

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STANDARD OVERHAUL PRACTICES MANUAL

Revision No. 9
Jul 01/2009

To: All holders of SILVER PLATING 20-42-06.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

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

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All revisions to this manual will be accompanied by transmittal sheet bearing the revision number. Enter the revision number in numerical order, together with the revision date, the date filed and the initials of the person filing.

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Revision		Filed		Revision		Filed	
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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.

SILVER PLATING

1. INTRODUCTION

A. The data in this subject comes from Boeing Process Specification BAC5715. 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 to help you write minimum standards.

C. The procedure will make silver plating that agrees with QQ-S-365. Equivalent procedures can be used.

D. The types and grades are the same as those specified in QQ-S-365:

Type 1 – Matte (dull, not shiny)

Type 2 – Semibright (partially shiny)

Type 3 – Bright (shiny)

Grade A – With supplementary tarnish-resistant chromate treatment

Grade B – Without supplementary tarnish resistant treatment

E. Do not use this procedure to silver plate steels heat treated above 220 ksi.

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

2. MATERIALS

A. Silver cyanide – Plating grade

B. Sodium cyanide, 97% NaCN minimum – Plating Grade

C. Potassium cyanide, 98% KCN minimum – Plating Grade

D. Sodium carbonate, anhydrous, technical – O-S-571

E. Potassium carbonate, anhydrous, technical

F. Carbon disulfide, technical

G. Silver anodes, 999.5 + fine, minimum

H. Abrasives for scouring

(1) Wyandotte F-1013, V54151

(2) Pumice, Grade FF

(3) Tripoli Powder

I. Hydrochloric acid, 20 degree Baume', technical – O-H-765

J. Inhibitors

(1) Acryl, V61102

(2) Polyrad 1110A, V28284

(3) Rodine 123, V84063

K. Potassium hydroxide, technical

L. Nitric acid, 40- or 42-degree Baume', technical – O-N-350

M. Sodium thiosulfate, crystal – USP grade

N. Silver-Lume Brightener A, V27201 or V76323

O. Silver-Lume Brightener B, V27201 or V76323

P. Chromate Compound – Iridiate 18-P, V70308

Q. Anode bags, woven nylon

R. Masking Materials

(1) Turco No. 522 or 544, V61102

(2) Microshield Stopoff Lacquer, V01058

(3) Micromask, V01058

(4) Platers Tape, yellow, V3M808

S. Endox 214 solution (Ref SOPM 20-30-03)

T. Nickel strike solution (Ref SOPM 20-42-09)

3. SOLUTION PREPARATION

WARNING: THE SILVER PLATING SOLUTIONS CONTAIN CYANIDE SALTS AND ARE VERY POISONOUS. DO NOT LET ACIDS GET INTO SOLUTIONS. DO NOT LET SOLUTIONS TOUCH EYES, SKIN, OR CLOTHING. DO NOT BREATHE MIST OR VAPOR. KEEP CYANIDES AWAY FROM HEAT, SPARKS, AND OPEN FLAMES.

A. Silver Strike Bath

(1) Clean tank thoroughly and add 1/2 the total amount water.

(2) Add 60 pounds (9.5 oz/gal) sodium cyanide or potassium cyanide and 6 pounds (1.0 oz/gal) sodium carbonate or potassium carbonate per 100 gallons of final solution. Stir solution until these chemicals are dissolved.

(3) Add 3.75 pounds (0.6 oz/gal) silver cyanide per 100 gallons of final solution. Add this chemical slowly with constant stirring of solution.

(4) Add water to fill tank to operating level.

(5) Control the solution temperature at room temperature to 90°F.

(6) Control solution at 8.0-11.4 oz/gal free sodium cyanide.

(7) Control current density at 40 to 100 asf.

(8) Use steel anodes as required.

B. Silver Plate Solution for Matte and Semibright Plating

(1) Clean tank thoroughly and add 1/2 the total amount water.

(2) Add 43 pounds (7.0 oz/gal) potassium cyanide and 31 pounds (5.0 oz/gal) potassium carbonate per 100 gallons of final solution. Stir solution until these chemicals dissolve.

(3) Add 25 pounds (4.0 oz/gal) silver cyanide per 100 gallons of final solution. Add this chemical slowly and stir constantly.

