BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 32.01

PRODUCTION PROCESS STANDARD

CHEMICAL CONVERSION COATING OF ALUMINUM AND TITANIUM ALLOYS BY IMMERSION (C1)

Issue 31
- This standard supersedes PPS 32.01, Issue 30.
- 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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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for C1 chemical conversion coating of aluminum and titanium alloy surfaces by immersion.

1.1.1 As an alternative to the procedure and requirements specified herein for coloured chemical conversion coating of aluminum surfaces by immersion, it is acceptable to perform coloured chemical conversion coating of aluminum surfaces by immersion according to BAPS 160-020. Perform colourless chemical conversion coating of aluminum surfaces (i.e., on investment cast appearance items that will subsequently be coated with clear polyurethane) and colour or colourless chemical conversion coating of titanium alloy surfaces by immersion according to this PPS.

- Perform coloured chemical conversion coating of aluminum surfaces by immersion according to the procedure and requirements of either BAPS 160-020 or this PPS in their entirety; a piecemeal approach utilizing certain sections or portions of BAPS 160-020 and this PPS is **not** acceptable.
- Subcontractor facilities which have been approved by Bombardier to perform chemical conversion coating of aluminum surfaces by immersion according to BAPS 160-020 are considered approved to perform coloured chemical conversion coating of aluminum surfaces by immersion according to this PPS without further approval needed.
- PPS Process Standard Deviations (PSD's) issued against this PPS are **not** applicable to BAPS 160-020. Likewise, requests for deviation (RFD's) allowed against BAPS 160-020 are not applicable to this PPS.
- When processing parts according to BAPS 160-020 as an alternative to processing parts according to PPS 32.01, deviations allowed by an approved RFD against BAPS 160-020 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.

1.1.4 Chemical conversion coating of aluminum and titanium alloys as specified in this PPS is identified as protective treatment code C1. For C10 chemical conversion coating for low electrical resistance, process according to PPS 32.35.

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

3.3 ASTM D3359 - Standard Test Methods for Measuring Adhesion By Tape Test.

3.4 BAERD GEN-018 - Engineering Requirements for Laboratories.

3.5 BAPS 160-020 - Chemical Conversion Treatment for Aluminum Alloys.

3.6 Bombardier Toronto Laboratory Drawings - LAB 064 and LAB 066.

3.7 DHLPM Procedure No. 3055 - Tape Adhesion Test for Organic Coatings.

3.8 DHLPM Procedure No. 6011 - Description of Operation and Conditions Required for Salt Spray (Fog) Testing for Specification Purposes.

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

3.10 MIL-DTL-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys.

3.11 PPS 13.13 - Personal Protective Respiratory Equipment.

3.12 PPS 13.26 - General Subcontractor Provisions.

3.13 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.14 PPS 24.02 - Ion Vapour Deposited Aluminum Coatings (M2).

3.15 PPS 25.50 - Use of DSC 233 RTV Silicone Adhesive/Sealant.

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

3.17 PPS 31.04 - Degreasing Processes.

3.18 PPS 31.09 - Cleaning of Titanium and Titanium Alloys.

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

3.20 PPS 32.35 - Chemical Conversion Coating for Low Electrical Resistance (C10).

3.21 PPS 34.03 - Application of Polyurethane Enamel.

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

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

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Coloured Conversion Coating Solutions:

- Bonderite M-CR 1200 Aero, Henkel Technologies.
- Bonderite M-CR 600 Aero, Henkel Technologies.
- Bonderite M-CR 1200S Aero, Henkel Technologies.
- Bonderite M-CR 1600 Aero, Henkel Technologies.
- Bonderite M-CR T-5900 Aero, Henkel Technologies.
- Turcoat Alumigold (TC-Alumigold B), Henkel Technologies.
- Divercoat LR, Heatbath Corp.
- Iridite 14-2, MacDermid Inc.
- Chemeon TCP-HF, Chemeon Surface Technology.
- Chromicoat L25, Chemetall.
- SurTec 650 (ChromitAL), SurTec International.
- Turcoat Liquid Accelagold, Henkel Technologies.

