BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 32.02

PRODUCTION PROCESS STANDARD

MANUAL APPLICATION OF C1 CHEMICAL CONVERSION COATINGS

Issue 24
- This standard supersedes PPS 32.02, Issue 23.
- 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 the manual application of C1 chemical conversion coating to aluminum or aluminum coated and titanium parts.

1.1.1 As an alternative to the procedure and requirements specified herein, it is acceptable to perform manual application of chemical conversion coating to aluminum or aluminum coated parts according to BAPS 160-020. Perform manual application of chemical conversion coating to titanium parts according to this PPS.

- Perform manual application of chemical conversion coating to aluminum or aluminum coated parts 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 manual application of chemical conversion coating to aluminum or aluminum coated parts according to BAPS 160-020 are considered approved to perform manual application of chemical conversion coating to aluminum or aluminum coated parts 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 32.02, 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 or aluminum coated and titanium alloys as specified in this PPS is identified as protective treatment code C1. If the engineering drawing or PPS specifies chemical conversion coating for low electrical resistance or electrical bonding (identified as protective treatment code C10), perform chemical conversion coating 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 BAERD GEN-018 - Engineering Requirements for Laboratories.

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

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

3.4 PPS 13.13 - Personal Protective Respiratory Equipment.

3.5 PPS 13.26 - General Subcontractor Provisions.

3.6 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

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

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

3.9 PPS 31.04 - Degreasing Processes.

3.10 PPS 31.09 - Cleaning of Titanium and Titanium Alloys.

3.11 PPS 31.17 - Solvent Usage.

3.12 PPS 32.01 - C1 Chemical Conversion Coating of Aluminum and Titanium Alloys by Immersion.

4 MATERIALS. EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Bonderite M-CR 600 Aero, Henkel Technologies.

4.1.2 Bonderite M-CR 1200 Aero, Henkel Technologies.

4.1.3 Bonderite M-CR 1200S Aero, Henkel Technologies.

4.1.4 Bonderite M-CR 1201 Aero, Henkel Technologies.

4.1.5 Bonderite M-CR 1132 Aero, Henkel Technologies.

4.1.6 Bonderite M-CR T-5900 RTU Aero, Henkel Technologies.

4.1.7 SurTec 650 (ChromitAL) RTU, SurTec International.

4.1.8 Turcoat Liquid Accelagold, Henkel Technologies.

4.2 Equipment

4.2.1 Abrasive pads (e.g., Scotch-Brite pads, Medium, Fine or Very Fine, 3M Canada Ltd.).

4.2.2 Abrasive paper, aluminum oxide, 180 - 240 grit or finer (e.g., 3M TRI-M-ITE).

4.2.3 Acid resistant mixing containers of stainless steel, plastic, rubbers or wood. Do not use lead, glass or galvanized iron.

4.2.4 Bombardier approved chemical splash goggles.

4.2.5 Clean lint-free cotton wipers (e.g., DSC 378-2).

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

4.2.7 Foam tip applicator, 1 or 2 fl. oz. plastic bottle with foam tip (18 mm, Dab-O-Matic #W/D-119-82) and polypropylene cap (Dab-O-Matic #18/400).

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

4.2.9 Polyethylene squeeze bottles or plunger-type containers which have been properly labelled with the solution name and expiry date.

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

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 manual application of C1 chemical conversion coating to aluminum or aluminum coated and titanium parts according to this PPS.

4.3.2 Bombardier subcontractors shall direct requests for approval to Bombardier Aerospace Supplier Quality Management. Bombardier 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 manual application of C1 chemical conversion coating to aluminum or aluminum coated and titanium parts according to this PPS completion of a test program and submission of suitable test samples representative of production parts may be required. Test samples shall meet the requirements specified Bombardier Toronto Engineering.

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 Manually apply C1 chemical conversion coating solution **only** if application of the solution by immersion according to PPS 32.01 is not permitted due to the part's size or the assemblies' potential for solution entrapment.

