**BOMBARDIER**
*Toronto Site*
**PROPRIETARY INFORMATION**

# PPS 32.03

**PRODUCTION PROCESS STANDARD**

# CHROMIC ACID ANODIZING (A1)

Issue 26
- This standard supersedes PPS 32.03, Issue 25.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@aero.bombardier.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

| | | |
|---|---|---|
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**Tables, Figures & Flow Charts**

## 1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for chromic acid anodizing (CAA) of aluminum and aluminum alloys which will not be high strength adhesive bonded. **Chromic acid anodize parts that are to be high strength adhesive bonded according to PPS 32.11.** Chromic acid anodizing is identified by protective treatment code A1.

1.1.1 As an alternative to the procedure and requirements specified herein, it is acceptable to perform chromic acid anodizing of aluminum and aluminum alloys which will not be high strength adhesive bonded according to BAPS 160-010. However, it is **not** acceptable to use any other alternate BAPS, even if allowed in BAPS 160-010 (i.e., BAPS 160-045 cannot be utilized to process parts where A1 to PPS 32.03 is specified on the engineering drawing).

- Perform chromic acid anodizing of aluminum and aluminum alloys which will not be high strength adhesive bonded according to the procedure and requirements of either BAPS 160-010 or this PPS in their entirety; a piecemeal approach utilizing certain sections or portions of BAPS 160-010 and this PPS is **not** acceptable.
- Subcontractor facilities which have been approved by Bombardier to perform chromic acid anodizing according to BAPS 160-010 are considered approved to perform chromic acid anodizing according to this PPS without further approval needed.
- PPS Process Standard Deviations (PSD's) issued against this PPS are **not** applicable to BAPS 160-010. Likewise, requests for deviation (RFD's) allowed against BAPS 160-010 are not applicable to this PPS.
- When processing parts according to BAPS 160-010 as an alternative to processing parts according to PPS 32.03, deviations allowed by an approved RFD against BAPS 160-010 may be used unless a specific limitation regarding program applicability is specified by the RFD comments/restrictions.

1.1.2 This PPS complements the engineering drawings that specify its use as an authorized instruction. Except as noted in paragraph 1.1.1, the procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications and to fulfil the engineering design and reliability objectives. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing.

1.1.3 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

## 2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto Environment, Health and Safety Department.

## 3 REFERENCES

3.1 ASTM B117 - Standard Test Method of Salt Spray (Fog) Testing.

3.2 ASTM B137 - Standard Test Method for Measurement of Weight of Coating on Anodically Coated Aluminum.

3.3 ASTM D2794 - Standard Test for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

3.4 BAERD GEN-018 - Engineering Requirements for Laboratories.

3.5 BAERD GEN-023 - Contamination Control for Compressed Air.

3.6 BAPS 160-010 - Chromic Acid Anodizing.

3.7 Bombardier Toronto Laboratory Drawings - LAB 064, LAB 065, and LAB 066.

3.8 DHLPM Procedure No. 3111 - Coating Weight of Anodic Coatings - *Bombardier Toronto internal operating procedure*.

3.9 DHLPM Procedure No. 6011 - Description of Operation and Conditions Required For Salt Spray (Fog) Testing For Specification Purposes - *Bombardier Toronto internal operating procedure*.

3.10 EHS-OP-005 - Hazardous Materials Management - *Bombardier Toronto internal procedure*.

3.11 MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys.

3.12 PPS 13.13 - Personal Protective Respiratory Equipment.

3.13 PPS 13.26 - General Subcontractor Provisions.

3.14 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.15 PPS 27.09 - Repair of Surface Defects in Aluminum Alloy Tubing.

3.16 PPS 31.02 - Cleaning Processes for Aluminum and Aluminum Alloys.

3.17 PPS 32.02 - Manual Application of C1 Chemical Conversion Coatings.

3.18 PPS 32.11 - Chromic Acid Anodizing for High Strength Adhesive Bonding.

3.19 PPS 34.08 - Application of Epoxy-Polyamide Primer (F19 & F45).

3.20 QDI-09-02 - Process Control - *Bombardier Toronto internal Quality procedure*.

## 4 MATERIALS, EQUIPMENT AND FACILITIES

### 4.1 Materials

4.1.1 Aluminum alloy wire, 1/16" and 3/32" diameter gauge.

4.1.2 Chromic acid flakes, technical grade, A-A-55827.

4.1.3 Magnesium chromate ($MgCrO_4$), technical grade.

4.1.4 Microstop masking lacquer and Microstrip.

4.1.5 Protective wrapping, neutral Kraft paper or polyethylene plastic bags.

4.1.6 Sodium chromate ($Na_2CrO_4$), technical grade, O-S-588.

### 4.2 Equipment

4.2.1 Aluminum wool or brass wire brush.

4.2.2 Aluminum or titanium racks, straps and clamps capable of providing both support and positive electrical contact with the parts.

