BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 32.04

PRODUCTION PROCESS STANDARD

HARD ANODIZING (A2 AND A6)

Issue 12
- This standard supersedes PPS 32.04, Issue 11.
- Vertical lines in the left hand margin indicate 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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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for hard anodizing of aluminum and aluminum alloys.

1.1.1 The procedure and requirements specified herein are according to those specified in MIL-A-8625 Type III, Class I or MIL-A-63576 Type I anodic coatings.

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

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

1.1.4 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. do not supersede the procedure or requirements specified in this PPS. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

1.2 The hard anodic coating is identified by the protective treatment code A2 for MIL-A-8625 Type III, Class I and A6 for MIL-A-63576 Type I.

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 - Salt Spray (Fog) Testing.

3.2 BAERD GEN-018 - Engineering Requirements for Laboratories.

3.3 de Havilland Laboratory Procedures Manual (DHLPM) No. 6011.

3.4 Federal Test Method Standard No. 141.

3.5 Laboratory Drawing - LAB 064-1, LAB 067-1.

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

3.7 MIL-A-63576 - Aluminum Oxide Coatings, Lubricative, for Aluminum and Aluminum Alloys.

3.8 PPS 13.26 - General Subcontractor Provisions.

3.9 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

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

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

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

4.1.2 Neoprene gloves (e.g., DSC 422-5).

4.2 Equipment

4.2.1 All equipment and facilities employed in carrying out the processes specified herein shall be approved by Bombardier Quality as meeting the requirements of this standard.

4.3 Facilities

4.3.1 This PPS has been identified as a “Critical or Special” process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform hard 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 hard 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 As far as possible, complete all fabricating operations (i.e., machining, grinding, forming, etc.) and heat treatment before hard anodizing.

5.1.2 Refer to Flow Chart 1 for processing operations and sequence.

5.2 Preparation of Solutions

5.2.1 It is the responsibility of the subcontractor to ensure that the bath is maintained so that the finished parts meet the requirements of this standard.

5.3 Restrictions

5.3.1 Assemblies containing inserts shall not be hard anodized unless such inserts have been suitably masked off, both electrically and chemically, so as to prevent burning and corrosion in surrounding areas.

5.3.1.1 When masking off inserts as above, it is of the utmost importance that the masking completely seal the faying surface between the insert and the parent metal so as to prevent absorption of the solution.

5.4 Preparation of Parts

5.4.1 Clean all parts according to PPS 31.02. Do not handle cleaned parts with bare hands. Operators shall wear clean rubber or cotton gloves.

5.4.2 Mask areas not requiring hard anodizing, according to the engineering drawings, using a suitable maskant.

5.5 Racking of Parts

5.5.1 Assemble parts on racks or wired to an anode bar so as to prevent the parts from contacting one another and to permit the free circulation of the anodizing solution to all areas of the work.

5.5.2 Use only aluminum or aluminum alloy wire of sufficient current carrying capacity, if required, to suspend parts from the anode bar.

5.5.3 Wind wire tightly around the parts to ensure proper electrical contact.

5.5.4 If tubes or cylinders are to be coated on the inside, use internal cathodes.

5.6 Hard Anodizing Procedure

5.6.1 Production parts shall be hard anodized by the subcontractor to meet the requirements of this standard.

5.6.2 Unless otherwise specified, hard anodize to a thickness of 0.002" ± 0.0002". Of this thickness, 0.001" per surface is penetration into the base metal and 0.001" per surface is growth.

5.6.3 Hard anodizing shall be a continuous process (i.e., do not allow the part surfaces to dry).

5.6.4 After hard anodizing, thoroughly rinse all parts in clean cold water (60°F to 90°F).

5.6.5 For A2 anodic coating, warm air or oven dry all parts at a maximum temperature of 160°F.

5.6.6 For A6 hard anodized coating, impregnate polytetrafluoroethylene (PTFE) into the unsealed surface asperities of the anodic coating. The impregnated anodic coating shall be 0.002" ± 0.0002". After the anodic coating is impregnated, air dry the parts.

6 REQUIREMENTS

6.1 For visual inspection and non-destructive coating thickness tests, select a sample from each inspection lot by taking at random, from the lot, not less than the number of items specified in Table I.