5.1.2 Except as specified in paragraph 5.1.2.1 and paragraph 5.1.2.2, touch-up small surfaces (i.e., spotfacing, countersinks, repair areas, etc.) with conversion coating chemicals according to section 5.4.

5.1.2.1 Use Bonderite M-CR 1132 Aero markers for touch-up of chemical conversion coating on aluminum or aluminum coated parts only. Due to difficulties associated with puddling of the Bonderite M-CR 1132 Aero markers when applied to small areas, the markers are not recommended on small surfaces less than half a square inch.

5.1.2.2 **Do not** apply tri-valent chromium solutions on titanium surfaces (i.e., Bonderite M-CR T-5900 RTU Aero and SurTec 650 RTU).

5.1.3 Except as specified in paragraph 5.1.3.1, manually apply the coating to larger areas according to section 5.5.

5.1.3.1 Bonderite M-CR 1132 Aero markers shall not be used on large surface applications.

5.1.4 If the assemblies contain materials other than aluminum or titanium, take extreme care when processing these assemblies because the C1 chemical conversion coating solution may cause corrosion.

5.1.5 Ensure part surface temperature is between 60° and 100°F when applying chemical conversion coating solution.

5.1.6 Wear clean protective gloves when handling cleaned parts for chemical conversion coating.

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

5.1.8 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) and the pH shall be from 5.0 to 8.0. If the water TDS exceeds the specified limits, soften the water (i.e., reduce the amount of dissolved solids) or use de-ionized water.

5.2 Preparation and Maintenance of Solutions

5.2.1 Mix only sufficient solution for the job on hand or which will be used up within the specified working life of the solution (e.g., Bonderite M-CR 1200 Aero has a working life of 7 days in a closed container). Discard solution upon expiration of the working life according to section 10.

5.2.2 Except as specified in paragraph 5.2.2.1 and paragraph 5.2.2.2, prepare C1 chemical conversion coating solution as follows:

Step 1. Fill an acid resistant mixing container with clean (see paragraph 5.1.8) lukewarm water.

Step 2. Carefully add the chemical composition as specified in Table I.

Step 3. Thoroughly mix the solution until the chemicals are thoroughly blended. Disregard the small amount of insoluble material which may settle out of solution.

5.2.2.1 Bonderite M-CR 1201 Aero does not require pre-mixing before application as it should be purchased pre-mixed.

5.2.2.2 Use Bonderite M-CR 1132 Aero markers as supplied.

5.2.2.3 Tri-valent chromium solutions (i.e., Bonderite M-CR T-5900 RTU Aero and SurTec 650 RTU) should be purchased in the ready to use (RTU) form.

TABLE I - CONTROL OF SOLUTIONS

SOLUTION (See Note 1)	CONTROL LIMITS				DWELL TIME
	CHEMICAL CONCENTRATION			pH	
	IMPERIAL UNITS	METRIC UNITS	U.S. UNITS		
Bonderite M-CR 600 Aero	3.2 to 4.0 wt oz/gal	20 to 25 g/L	2.7 to 3.3 wt oz/gal	1.5 to 2.2	1 to 5 minutes (See Note 2)
Bonderite M-CR 1200 Aero (Notes 3 and 4)	3.6 wt oz/gal	22.5 g/L	3.0 wt oz/gal	1.5 to 2.1	
Bonderite M-CR 1200S Aero (Notes 5 and 6)	1.3 to 3.7 wt oz/gal	8.0 to 23.0 g/L	1.0 to 3.0 wt oz/gal	1.3 to 1.8	
Turcoat Liquid Accelagold	1.3 to 3.7 wt oz/gal	8.0 to 23.0 g/L	1.0 to 3.0 wt oz/gal	1.5 to 1.9	
Bonderite M-CR 1201 Aero	Use as supplied				
Bonderite M-CR 1132 Aero (Pens)	Use as supplied				See Note 7
Bonderite M-CR T-5900 Aero RTU	Use as supplied				5 to 7 minutes
SurTec 650 RTU	Use as supplied				2 to 4 minutes