4.1.2 Colourless Conversion Coating Solutions:

- Bonderite M-CR 1000 L Aero, Henkel Technologies.
- Bonderite M-CR 1500 Aero, Henkel Technologies.

4.1.3 Nitric Acid, 40° or 42° Bé, O-N-350.

4.1.4 Ammonium hydroxide, technical grade.

4.1.5 Potassium hydroxide, technical grade.

4.1.6 Sodium hydroxide, ASTM D456.

4.1.7 Sulphuric acid, 66° Bé.

4.1.8 Protective wrapping, neutral Kraft paper.

4.2 Equipment

4.2.1 Immersion tanks resistant to the chemicals and to the operating temperatures used (e.g., stainless steel or polyethylene lined mild steel).

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

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

4.3 Facilities

4.3.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39 and as such only facilities specifically approved according to PPS 13.39 are authorized to perform C1 chemical conversion coating of aluminum and titanium alloy surfaces by immersion 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 C1 chemical conversion coating of aluminum and titanium alloy surfaces by immersion 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 Refer to Flow Chart 1 for processing operations and sequence.

5.1.3 Except as specified below, C1 chemical conversion coating may be performed using any of the baths specified in Table I:

- Colourless chemical conversion coating (i.e., use of Bonderite M-CR 1000L Aero or Bonderite M-CR 1500 Aero) may be applied only to investment cast appearance items that will subsequently be coated with clear polyurethane according to PPS 34.03.
- **Do not** process titanium parts in Divercoat LR or the tri-valent chromium solutions (i.e., Bonderite M-CR T-5900 Aero, Chemeon TCP-HF and SurTec 650).

5.1.4 Except as noted, only process aluminum alloys, alloys with aluminum coatings, titanium or titanium alloys through these tanks. For assemblies which may entrap solution, apply C1 chemical conversion coating manually according to PPS 32.02. DSC 233-1 silicone adhesive may be applied to tubes according to PPS 25.50 before applying C1 chemical conversion coating according to this PPS.

5.1.5 Do not touch conversion coated surfaces with bare hands. Wear clean lint-free cotton gloves when handling such parts.

5.1.6 For parts to be transported for further processing or to be held for more than 24 hours, wrap the parts completely or interlace with Kraft paper to ensure that the conversion coated surfaces are not exposed to contamination. Coated parts that are to be primed within 24 hours do not require protective wrapping but shall be kept free from contamination and be handled only while wearing clean cotton gloves.

5.2 Preparation of Solutions

5.2.1 Make-up a new or top up C1 chemical conversion solutions using the following procedure:

Step 1. Half-fill the **remaining** operating volume of the tank with clean water. Check incoming water to ensure it does not contain more than 350 ppm (550 µS/cm at 77 ±10°F) of total dissolved solids (TDS). If the water TDS exceeds the specified limits, soften the water (i.e., reduce the amount of dissolved solids) or use de-ionized water. Each time a new bath is made up, or renewed, analyze the incoming water.

Step 2. Add the required amount of chemicals specified in Table I (e.g., if preparing a Bonderite M-CR 1200S Aero solution and the remaining operating volume of the tank was 1000 gallons **before** adding the remaining water, add 65 to 95 lbs of Bonderite M-CR 1200S Aero). Do not add dry powder to the bath, mix powders into a slurry with water before adding the slurry to the bath.

Step 3. Fill the tank to operating level with water and mix until the chemicals are thoroughly blended.

Step 4. Analyse a sample of the tank to ensure the concentration requirements of Table V are met. If necessary, add the required chemical to the bath. Mix thoroughly and re-test the solution after every addition.