4.2.3 Bombardier approved chemical splash goggles.

4.2.4 Compressed air shall meet the requirements of BAERD GEN-023.

4.2.5 Immersion tanks resistant to the chemicals and to the operating temperatures used (e.g., stainless steel or polyethylene lined). Immersion tanks shall be equipped with an agitation system capable of providing uniform solution temperature throughout the tank (to prevent localized overheating).

4.2.5.1 Air utilized to agitate the chemical solutions shall meet the requirements of BAERD GEN-023.

4.2.6 Lint-free cotton gloves (e.g., DSC 422-1).

4.2.7 Low voltage gloves (e.g., DSC 422-10).

4.2.8 Neoprene rubber boots and aprons.

4.2.9 Protective gloves, neoprene or rubber (e.g., DSC 422-2 or DSC 422-5).

4.2.10 Rectifier (e.g., CE# 3499/1).

### 4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Critical Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform A1 chromic acid anodizing of aluminum and aluminum alloys according to this PPS.

4.3.2 Bombardier subcontractors shall direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier Aerospace facilities shall direct requests for approval to the appropriate internal Quality Manager.

4.3.3 Facility approval shall be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report shall detail the materials and equipment to be used, the process sequence to be followed and the laboratory facilities used to show compliance with the requirements of this PPS. Any deviation from the procedure or requirements of this PPS shall be detailed in the facility report. Based upon the facility report, Bombardier Toronto Engineering may identify additional qualification and/or process control test requirements. During the facility survey, the facility requesting qualification shall be prepared to demonstrate their capability. Once approved, no changes to subcontractor facilities may be made without prior written approval from Bombardier Aerospace Supplier Quality Management.

4.3.3.1 For approval of subcontractor facilities to perform A1 chromic acid anodizing of aluminum and aluminum alloys according to this PPS, completion of a test program and submission of suitable test samples representative of production parts is required. Test samples shall meet the requirements specified in section 6.

4.3.3.2 All testing and evaluation specified herein shall only be performed by Bombardier Toronto Materials Laboratory or by laboratories accredited according to BAERD GEN-018.

## 5 PROCEDURE

### 5.1 General

5.1.1 For the purposes of this PPS, the term “MRB” (Material Review Board) shall be considered to include Bombardier Toronto MRB and Bombardier Toronto delegated MRB.

5.1.2 A1 chromic acid anodizing consists of forming a thin, impervious, oxide layer on the surface of aluminum alloys by electro-chemical means to provide increased corrosion resistance and improved paint adhesion.

5.1.3 Complete all fabricating operations (i.e., heat treatment, machining, forming, filing, etc.) before anodizing.

5.1.4 Do not anodize parts or assemblies that contain joints or recesses which could entrap solutions. Do not anodize assemblies containing inserts or attachments unless such inserts have been suitably masked off, both chemically and electrically, with Microstop masking lacquer to prevent burning and corrosion in the surrounding areas. When masking off inserts and attachments, it is important that the masking completely seals the faying surface between the insert and parent metal to prevent ingress of the solution.

5.1.5 Refer to Flow Chart 1 for processing sequences and operations.

### 5.2 Preparation of Solutions

5.2.1 Prepare and operate anodizing solutions according to Table I. Prepare the chemical solutions as follows:

Step 1. Half fill the tank with de-ionized water.

Step 2. Add the required amount of chemicals.

Step 3. Fill the tank to operating level with de-ionized water.

5.2.2 Equip sealing and rinse tanks with inlet and outlet provisions to allow fresh de-ionized water to be added, as required, to maintain the baths within the limits specified in Table V.