(4) Add water to fill tank to operating level.

(5) Control the solution temperature at room temperature to 90°F.

(6) Control solution at 13.4 (maximum) oz/gal potassium carbonate, 4.0-6.0 oz/gal free potassium cyanide, and 2.9-4.0 oz/gal silver metal.

(7) Control current density at 12 asf, maximum.

(8) Control anode to cathode ratio at 1 to 1, minimum.

(9) Use silver anodes and anode bags.

(10) For Type 1 (matte) plating, brightener per Paragraph 3.B.(11) is permitted, if necessary, to make a smooth finish.

(11) For Type 2 (semibright) plating, add one of these two brighteners:

(a) Dissolve sodium thiosulfate in water to make a thin paste. Add small quantities of this to the plating bath, as necessary to make a semibright plate.

WARNING: CARBON DISULFIDE IS VERY FLAMMABLE. FRICTION CAN CAUSE IGNITION.

(b) As an alternative, use this carbon disulfide brightener: 9.5 oz/gal potassium cyanide and 1.0 oz/gal potassium carbonate in water. First add the potassium cyanide and potassium carbonate to approximately one-half the total volume of water. Stir until these chemicals are dissolved. Add 0.6 oz/gal silver cyanide slowly to the mixture and stir constantly. Then add water to the final volume, to get the specific concentrations of these chemicals. Shake with an excess of carbon disulfide until the mixture is saturated. Add approximately 1/8 fluid ounce of this mixture per gallon of the plating solution.

C. Silver Plate Solution for Bright Plating

(1) Clean tank thoroughly and add 1/2 the total amount water.

(2) Add 100 pounds (16.0 oz/gal) potassium cyanide and 19 pounds (3.0 oz/gal) potassium carbonate per 100 gallons of final solution. Stir solution until these chemicals are dissolved.

(3) Add 37.5 pounds (6.0 oz/gal) silver cyanide per 100 gallons of final solution. Add this chemical slowly and stir constantly.

(4) Add water to fill tank to operating level.

(5) Control the solution temperature at 70-120°F.

(6) Control solution at 3.0-10.0 oz/gal potassium carbonate, 12.0-14.0 oz/gal free potassium cyanide, and 4.5-6.0 oz/gal silver metal.

(7) Control current density at 10 asf when the solution temperature is 70-75°F. Higher current densities can be used at higher solution temperatures.

(8) Control anode to cathode ratio at 1 to 1, minimum, for current density up to 10 asf. Increase the ratio for higher current densities.

(9) Use silver anodes and anode bags.

(10) Add Silver-Lume Brighteners A and B and maintain the concentration of each independently to produce a bright plate. Use the manufacturer's instructions for makeup and control.

(a) Mix Brightener A at the ratio of 1.0 ounce Brightener A to 8 fluid ounces of a water solution of potassium hydroxide (10.5 oz KOH/gal). Do not prepare this mixture more than one week before it will be used.

(b) Add Brightener B directly to the plating solution and stir.

D. Nitric Acid Solution

(1) Fill the tank to 9/10 level with water.

(2) Add an amount of nitric acid equal to 0.5% of the final tank volume (that is, 0.5 gallon nitric acid per 100 gallons of final solution).

(3) Fill the tank to the operating level with water.

(4) Use this solution at room temperature. Discard the solution when it is not serviceable.

E. Chromate Solution

(1) Clean tank thoroughly and add approximately 1/2 the total amount of water.

(2) Add 1.5 ounces chromate compound per gallon of final solution.

(3) Add nitric acid until the pH is 1.5.

(4) Add water to fill tank to operating level.

(5) Use this solution at room temperature.

(6) Control the solution at 1.5-3.0 oz/gal chromate compound and pH of 1.5-2.1.

F. Inhibited Hydrochloric Acid Solution (BAC5625 Solution 1)

(1) Add approximately 1/10 the total amount of water to the tank.

(2) Add 54 gallons hydrochloric acid for each 100 gallons final solution.

(3) Add 5 pints inhibitor per 100 gallons of final solution. Use only one inhibitor. Do not mix different inhibitors in the same solution.

(4) Add water as necessary to fill the tank to the operating level.

(5) Use this solution at room temperature.