5.2.2 Prepare water rinse tanks by filling the tank to operating level with cold water. Incoming water shall not contain more than 350 ppm (550 µS/cm at 77°F ±10°F) of TDS. If the water TDS exceeds the specified limits, soften the water (i.e., reduce the amount of dissolved solids) or use de-ionized water. Equip the tank with an inlet and an outlet to allow fresh tap water to be added to the tank, as required, to maintain the control limits according to Table V.

5.2.3 Prepare the warm de-ionized water rinse tank by filling the tank to the operating level with de-ionized water. Maintain the bath temperature between 110°F and 130°F. Equip the bath with an inlet and an outlet to allow fresh de-ionized water to be added to the bath, as required, to maintain the control limits according to Table V.

TABLE I - MAKE-UP OF SOLUTIONS

SOLUTION (NOTE 2)	CHEMICALS	BATH MAKE-UP (NOTE 1)			OPERATING TEMPERATURE
		IMPERIAL UNIT	METRIC UNIT	U.S. UNIT	
RINSE WATER					
Tap Water		Incoming water shall not exceed 350 ppm (550 µS/cm @ 77 ±10°F) TDS			70 - 90°F
Warm Tap Water					100 - 130°F
De-ionized Water		Incoming water shall not exceed 12 ppm (20 µS/cm @ 77 ±10°F) TDS			110 - 130°F
COLOURED CONVERSION COATINGS					
Bonderite M-CR 1200 Aero (Note 3)	Bonderite M-CR 1200 Aero	15.0 lbs/100 gal	1.5 Kg/100 L	12.5 lbs/100 gal	60 - 90°F
Bonderite M-CR 600 Aero (Note 4)	Bonderite M-CR 600 Aero	8.75 lbs/100 gal	0.875 Kg/100 L	7.27 lbs/100 gal	60 - 100°F
Bonderite M-CR 1200 Aero	Bonderite M-CR 1200 Aero	7.4 lbs per 100 gal	0.74 Kg per 100 L	6.2 lbs per 100 gal	60 - 100°F
Bonderite M-CR 1200S Aero	Bonderite M-CR 1200S Aero	8.0 lbs per 100 gal	0.80 Kg per 100 L	6.7 lbs per 100 gal	60 - 100°F
Bonderite M-CR 1600 Aero	Bonderite M-CR 1600 Aero	0.65 gal/100 gal	0.65 L/100 L	0.65 gal/100 gal	60 - 130°F
Bonderite M-CR T-5900 Aero	T-5900	5 gal/100 gal	5 L/100 L	5 gal/100 gal	75 - 110°F
	T-5900 Toner	1 gal/100 gal	1 L/100 L	1 gal/100 gal	
TC-Alumigold B	TC-Alumigold B	9.4 lbs/100 gal	0.94 Kg/100 L	7.8 lbs/100 gal	70 - 90°F
Divercoat LR	Divercoat LR	15.0 lbs/100 gal	1.5 Kg/100 L	12.5 lbs/100 gal	70 - 80°F
Iridite 14-2	Iridite 14-2	7.5 lbs/100 gal	0.75 Kg/100 L	6.25 lbs/100 gal	60 - 100°F
Chemeon TCP-HF	Chemeon TCP-HF	25 gal/100 gal	25 L/100 L	25 gal/100 gal	65 - 90°F
Chromicoat L25	Chromicoat L25	5 gal/100 gal	5 L/100 L	5 gal/100 gal	80 - 120°F
SurTec 650	SurTec 650	25 gal/100 gal	25 L/100 L	25 gal/100 gal	85 - 105°F
Turcoat Liquid Accelagold	Turcoat Liquid Accelagold	7.2 - 9.6 lbs per 100 gal	0.72 - 0.96 Kg per 100 L	6.0 - 8.0 lbs per 100 gal	77 - 86°F
COLOURLESS CONVERSION COATINGS					
Bonderite M-CR 1000L Aero	Bonderite M-CR 1000L Aero	10% by volume			140 - 160°F
Bonderite M-CR 1500 Aero	Bonderite M-CR 1500 Aero	1.60 fl oz./gal	10.0 mL/L	1.33 fl oz./gal	150 - 160°F

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 mild steel).
Note 3. Allow the solution to stand for at least 24 hours before use.