**TABLE I - SOLUTION PREPARATION (Note 1)**

| BATH TYPE (NOTE 2) | SOLUTION MAKE-UP | | | | | OPERATING TEMPERATURE (°F) |
|---|---|---|---|---|---|---|
| | CHEMICALS | IMPERIAL UNITS | METRIC UNITS | U.S. UNITS | WATER | |
| Anodizing Bath | Chromic acid | 40 lbs/100 gal | 4.0 Kg/100 L | 33 lbs/100 gal | De-ionized | 90 to 100 |
| Hot De-ionized Water Sealing Bath | — | | | | De-ionized | 190 to 210 |
| De-ionized Water Rinse | — | | | | De-ionized | 95 maximum |

Note 1. It is acceptable for subcontractors to deviate from the specified make-up of solutions provided that the control requirements of Table V are met.
Note 2. The tank material shall be resistant to the chemicals and to the operating temperatures used (e.g., stainless steel or polyethylene lined).

### 5.3 Preparation of Parts

#### 5.3.1 Racking of Parts

5.3.1.1 Assemble parts on splines or wire them directly to the anode rack to:

- permit free circulation of the anodizing solution to all work surfaces
- permit good drainage
- prevent contact with the wall of the tank or adjacent parts
- prevent air entrapment
- minimize the number of contact points on the part

5.3.1.2 If the parts are too large to be clipped to the splines, wire them directly to the anode rack ensuring that:

- there are no contact points between adjacent parts
- the racking wires are used only once unless the oxide layer on the wire formed during anodizing is stripped before re-use
- the cross-sectional area of the suspending wire from the parts to the rack is kept uniform
- the wire is wound tightly around the parts to ensure good electrical contact

#### 5.3.2 Cleaning of Parts

5.3.2.1 Clean all parts, while racked, according to PPS 31.02 immediately before anodizing. Clean and anodize parts in an uninterrupted sequence.

### 5.4 Anodizing

5.4.1 All production parts shall be anodized at 22 ± 2 volts. However, for the following parts only, as a special check for soft spots, anodize first at 40 ± 2 volts and then, if the parts are found to be acceptable, re-anodize at 22 ± 2 volts.

- For tape proving of N/C machined 7000 series aluminum alloy first-off parts or whenever a change is made to the N/C tape.
- N/C machined 7000 series aluminum alloy production parts which have been exposed to excessive heating due to lack of coolant contacting the part surface caused by plugged spray nozzles, dull tool bits or too rapid of a tool plunge rate.

5.4.2 Anodize parts at 40 ± 2 volts as follows:

Step 1. Immerse the parts completely in the agitated anodizing bath.

Step 2. Apply the current within 2 minutes of immersion by starting at zero volts and increasing at 5 volts/minute (ramp-up rate) for 8 minutes until 40 ± 2 volts is reached.

Step 3. Anodize at 40 ± 2 volts for 35 - 37 minutes.

Step 4. Shut-off the current.

Step 5. Remove the parts from the bath within 2 minutes of the current being shut-off.

Step 6. Drain parts over the anodizing bath for approximately 1 minute.

Step 7. Rinse parts thoroughly in cold de-ionized water (maximum 95°F) for 2 to 15 minutes.

Step 8. Visually inspect parts according to section 6.3.5.

Step 9. Before the parts dry, re-anodize at 22 ± 2 volts.

5.4.3 Anodize parts at 22 ± 2 volts as follows:

Step 1. Immerse the parts completely in the agitated anodizing bath.

Step 2. Apply the current within 2 minutes of immersion by starting at zero volts and increasing at no more than 7 volts/minute (ramp-up rate) until 22 ± 2 volts is reached.

Step 3. Anodize at 22 ± 2 volts for 35 - 40 minutes.

Step 4. Shut-off the current.

Step 5. Remove the parts from the bath within 2 minutes of the current being shut-off.

Step 6. Drain parts over the anodizing bath for approximately 1 minute.

Step 7. Rinse parts thoroughly in cold de-ionized water (maximum 95°F) for 2 to 15 minutes. Rinse tanks containing tap water having 350 ppm maximum total dissolved solids and pH in the range of 5.5 to 8.0 may be used instead of de-ionized water.

Step 8. Visually inspect parts according to section 6.3.5.