(6) Control the acid concentration at 23-38 oz/gal HCl. Add 1 fluid ounce inhibitors with each gallon hydrochloric acid (that is, 0.8% by volume) used to adjust the acid concentration.

(7) Metal contamination limits – Iron, 5 oz/gal maximum; copper, 0.5 oz/gal maximum.

G. Uninhibited Hydrochloric Acid Solution (BAC 5625 Solution 19)

(1) Add approximately 2/3 the total amount of water to the tank.

(2) Add 14 gallons hydrochloric acid for each 100 gallons final solution.

(3) Add water as necessary to fill the tank to the operating level.

(4) Use this solution at temperatures from room temperature to 140°F.

(5) Metal contamination limits – Iron, 1 oz/gal maximum

4. PLATING PROCEDURES

A. Before plating, stress relieve all low alloy and corrosion resistant steel parts per the overhaul instructions. Where no stress relief details are given, stress relieve per SOPM 20-10-02.

B. Surfaces must be water break-free after they were in any processing solution or rinse, except vapor degreasing, solvent cleaning, or emulsion cleaning. A water break-free surface is a surface which keeps a continuous water film for a minimum of at least 30 seconds after it was sprayed or immersion rinsed in clean water at a temperature below 100°F. Clean parts again which show water breaks.

C. Ferrous alloys, nickel alloys, cobalt alloys, and nickel plate:

(1) Stress relieve, if necessary (Paragraph 4.A.).

(2) Vapor degrease, emulsion clean, or solvent clean, per SOPM 20-30-03, if required.

(3) Remove rust or scale, per SOPM 20-30-03, if required.

(4) Mask and rack, as required.

(5) Alkaline clean and rinse per SOPM 20-30-03. Do not allow part to dry.

(6) For low alloy steel:

CAUTION: THE UNINHIBITED SOLUTION COULD ETCH SURFACE IF PARTS ARE KEPT IN IT FOR MORE THAN 1 MINUTE.

(a) Put the parts in inhibited hydrochloric acid solution for 2 minutes, or in uninhibited hydrochloric acid solution for 30-60 seconds.

(b) Rinse thoroughly in cold water, 2 minutes maximum. Do not allow part to dry.

(c) If smut is present, remove it by one of these three procedures. When you rinse, do not let the parts dry.

1) Scour with abrasive and rinse to remove the unwanted material and abrasive.

2) Clean the parts in Endox 214 per SOPM 20-30-03. Anodic clean at 60-80 asf for 2-6 minutes. Then rinse.

3) Blast with a mixture of pumice and water. Then rinse.

(d) As an option to Paragraph 4.C.(6)(a), Paragraph 4.C.(6)(b), Paragraph 4.C.(6)(c) above, electrolytic clean in Endox 214 per Alkaline Cleaning Method 3 in SOPM 20-30-03. Rinse, then electrolytic clean for 1-2 more minutes. Stop on the anodic cycle. Let the Endox solution drain from the parts, but do not rinse or let the parts dry.

(e) Put the parts in nickel strike solution within 1 minute. Apply current cathodically for 2 minutes at 30-40 asf.

(f) Rinse in cold water. Do not let the parts dry.

(7) For all other ferrous alloys, nickel alloys, cobalt alloys, and nickel plate:

(a) Nickel strike per SOPM 20-42-09 within 1 minute.

(b) Rinse in cold water. Do not let the parts dry.

(8) Silver strike within 1 minute. Make cathodic electrical connections to the parts outside the tank, apply power and then silver strike for 30 seconds at 40-100 asf.

(9) Silver plate within 1 minute. Do not let the parts dry. Make cathodic electrical connections to the parts outside the tank, apply power and then silver plate at 12 asf current density for matte or semibright plate, or at 10 asf current density for bright plate, to get the specified plate thickness.

(10) If the current is stopped during plating, apply anodic current at 4-5 asf for 2.0-2.5 minutes, and then change back to cathodic current per Paragraph 4.C.(9).

(11) Rinse in cold water. As an option, then hot water rinse to help dry the parts.