5.3 Preparation of Parts

5.3.1 Except for Type II ion vapour deposited (IVD) coated aluminum parts, clean aluminum parts according to PPS 31.02.

5.3.2 Prepare Type II IVD aluminum coated parts according to PPS 24.02 and conversion coat within 48 hours of having their surfaces prepared. If the delay between surface preparation and conversion coating exceeds 48 hours, degrease the parts according to PPS 31.04 and alkaline clean according to PPS 31.02 before conversion coating.

5.3.3 Mask any bare areas on Type II IVD aluminum coated parts to prevent acid exposure during conversion coating. If masking of these areas is not possible, conversion coat the parts manually according to PPS 32.02.

5.3.4 Mask dissimilar metal inserts before applying C1 chemical conversion solution.

5.3.5 Clean titanium and titanium alloys according to PPS 31.09 and transfer the parts to the C1 chemical conversion solution within 5 minutes of rinsing.

5.4 Application of C1 Chemical Conversion Coating

5.4.1 Control all solutions, inclusive of rinse tanks, according to Table V.

5.4.2 Apply C1 chemical conversion coating as follows:

Step 1. With the exceptions as specified below, for aluminum parts, immerse the cleaned parts in one of the baths specified in Table I until an iridescent light golden colour is obtained.

- Heat treated parts may require a longer treatment to experience a colour change.
- Titanium parts and colourless conversion coating do not exhibit a definitive colour change, immerse such parts in the bath for 15 to 20 minutes.
- Immersion time for Bonderite M-CR 1000L (colourless conversion coating) shall be for 2 to 5 minutes.
- Tri-valent chrome solutions (i.e., Bonderite M-CR T-5900 Aero, Chemeon TCP-HF and SurTec 650) do not exhibit a definitive colour change (i.e., treated parts will appear colourless to a faint blue). Therefore, if such solutions are utilized for coloured chemical conversion coating, immerse aluminum parts for 4 to 8 minutes.
- **Do not** use tri-valent chromium or Divercoat LR solutions for C1 treatment of titanium parts.

Step 2. Remove the parts from the bath and allow it to drain above the bath for 30 to 60 seconds.

Step 3. Thoroughly rinse the parts in the water rinse tank for approximately 60 seconds. Parts may be rinsed by either immersion or spray rinsing. If spray rinsing, incoming water shall meet the requirements specified in paragraph 5.2.2. Ensure complete removal of chemical conversion treatment solution. If it is intended that this be the final rinse (i.e., if omitting the warm de-ionized water rinse specified in Step 4, it is recommended that warm (100°F to 130°F) tap water be used to aid drying of parts).

Step 4. Remove the parts and rinse thoroughly in the warm de-ionized water rinse for approximately 60 seconds. This de-ionized water rinse may be omitted if the tap water rinse that preceded has completely removed all trace of the conversion treatment solution.

Step 5. Remove the parts from the final rinse tank and allow parts to dry.

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 as specified in Table II through the full C1 chemical conversion coating process and submit for visual inspection, corrosion resistance testing and paint adhesion testing as specified herein.