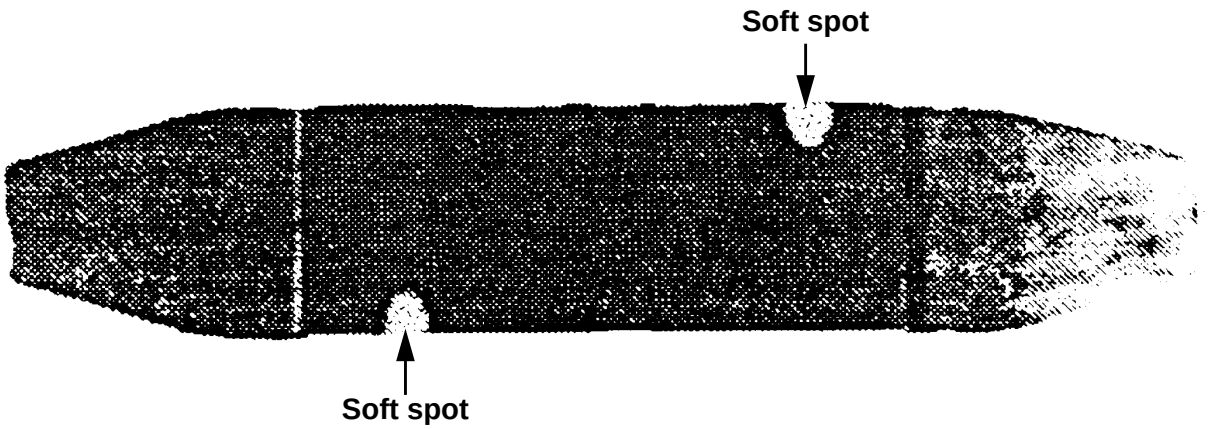



**FIGURE 1 - 7075-T6 ALUMINUM ATTACHMENT TEE WITH SOFT SPOT AREAS**

### 5.5 Post Anodizing Treatment

5.5.1 After anodizing, process parts as follows. Handle all dried anodized parts with clean cotton gloves.

Step 1. Rinse the parts thoroughly in cold de-ionized water (maximum 95°F) for 2 to 15 minutes. Rinse tanks containing tap water having 350 ppm maximum total dissolved solids and pH in the range of 5.5 to 8.0 may be used instead of de-ionized water.

Step 2. Seal the parts by immersing in a hot de-ionized water solution for 20 to 30 minutes.

Step 3. Air dry the parts at room temperature. If required, drying may be hastened by directing clean, dry, oil-free compressed air over the anodized parts. Dry fuel tank components and other parts difficult to drain by heating in an oven at a maximum temperature of 160°F.

Step 4. Remove Microstop masking lacquer from the dried parts unless needed for further processing operations.

Step 5. If the parts are to be transported or held for more than 24 hours, wrap in neutral Kraft paper and seal parts in polyethylene plastic bags. However, if the parts are to be primed within 24 hours, they do not require protective wrapping but shall be kept free from contamination and handled only while wearing clean cotton gloves.

### 5.6 Touch-Up of Anodic Coating

5.6.1 Repair isolated small areas where the anodic coating has been scratched (i.e., hairline surface scratches) by touching up with chemical conversion coating according to PPS 32.02.

5.6.2 Tubes which have had surface defects repaired according to PPS 27.09 shall be cleaned according to section 5.3.2 and re-anodize as follows:

Step 1. Wind aluminum wire twice around the circumference of the section of the tube where the anodic coating have been removed.

Step 2. Rack the tubes according to section 5.3.1.

Step 3. Re-anodize and re-seal the tubes according to section 5.4 and section 5.5, respectively.

## 6 REQUIREMENTS

### 6.1 General

6.1.1 All testing and evaluation specified herein shall only be performed by Bombardier Toronto Materials Laboratory or by laboratories accredited according to BAERD GEN-018.

### 6.2 Process Qualification

6.2.1 For process qualification, process test panels through the full anodizing cycle (including post anodizing treatment) and submit for testing as specified in Table II.

6.2.2 Process qualification test panels shall be submitted to a laboratory as specified in paragraph 4.3.3.2. Additional tests may be requested at any time at the discretion of Bombardier.