TABLE I - SAMPLING SCHEDULE

NUMBER OF ITEMS IN INSPECTION LOT	NUMBER OF ITEMS IN SAMPLE (SELECTED AT RANDOM)	ACCEPTANCE NUMBER (NOTE 1)	REJECTION NUMBER
1 - 8	All	0	1
9 - 15	13	0	1
16 - 25	13	0	1
26 - 50	13	0	1
51 - 90	13	0	1
91 - 150	13	0	1
151 - 280	20	0	1
281 - 500	29	0	1
501 - 1200	34	0	1

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

6.2 Visual Appearance

6.2.1 The hard anodic coating shall be continuous, smooth, adherent, uniform in appearance and free from powdery areas, breaks, scratches or other damage. The number of contact points shall be at a minimum, consistent with good practice.

6.2.2 Those items of a sample lot which do not meet the above requirements shall be considered as being non-conforming and, when the number of such items exceeds the acceptance number for that sample (see Table I), the represented lot shall be rejected and actioned according to paragraph 6.7.1.

6.3 Coating Thickness

6.3.1 Unless otherwise specified, the hard anodic coating shall be 0.002" ± 0.0002" in thickness.

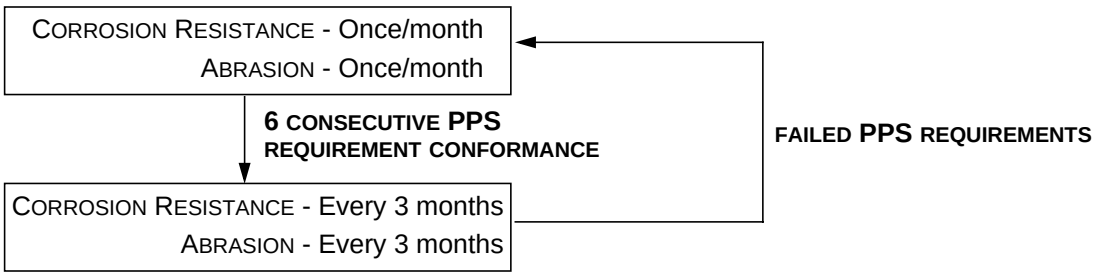
6.3.2 The coating thickness shall be calculated from measurements, taken before and after coating, at several locations where the coating thickness would be expected to be at a minimum. For A6 PTFE impregnated anodized coating, it is also required to check after impregnation.

6.3.3 Those items of a sample lot which do not meet the coating thickness requirements shall be considered as being non-conforming and, when the number of such items exceeds the acceptance number for that sample (see Table I), the represented lot shall be rejected and actioned according to paragraph 6.7.1.

6.4 Test Panels

6.4.1 Test Frequency

6.4.1.1 Process control requirements for corrosion resistance and abrasion shall be tested on a periodic basis. The testing frequency shall be as follows:



6.4.1.2 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.

6.5 Corrosion Resistance Testing

6.5.1 Corrosion resistance testing is only applicable for A6 PTFE impregnated anodized parts.

6.5.2 Expose 5 anodized LAB 064-1 test panels for corrosion resistance to a 5% salt spray according to DHLPM Procedure No. 6011 or ASTM B117, except the test surface shall be inclined 6° from the vertical. Expose the panels for 1000 hours and examine them for corrosive attack.

6.5.2.1 If there is evidence of corrosive attack in excess of the following specified limits, disposition according to paragraph 6.7.2:

- There shall be no more than 15 isolated spots or pits, none larger than 0.031" in diameter, in total on the 150 in^2 of test area. Do not count spots or pits less than 0.010" in diameter or within 0.062" 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 0.062" of identification markings, holding points or panel edges.

6.6 Abrasion Test

6.6.1 Three anodized LAB 067-1 test specimens (6061 alloy) shall be submitted to the Bombardier Toronto Materials Laboratory or a Bombardier approved laboratory for abrasion resistance testing according to Federal Test Method Standard No. 141 Method 6192.1.

6.6.1.1 The calculated weight loss after testing shall not exceed 15 milligrams.

6.6.1.2 Evidence of weight loss in excess of the above limits shall be cause for action according to paragraph 6.7.2.

6.7 Disposition

6.7.1 Lots failing to meet the requirements of section 6.2 or section 6.3 shall be 100% inspected and parts meeting the requirements shall be accepted.

6.7.2 If test samples fail to meet the requirements of section 6.5 or section 6.6, suspend the hard anodizing process until the cause of failure has been established, corrective action taken by the subcontractor and further test specimens submitted and tested according to section 6.5 or section 6.6.