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 6.3.3)
Corrosion Resistance	5	LAB 064-1 or MIL-DTL-5541 (0.032" min)	C1	DHLPM Procedure No. 6011 or ASTM B117 (according to section 6.3.4)
Paint Adhesion (Exterior Skin Panels)	2	LAB 066-1 or MIL-DTL-5541 (0.032" min)	C1	According to paragraph 6.3.5.1
Paint Adhesion (All other Parts)	2		C1	According to paragraph 6.3.5.2

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

6.3 Production Parts

6.3.1 Test Requirements

6.3.1.1 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 section 6.3.3	According to Table IV	Production parts	Visual (according to section 6.3.3)
Corrosion Resistance	Monthly (see section 6.3.2)	5	LAB 064-1 or MIL-DTL-5541 (0.032" min)	DHLPM Procedure No. 6011 or ASTM B117 (according to section 6.3.4)
Paint Adhesion (Exterior Skin Panels)	Monthly (see section 6.3.2)	2	LAB 066-1 or MIL-DTL-5541 (0.032" min)	According to paragraph 6.3.5.1
Paint Adhesion (All other Parts)		2		According to paragraph 6.3.5.2
Note 1. Refer to the appropriate sections for details regarding test requirements.				

6.3.1.2 For visual inspection according to section 6.3.3, select a sample from each production lot, including any parts that appear unusual in appearance, by taking at random from the lot, not less than the number of items indicated in Table IV.

6.3.1.2.1 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 6.3.6.

TABLE IV - VISUAL 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.

6.3.2 Testing Frequency (Aluminum only)

6.3.2.1 If processing aluminum alloy or aluminum alloy coated parts, process test panels through the conversion coating cycle for corrosion resistance and paint adhesion testing as specified in paragraph 6.3.4.1, paragraph 6.3.5.1 and/or paragraph 6.3.5.2 at least once a month. Maintain records of all test results. At least once each quarter, subcontractors shall submit the test panels to a laboratory as specified in paragraph 4.3.3.2 for this testing.

6.3.3 Visual Inspection

6.3.3.1 Conversion coating on production parts shall be continuous and free from powder, imperfections and excessive blotches. In addition, coloured conversion coating shall be an iridescent, light golden colour; compare the colour of the parts to an approved sample panel which shall be prominently displayed in the operating area. If a coating fails to meet the requirements after processing, disposition parts according to section 6.3.6.

6.3.3.2 One or more of the following conditions may be cause for the conversion coating being too light:

- The time of immersion was too short.
- The chemical concentration in the bath is too low.
- The pH of the bath is not within the specified limits.

6.3.3.3 One or more of the following conditions may be the cause of abnormal amounts of powder being encountered:

- The parts were improperly cleaned.
- Deposits from the cleaning bath remained on the work.
- The chemical concentration in the bath is too high.
- The time of immersion was too long.
- The pH of the bath is not within the specified limits.

6.3.4 Corrosion Resistance

6.3.4.1 For corrosion resistance testing, expose 5 LAB 064-1 test panels or 5 test panels meeting the requirements of MIL-DTL-5541 (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 168 hours and examine them for corrosive attack. If there is evidence of corrosive attack in excess of the following limits suspend the chemical conversion coating 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).

6.3.5 Paint Adhesion

6.3.5.1 If processing exterior skin panels, subject two C1 coated LAB 066-1 test panels or test panels meeting the requirements of MIL-DTL-5541 (0.032" thick minimum) to impact paint adhesion testing as 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 and cure for 7 days at room temperature (60°F to 90°F).

Step 2. Subject all the test panels to a forward impact of 40 inch-pounds and reverse impact of 30 inch-pounds according to ASTM D2794. Adhesion is considered satisfactory if the primer does not crack, flake or peel.

6.3.5.2 If processing panels other than exterior skin panels, subject two C1 coated LAB 066-1 test panels or test panels meeting the requirements of MIL-DTL-5541 (0.032" thick minimum) to wet tape adhesion testing as 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 and cure for 7 days at room temperature (60 to 90°F).

Step 2. Immerse the test panels in de-ionized water for 24 hours.

Step 3. Wipe dry and within 5 minutes test for adhesion of the F19 primer according to DHLPM Procedure No. 3055 Method III, Class 3, or ASTM D3359 Method B. The coating shall have a minimum adhesion level of 3B.