(12) If the plating is too thin, alkaline etch and clean the parts per SOPM 20-30-03. Then connect the parts anodically, apply power, and put the parts back in the silver plating solution with anodic current at 4-5 asf for 2-5 minutes. Then change back to cathodic current at 5-10 asf and silver plate per Paragraph 4.C.(9) to get the specified plating thickness.

(13) If Grade A (tarnish resistant) plating is specified:

(a) Put the parts in nitric acid solution for 5-15 seconds.

(b) Rinse.

(c) Put the parts in chromate solution for 0.5-2.0 minutes.

(d) Rinse.

(14) Dry with clean, dry compressed air.

(15) Within 8 hours after plating, bake the steel parts as follows:

NOTE: Nickel alloys Inconel 625, 718, and corrosion resistant steels 17-7PH (CH900), A286, 300-series, do not require baking.

(a) Carburized parts: 5-8 hours at 250-300°F

(b) Threaded parts (unless carburized) and all other ferrous alloy parts, 180-220 ksi: 3 hours minimum at 350-400°F.

D. Copper and Copper Base Alloys

(1) Vapor degrease, emulsion clean, or solvent clean, per SOPM 20-30-03, if necessary.

(2) Remove rust or scale per SOPM 20-30-03, if necessary.

(3) Silver plate within 1 minute. Do not let the parts dry. Make cathodic electrical connections to the part outside the tank, apply power, and then silver plate at 12 asf current density for matte or semibright plate, or at 10 asf current density for bright plate, to get the specified plate thickness.

(4) If the current is stopped during plating, apply anodic current at 4-5 asf for 2.0-2.5 minutes, and then change back to cathodic current per Paragraph 4.D.(3).

(5) Rinse in cold water. As an option, then hot water rinse to help dry the part.

(6) If the plating is too thin, alkaline etch and clean the parts per SOPM 20-30-03. Then connect the parts anodically, apply power, and put the parts back in the silver plating solution with anodic current at 4-5 asf for 2-5 minutes. Then change back to cathodic current at 5-10 asf and silver plate per Paragraph 4.D.(3) to get the specified plating thickness.

(7) If Grade A (tarnish resistant) plating is specified:

(a) Put the parts in nitric acid solution for 5-15 seconds.

(b) Rinse.

(c) Put the parts in chromate solution for 0.5-2.0 minutes.

(d) Rinse.

(8) Dry with clean, dry compressed air.

E. Aluminum Alloys

(1) Prepare the parts per SOPM 20-42-04.

(2) Silver plate within 1 minute. Do not let the part dry. Make cathodic electrical connections to the part outside the tank, apply power, and then silver plate at 12 asf current density for matte or semibright plate, or at 10 asf current density for bright plate, to get the specified plate thickness.

(3) If the current is stopped during plating, apply anodic current at 4-5 asf for 2.0-2.5 minutes, and then change back to cathodic current per Paragraph 4.E.(2).

(4) Rinse in cold water. As an option, then hot water rinse to help dry the part.

(5) If the plating is too thin, alkaline etch and clean the parts per SOPM 20-30-03. Then connect the parts anodically, apply power, and put the parts back in the silver plating solution with anodic current at 4-5 asf for 2-5 minutes. Then change back to cathodic current at 5-10 asf and silver plate per Paragraph 4.E.(2) to get the specified plating thickness.

(6) If Grade A (tarnish resistant) plating is specified:

(a) Put the parts in nitric acid solution for 5-15 seconds.

(b) Rinse.

(c) Put the parts in chromate solution for 0.5-2.0 minutes.

(d) Rinse.

(7) Dry with clean, dry compressed air.

(8) Bake parts at 200-225°F for 1 hour, or put in boiling water for 1 hour. Use water low in chlorides and sulfides, to help prevent tarnishing of the silver plate.

5. QUALITY CONTROL

A. The silver plate must be smooth, fine grained, and have no blisters, pits, nodules, burns or other defects, or separation when examined without magnification.

B. On parts other than aluminum, the plating must not come off when tested per BSS7235.

C. Unless specified by the overhaul instructions, the minimum thickness must be 0.0005 inch. Measure the thickness with a procedure that is accurate within +/- 10%.

D. Unless specified by the overhaul instructions, the thickness requirements are for only visible surfaces which can be touched by a ball 0.75 inch in diameter. The plating must be continuous on all surfaces touched by the plating current.