**TABLE II - PROCESS QUALIFICATION TESTING REQUIREMENTS**

| TEST | NUMBER OF PANELS | TEST SPECIMENS | PROCESS | TESTING PROCEDURE (NOTE 1) |
|---|---|---|---|---|
| Visual Inspection | All | As specified below | All | Visual (according to section 6.3.5) |
| Coating Weight | 3 | LAB 065-1 or 2024-T3 per QQ-A-250/4 (0.032" min) | Anodize - Not Sealed | DHLPM Procedure No. 3111 or ASTM B137 |
| Corrosion Resistance | 5 | LAB 064-1 or 2024-T3 per QQ-A-250/4 (0.032" min) | Anodize and Seal | DHLPM Procedure No. 6011 or ASTM B117 |
| Paint Adhesion | 2 | LAB 066-1 or 2024-T3 per QQ-A-250/5 (0.032" min) | Anodize, Seal and F19 Prime | According to section 6.3.8 |

Note 1. Refer to the appropriate sections for details regarding test requirements.

## 6.3 Production Parts

### 6.3.1 General

6.3.1.1 Every month during which there has been production of Bombardier Toronto parts, test panels shall be processed through the anodizing cycle and submitted to a laboratory as specified in paragraph 4.3.3.2 for coating weight determination, corrosion resistance testing and paint adhesion testing as specified herein.

- Once each quarter, subcontractors shall forward the results of monthly test panels to Bombardier Toronto.
- If monthly panels were tested by a Bombardier approved laboratory and not the Bombardier Toronto Materials Laboratory, every 6 months, subcontractors shall forward bi-annual results to Bombardier Toronto.
- At the discretion of Bombardier, it may be necessary that monthly test panels be likewise submitted for verification of test results.
- In order to maintain qualified status, all facilities processing parts for Bombardier Toronto according to this PPS shall maintain records of monthly testing. If these records cannot be produced, then the facility may be required to re-qualify.

6.3.1.2 If there has been no production of Bombardier Toronto parts for 1 to 6 months but there has been production on non-Bombardier Toronto parts, forward monthly test results for corrosion resistance and coating weight distribution testing performed according to MIL-A-8625 for the period during which when no Bombardier Toronto parts were being processed to Bombardier Toronto for review and approval before resuming processing of parts for Bombardier Toronto. If such test results are not available, process test panels for coating weight determination, corrosion resistance testing and paint adhesion testing as specified herein and forward the test results to Bombardier Toronto for review and approval before resuming processing of parts for Bombardier Toronto.

6.3.1.3 If the A1 chromic acid anodizing line has not been processing any parts for more than 1 month or if there has been no production of Bombardier Toronto parts for over 6 months, process test panels for coating weight determination, corrosion resistance testing and paint adhesion testing as specified herein and forward the test results to Bombardier Toronto for review and approval before resuming processing of parts for Bombardier Toronto.

### 6.3.2 Process Checks

6.3.2.1 Once per shift, check the following to verify that anodizing is being conducted according to this PPS. Take corrective actions, as necessary.

- operating voltage
- anodizing bath temperature
- details of the sealing procedure (e.g., sealing bath temperature and immersion time)

### 6.3.3 Testing Requirements

6.3.3.1 Refer to Table III for a summary of test panel requirements.

**TABLE III - SUMMARY OF TESTING REQUIREMENTS**

| TEST | TESTING FREQUENCY | NUMBER OF PANELS | TEST SPECIMENS | TESTING PROCEDURE (NOTE 1) |
|---|---|---|---|---|
| Visual Inspection | According to Table IV and paragraph 6.3.5.2 | According to Table IV | Production parts | Visual (according to section 6.3.5) |
| Coating Weight | Monthly (see section 6.3.4) | 3 | LAB-065-1 or 2024-T3 per QQ-A-250/4 (0.032" min) | DHLPM Procedure No. 3111 or ASTM B137 |
| Corrosion Resistance | Monthly (see section 6.3.4) | 5 | LAB 064-1 or 2024-T3 per QQ-250/4 (0.032" min) | DHLPM Procedure No. 6011 or ASTM B117 |
| Paint Adhesion | Monthly (see section 6.3.4) | 2 | LAB 066-1 or 2024-T3 per QQ-A-250/5 (0.032" min) | According to section 6.3.8 |

Note 1. Refer to the appropriate sections for details regarding test requirements.

6.3.3.2 For visual inspection according to section 6.3.5, select a sample from each production lot, including any parts that appear unusual in colour or evenness of colouration, by taking at random from the lot, not less than the number of items indicated in Table IV.

6.3.3.2.1 If the number of non-conforming items in any sample exceeds the acceptance number specified in Table IV, reject the represented lot, and disposition them according to section 6.3.9.