6.3.5.3 If any of the test specimens fail to meet the corrosion resistance or paint adhesion requirements, suspend the conversion coating process, establish the cause of the failure and take corrective action before re-testing as specified herein. Refer any lots processed with unacceptable test panels to MRB for disposition.

6.3.6 Disposition

6.3.6.1 Any rejected lots shall be 100% inspected. Accept all parts that meet the above requirements. For chemical conversion coated 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 Once weekly, take samples of the conversion coating bath, warm de-ionized water rinse and tap water rinse for chemical analysis. 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 Except for tri-valent chromium solutions (i.e., Bonderite M-CR T-5900 Aero, Metalast TCP-HF and SurTec 650), when the conversion coating bath's effectiveness is reduced, keep 1/4 of the old solution and make up the remaining volume according to section 5.2. For tri-valent chromium solutions, when the bath's effectiveness is reduced, dispose of the solution completely according to EHS-OP-005, clean the tank thoroughly and a make a fresh bath according to section 5.2.

6.4.3 If the conversion coating bath becomes too contaminated, dispose of the coating solution according to EHS-OP-005, clean the tank thoroughly and a make a fresh bath according to section 5.2.

6.4.3.1 Prepare and maintain records of all solution tests (e.g., 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.

TABLE V - CONTROL OF SOLUTIONS

SOLUTION	CONTROL LIMITS				ANALYSIS FREQUENCY (NOTE 2)
	CONCENTRATION			PH (NOTE 1)	
	IMPERIAL UNIT	METRIC UNIT	U.S. UNIT		
Tap Water Rinse Tank	Conductivity @ 77 ±10°F - 2000 µS/cm maximum TDS			5.0 - 8.0	Standard: Weekly Extended: Weekly
Warm Tap Water Rinse Tank	Conductivity @ 77 ±10°F - 2000 µS/cm maximum TDS			5.0 - 8.0	
De-ionized Water Rinse	Conductivity @ 77 ±10°F - 600 µS/cm maximum TDS			5.0 - 8.0	
COLOURED CONVERSION COATINGS					
Bonderite M-CR 1200 Aero	1.2 - 3.6 wt. oz./gal	7.5 - 22.5 g/L	1.0 - 3.0 wt. oz./gal	1.5 - 2.1	Standard: Weekly Extended: Monthly
Bonderite M-CR 600 Aero	1.8 - 3.6 wt. oz./gal	11.2 - 22.4 g/L	1.5 - 3.0 wt. oz./gal	1.5 - 2.2	
Bonderite M-CR 1200 Aero	1.0 - 1.5 wt. oz./gal	6.2 - 9.4 g/L	0.8 - 1.3 wt. oz./gal	1.3 - 1.8	
Bonderite M-CR 1200S Aero	1.0 - 1.8 wt. oz./gal	6.2 - 11.0 g/L	0.8 - 1.5 wt. oz./gal	1.3 - 1.8	
Bonderite M-CR 1600 Aero	0.65 - 1.01 wt. oz./gal	4.0 - 6.3 g/L	0.54 - 0.84 wt. oz./gal	1.5 - 2.0	
Bonderite M-CR T-5900 Aero	8.0 - 10.0 fl oz./gal	50.0 - 60.0 mL/L	6.5 - 8.0 fl oz./gal	3.8 - 4.0	
TC-Alumigold B	1.2 - 1.8 wt. oz./gal	7.5 - 11.3 g/L	1.0 - 1.5 wt. oz./gal	1.6 - 1.9	
Divercoat LR	2.4 wt. oz./gal	16.0 g/L	2.0 wt. oz./gal	1.3 - 1.5	
Iridite 14-2	1.0 - 2.4 wt. oz./gal	6.2 - 15.0 g/L	0.8 - 2.0 wt. oz./gal	1.1 - 1.9	
Chemeon TCP-HF	25 to 30% by volume			3.6 - 4.0	
Chromicoat L25	4.8 - 8.0 fl oz./gal	31 - 50 mL/L	4.0 - 6.6 fl oz./gal	1.6 - 1.8	
SurTec 650	32 - 48 fl oz./gal	200 - 300 mL/L	27 - 40 fl oz./gal	3.7 - 4.0	
Turcoat Liquid Accelagold	0.6 - 2.4 wt. oz./gal	3.7 - 15 g/L	0.5 - 2.0 wt. oz./gal	1.5 - 1.9	
COLOURLESS CONVERSION COATINGS					
Bonderite M-CR 1000L Aero	10 to 15% by volume			below 4.0	Standard: Weekly Extended: Monthly
Bonderite M-CR 1500 Aero	1.38 - 2.34 fl oz./gal	8.6 - 14.6 mL/L	1.15 - 1.95 fl oz./gal	below 4.0	