7 SAFETY PRECAUTIONS

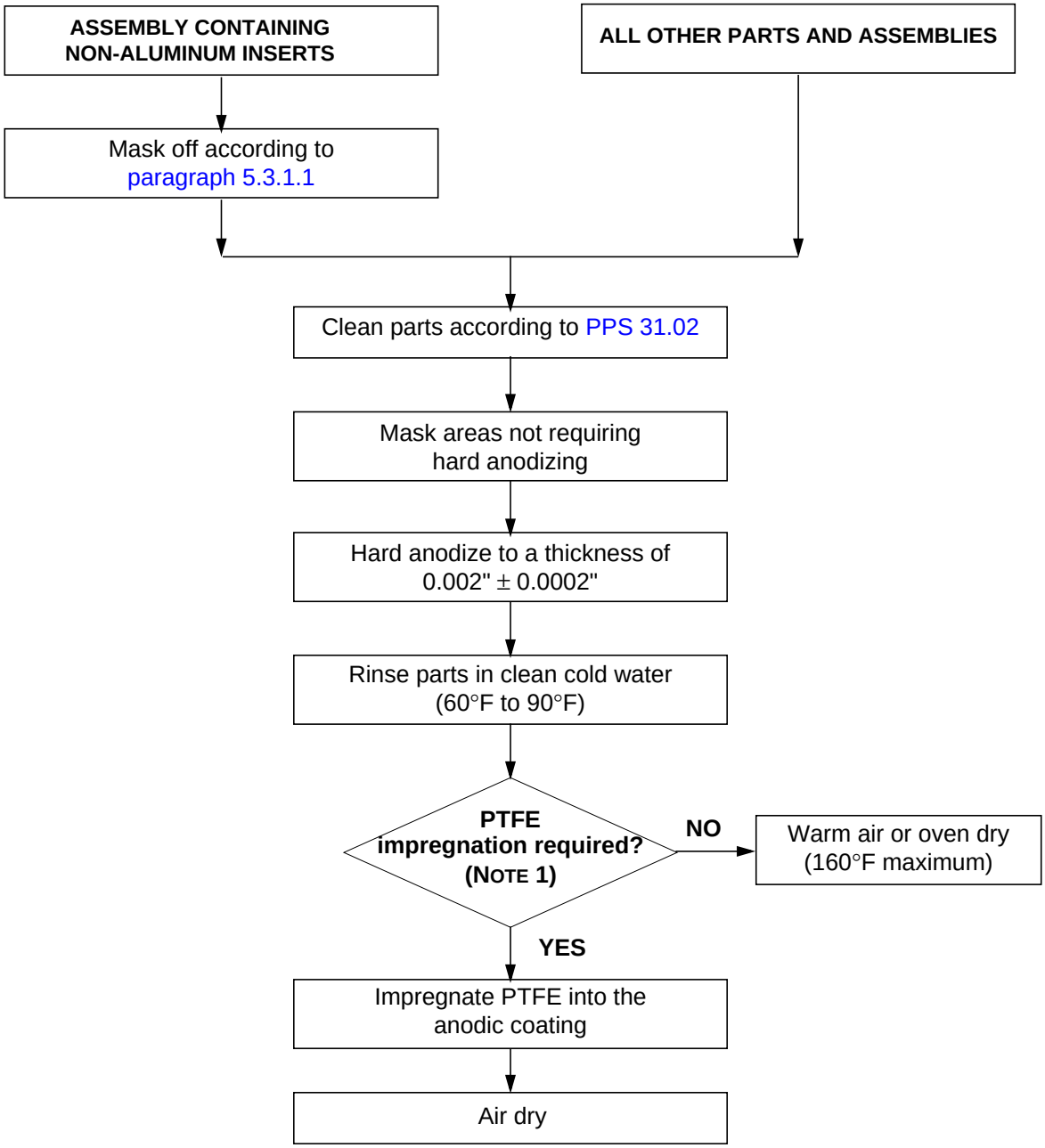
7.1 Safety precautions applicable to the materials and procedures specified herein shall be defined by the subcontractor performing such work for Bombardier Toronto.

8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a “Critical or Special” 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:

- understand the function of the hard anodic coating and/or PTFE impregnated hard anodic coating
- understand the importance of proper part surface preparation for anodizing
- know the importance of proper racking procedures to ensure electrical conductivity to all parts
- know how to apply proper electrical current to parts for anodizing
- know how to operate applicable force drying equipment
- know how official documents interact
- be familiar with engineering drawing notes and symbols
- know how to interpret instructions on work orders
- be familiar with how to identify and process test specimens
- know the frequency and procedure for submission of abrasion resistance test specimens
- know quality assurance requirements for visual inspection, coating thickness, corrosion resistance and abrasion resistance of hard anodic coatings.
- be familiar with the safety precautions for hard anodizing according to this standard

FLOW CHART 1 - HARD ANODIZING



Note 1. Protective treatment code, A2, does not require PTFE impregnation.