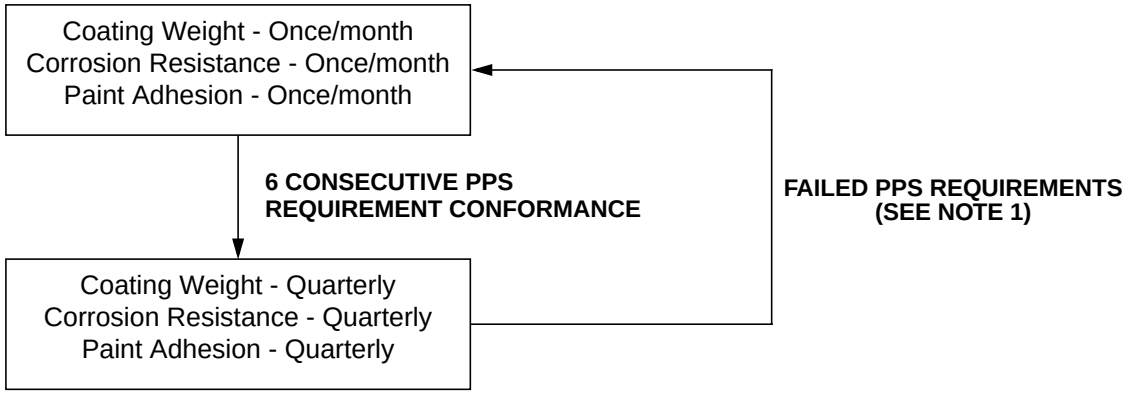
**TABLE IV - VISUAL AND PLATING THICKNESS SAMPLING SCHEDULE**

| NUMBER OF ITEMS IN INSPECTION LOT | NUMBER OF ITEMS IN SAMPLE (SELECTED AT RANDOM) | ACCEPTANCE NUMBER (NOTE 1) | REJECTION NUMBER |
|---|---|---|---|
| 1 to 5 | All | 0 | 1 |
| 6 to 25 | 5 | 0 | 1 |
| 26 to 50 | 8 | 0 | 1 |
| 51 to 90 | 13 | 0 | 1 |
| 91 to 150 | 20 | 1 | 2 |
| 151 to 280 | 32 | 1 | 2 |
| 281 to 500 | 50 | 2 | 3 |
| 501 to 1200 | 80 | 3 | 4 |

Note 1. Any defective items within the permitted number of defectives shall not be accepted with the lot but be rejected.

### 6.3.4 Testing Frequency

6.3.4.1 Process control requirements for coating weight, corrosion resistance and paint adhesion shall be tested on a periodic basis. The testing frequency shall be as follows:




Note 1. Refer to MRB for disposition of parts processed since the last successful testing.

6.3.4.2 In the event that processing panels fail to meet the requirements specified herein, production shall be suspended until corrective action is implemented and verified by re-testing. Parts fabricated during the loss of control time period shall be rejected and processed through MRB.

### 6.3.5 Visual Inspection

6.3.5.1 The anodic coating shall be continuous, smooth, uniform in appearance, adherent, and is free from powder areas, discontinuity, indications of burns, scratches or other defects.

6.3.5.2 Visually examine **all** N/C machined 7000 series aluminum alloy parts for evidence of soft spots as indicated by a colour contrast with the surrounding anodic coating (see Figure 1). Refer parts with soft spots to MRB for disposition.

### 6.3.6 Coating Weight

6.3.6.1 For coating weight determination, prepare and test 3 anodized LAB 065-1 test panels or 2024-T3 per QQ-A-250/4 test panels (0.032" thick minimum) according to DHLPM Procedure No. 3111 or ASTM B137. The optimum coating weight range is 200 - 450 mg/ft$^2$. If the coating weight of any of the panels is determined to be below 200 mg/ft$^2$, suspend the anodizing process until the cause of failure has been established and corrective action taken. If the coating weight of any of the panels is determined to be between 450 - 700 mg/ft$^2$, monitor the process and rectify the anomaly before coating weight exceeds 700 mg/ft$^2$. If the coating weight of any of the panels is greater than 700 mg/ft$^2$, determine the reasons for the increase and rectify the problem.