Note 1. With the exception of tri-valent chrome solutions (i.e., Bonderite M-CR T-5900 Aero, Metalast TCP-HF and SurTec 650), nitric acid (see paragraph 4.1.3) may be added to the bath, as required, to lower the pH levels to the range specified. For tri-valent chrome solutions: to lower the pH, add 5% sulfuric acid (see paragraph 4.1.7); to increase the pH, add 1% potassium hydroxide (see paragraph 4.1.5), 1% sodium hydroxide (see paragraph 4.1.6) or 1% ammonium hydroxide (see paragraph 4.1.4).

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.

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 4.2.2), aprons and boots and Bombardier approved chemical splash goggles while carrying out C1 chemical conversion coating operations.

7.3 Ensure adequate ventilation is supplied to the areas where the C1 chemical conversion coating process is being carried out. Avoid breathing the fumes or vapours from the C1 chemical conversion coating bath.

7.4 Operators shall wear protective respiratory equipment according to PPS 13.13 when operating chemical baths.

7.5 Avoid skin contact with solutions. If skin contact occurs, wash the affected area immediately with large quantities of water. If irritation of the skin occurs, contact the Health Centre immediately.

7.6 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.

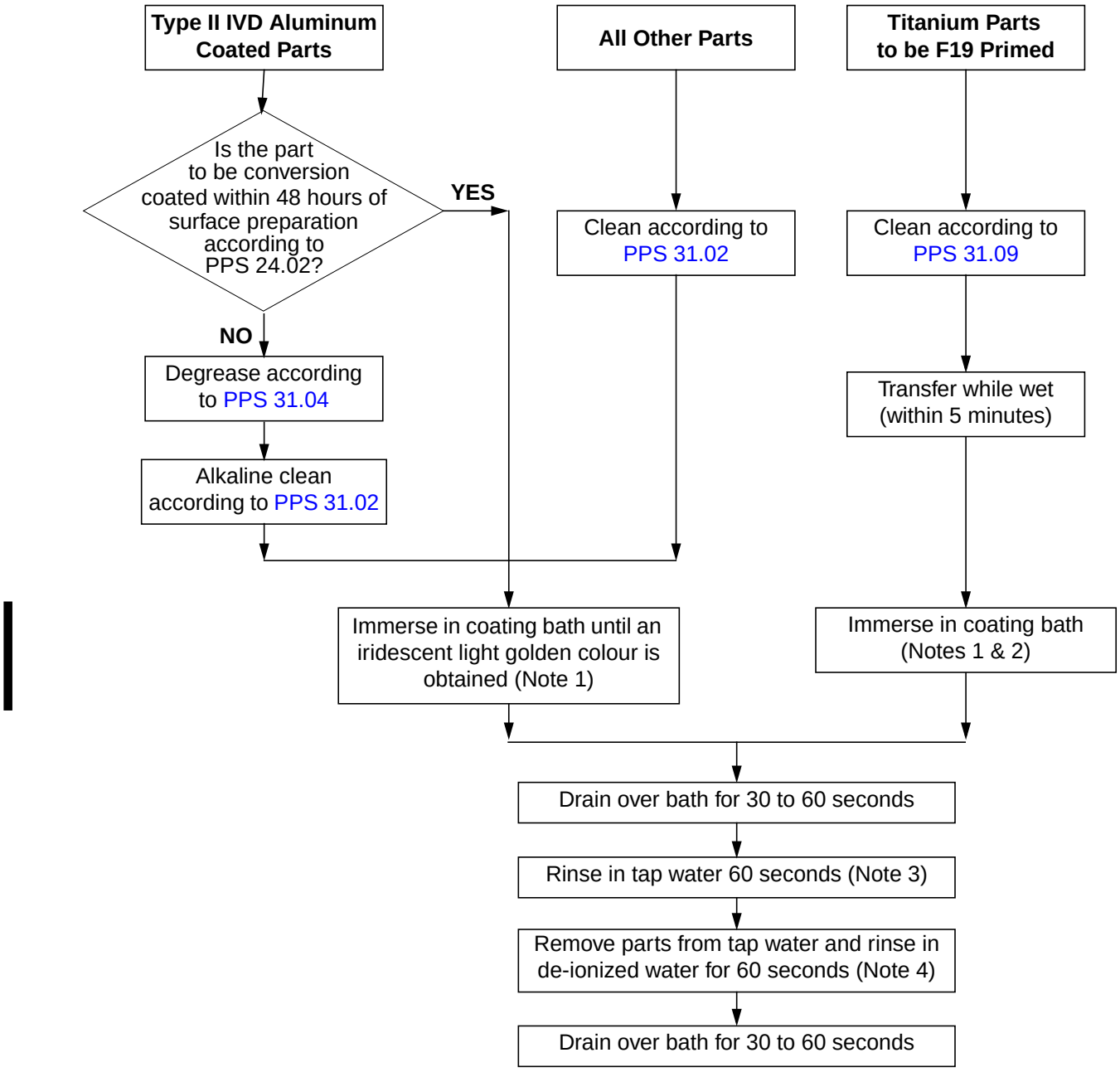
7.7 Avoid ingestion of chemicals or solutions. If ingestion occurs, do not induce vomiting. Drink large amounts of water or milk of magnesia, but never give anything by mouth to an unconscious person. Immediately contact the Health Centre and a physician.

8 PERSONNEL REQUIREMENTS

8.1 This PPS has been categorized as a Controlled 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:

- function of C1 chemical conversion coating
- importance of proper solution preparation and control