### 6.3.7 Corrosion Resistance

6.3.7.1 For corrosion resistance testing, expose 5 anodized LAB 064-1 or 2024-T3 per QQ-A-250/4 test panels (0.032" thick minimum) to a 5% salt spray according to ASTM B117 or DHLPM Procedure No. 6011, except the test surface shall be inclined 6° from the vertical. Expose the panels for 336 hours and examine them for corrosive attack. If there is evidence of corrosive attack in excess of the following limits suspend the anodizing process until the cause of the failure has been established and corrective action taken:

- There shall be no spots or pits larger than 0.031" in diameter and no more than 15 isolated spots or pits in total on the 150 in$^2$ of test area (do not count spots or pits less than 0.010" in diameter or within 0.25" of identification markings, holding points or panel edges).
- There shall be no more than 5 isolated spots or pits on any single panel (do not count spots or pits less than 0.010" in diameter or within 0.25" of identification markings, holding points or panel edges).

### 6.3.8 Paint Adhesion

6.3.8.1 Perform paint adhesion testing on 2 anodized LAB 066-1 or 2024-T3 per QQ-A-250/5 test panels (0.032" thick minimum) follows:

Step 1. Finish one side of each of the test panels with one coat of F19 Type 2 epoxy primer according to PPS 34.08.

Step 2. Subject all the test panels to a forward impact (coated side up) of 40 inch-pounds and reverse impact (coated side down) of 30 inch-pounds according to ASTM D2794. Adhesion is considered satisfactory if the primer does not crack, flake or peel. If one or more of the test panels shows evidence of cracking, flaking or peeling, suspend the anodizing process until the cause of failure has been established and corrective action taken.

### 6.3.9 Disposition

6.3.9.1 Any rejected lots shall be 100% inspected. Accept all parts that meet the above requirements. For anodized parts that fail to meet the requirements after initial processing, determine the cause of failure and correct before stripping according to PPS 31.02, re-processing and re-inspecting the parts as specified herein. If a coating fails to meet the requirements a second time after having already been stripped and re-processed once, refer the part to MRB for disposition.

## 6.4 Solutions Control

6.4.1 Take samples of the anodizing bath, de-ionized rinse water and sealing bath solutions for chemical analysis according to the analysis frequency specified in Table V. Ensure that the solutions are thoroughly mixed immediately before taking samples. Verify that the solutions meet the requirements specified in Table V.

6.4.2 Prepare and maintain records of all solution tests according to QDI-09-02. If additions are required, then indicate in the report the amount to be added. Re-test the solution within 24 hours of any adjustment.

6.4.3 Check the pH of all solutions weekly.

## TABLE V - CONTROL OF SOLUTIONS

| BATH TYPE | SOLUTION COMPONENT | CONCENTRATION | | | CONCENTRATION ANALYSIS FREQUENCY (Note 2) | | pH (Note 3) |
|---|---|---|---|---|---|---|---|
| | | IMPERIAL UNITS | METRIC UNITS | U. S. UNITS | STANDARD | EXTENDED | |
| Anodizing Bath | Free chromic acid | 4.8 - 8.4 oz/gal | 30.5 - 52.0 g/L | 4.0 - 7.0 oz/gal | Weekly | Weekly | 0.9 max. |
| | Total hexavalent chromium | 4.8 - 17.2 oz/gal | 30.5 - 107.5 g/L | 4.0 - 14.3 oz/gal | Monthly (Note 1) | Monthly (Note 1) | |
| | Chlorides (as NaCl) | 0.03 oz/gal maximum | 0.2 g/L maximum | 0.03 oz/gal maximum | Monthly | Every 3 months | |
| | Sulphates (as $SO_4$) | 0.08 oz/gal maximum | 0.5 g/L maximum | 0.07 oz/gal maximum | Monthly | Every 3 months | |
| Hot De-ionized Water Sealing Bath | De-ionized water | 12 ppm (20 µS/cm at 77 ± 10°F) maximum incoming total dissolved solids | | | Twice/Week | Twice/Week | 5.0 - 7.0 |
| | Total dissolved solids | 50 ppm (78 µS/cm at 77 ± 10°F) maximum accumulated total dissolved solids | | | | | |
| | Silicates ($SiO_2$) | 4 ppm maximum | | | Every 2 Weeks | Every 2 Weeks | |
| Rinse | De-ionized water | 350 ppm (550 µS/cm at 77 ± 10°F) maximum total dissolved solids | | | Weekly | Weekly | 3.0 - 8.0 |
| | Tap water | 350 ppm (550 µS/cm at 77 ± 10°F) maximum total dissolved solids | | | Weekly | Weekly | 5.5 - 8.0 |