- requirements of surface cleaning, pre-treatment, and the effects of improperly cleaned part surfaces on the performance of the C1 chemical conversion coating
- methods of applying C1 chemical conversion coatings
- restrictions on various alloys with reference to this process
- theory behind the coating application procedure
- material and part handling requirements
- operation of the complete process line and the function of the individual process tanks
- proper part racking procedures and crane operation
- operation of the individual process tanks involved in this process
- how to use all processing parameter controls to produce acceptable production parts
- relevant safety equipment and precautions
- engineering drawing notations regarding immersion application of C1 chemical conversion coatings
- procedure and requirements for the preparation of aluminum surfaces for immersion application of C1 chemical conversion coatings
- how to process production parts
- how to identify and process required test specimens
- requirements for immersion application of C1 chemical conversion coating appearance, paint adhesion properties, and corrosion resistance and how they are evaluated or measured
- how to identify processed test specimens
- requirements specified in this PPS and the references

FLOW CHART 1 - C1 CHEMICAL CONVERSION COATING BY IMMERSION



Note 1. Immerse for the time specified in paragraph 5.4.1.
Note 2. Do not use tri-valent chromium or Divercoat LR solutions for C1 treatment of titanium parts.
Note 3. Parts may be rinsed by either immersion or spray rinsing. When spray rinsing, take care to ensure complete removal of conversion treatment solution.
Note 4. De-ionized water rinse is optional provided that the tap water rinse completely removed all trace of the conversion treatment solution.