Note 1. Analyze the anodizing bath total hexavalent chromium concentration monthly or when any addition to the anodizing bath is made, whichever is more frequent.
Note 2. If, over a 12 month period, it can be demonstrated (through SPC charts, etc.) that the concentration of the applicable solution component is well within the requirements specified, then the analysis frequency may be reduced from “standard” to “extended”. However, in the event that the solution component analysis fails the requirements specified, revert back to the “standard” analysis frequency until a controlled process can again be demonstrated.
Note 3. Check pH of all solutions weekly.

## *7 SAFETY PRECAUTIONS*

*7.1 Observe standard plant safety precautions when performing the procedure specified herein.*

*7.2 Wear neoprene or rubber protective gloves (see paragraph 4.2.9), aprons and boots and Bombardier approved chemical splash goggles while carrying out A1 CAA operations.*

*7.3 Provide sufficient ventilation when working with chemical baths in confined areas. Wear respiratory equipment according to PPS 13.13 when operating chemical baths.*

*7.4 Avoid skin contact with solutions. If salts or solutions come into contact with skin or clothing, wash the affected area immediately in running water. The salts and solutions are highly corrosive and will cause damage to clothing and burning of the skin.*

*7.5 Take the necessary steps to protect cuts or abrasions of the skin with a waterproof type bandage when engaged in the anodizing process.*

*7.6 Keep the tank sides, tops and walkways clean and free from spilled solutions.*

*7.7 Avoid eye contact with chemicals or solutions. If eye contact occurs, immediately flush eyes in a directed stream of water for at least 15 minutes while forcibly holding eyelids apart to ensure completed irrigation of all eye and lid tissue. Contact the Health Centre and a physician.*

*7.8 Thoroughly rinse rags, paper and refuse which come into contact with the acid solutions in water before being placed in disposal containers. Dried, unrinsed material may result in spontaneous combustion.*

## 8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a Controlled Critical Process according to PPS 13.39. Refer to PPS 13.39 for additional personnel requirements. Certified and/or qualified personnel shall have a good working knowledge of the following, as applicable:

- the function of A1 chromic acid anodizing.
- the importance of proper solution preparation and control.
- the requirements of surface cleaning, pre-treatment and the effects of improperly cleaned part surfaces on the performance of the coating.
- the method of obtaining A1 chromic acid anodic coating.
- the restrictions on various alloys with reference to this process.
- the theory behind the anodizing procedure.
- the importance of proper sealing of the anodic coating.
- material and part handling requirements.
- the sequence of operations in the process line.
- proper part racking procedures and crane operation.
- the function and operation of the process tanks.
- the importance and application of the hot water sealing bath.
- how to use all processing parameter controls to produce acceptable production parts.
- the relevant safety equipment and precautions.
- identification of soft spots as illustrated in Figure 1.
- requirements for coating appearance, coating weight, paint adhesion and corrosion resistance and how they are evaluated or measured.
- engineering drawing notations regarding A1 chromic acid anodizing.
- the procedure and requirements for preparation of aluminum surfaces for A1 chromic acid anodizing.
- how to process production parts.
- how to identify and process required test specimens.

## 9 DISPOSAL OF CHEMICAL WASTES

9.1 Dispose of all chemical wastes according to national legislation and local regulations. At Bombardier Toronto, dispose of chemical wastes according to EHS-OP-005.

## 10 MAINTENANCE OF EQUIPMENT

10.1 Tighten and replace all loose clips attached to the racks.

10.2 Keep the contact surfaces of the rack hook and anode rack clean and free from chromic acid stains.

10.3 Examine contact pads weekly and clean contact areas with aluminum wool or a brass wire brush.

10.4 Wipe electrical equipment weekly with a cloth to remove dust and grime.

10.5 Once every 6 months, the anodizing control unit (i.e., rectifier, voltage ramp, anodizing voltage and cycle time control units) shall be calibrated. The temperature monitoring unit shall be calibrated once a year.

## FLOW CHART 1 - OVERALL PROCEDURE FOR A1 CHROMIC ACID ANODIZING