Note 1. Maintain solutions at 60 to 90°F.
Note 2. The colour of the coating will range from light iridescent gold to tan depending on the aluminum alloy, temperature, solution concentration and duration of the application. If this colour is not achieved in 5 minutes, it is acceptable to allow the solution to remain on the parts for another three more minutes maximum.
Note 3. Allow the solution to stand for at least one hour before use.
Note 4. The mixed solution has a working life of 7 days in a closed container.
Note 5. 1 mL/L of ARP #2 or Activol #1357 may be added to the solution.
Note 6. Nitric acid may be added to the solution to maintain pH (approximately 4 mL/L 38° Bé or equivalent amount of other concentration).
Note 7. The time shall be that required to dry each coat (approximately 5 minutes).

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. Ensure that surfaces are water break-free.

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 followed by alkaline cleaning according to PPS 31.02 before applying the conversion coating.

5.3.3 Clean titanium and titanium alloy parts or assemblies according to PPS 31.09 and chemical conversion coat within 5 minutes of rinsing.

5.3.4 Except for paragraph 5.3.4.1, mechanically clean small surfaces to be touched-up according to section 5.4 by lightly abrading the small surfaces with a water moistened abrasive pad or abrasive paper. Keep the amount of metal removed during mechanical cleaning to a minimum. Use a tack rag to remove any dust or adhering particles followed by solvent wiping according to PPS 31.17.

5.3.4.1 Do not hand abrade with abrasive pad or abrasive paper for Type II IVD aluminum coated surfaces but rather solvent wipe according to PPS 31.17 before the touch-up conversion coating process.

5.3.4.2 Process parts in a continuous sequence.

5.4 Touch-Up of C1 Chemical Conversion Coating

5.4.1 Except as specified in paragraph 5.4.2, touch-up parts with small surface areas with C1 chemical conversion coating solution as follows:

Step 1. Prepare parts according to section 5.3.

Step 2. Check to ensure surface is water break-free (see Figure 1). Wipe surface with a clean lint-free cotton cloth to ensure complete removal of dislodged oxides.

Step 3. Check to ensure that the surface to be coated is dry.

Step 4. Apply C1 chemical conversion coating solution to the prepared surface using a pencil brush, small abrasive pad or foam tip applicator to fully cover the applicable area. Prevent excess solution from dripping onto the surrounding structure.

Step 5. Allow the solution to remain on the part surface for the dwell time specified in Table I before washing off. Do not allow the solution to dry on the surface. Maintain a continuous wet surface. If drying does occur, re-wet the surface with solution before water rinsing.

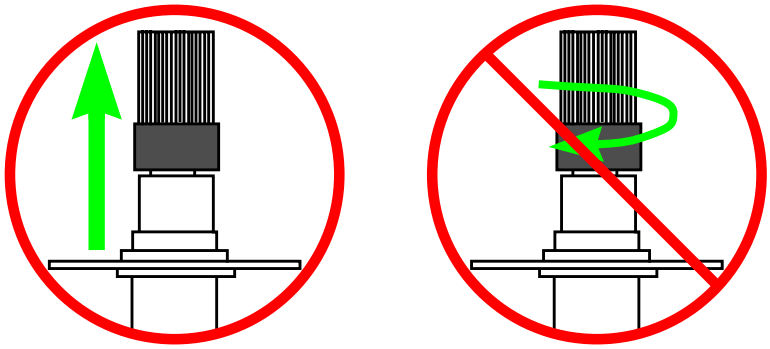
Step 6. Remove all traces of solution by rinsing with clean water (see paragraph 5.1.8) or wiping with water-damp cloths followed by wiping dry with a clean lint-free cloth or blowing dry with clean compressed air (see paragraph 4.2.6).

5.4.2 If using a Bonderite M-CR 1132 Aero marker, touch-up parts with small surface areas as follows. Due to difficulties associated with puddling of the Bonderite M-CR 1132 Aero marker coating when applied to small areas, the marker is not recommended on small surfaces less than half a square inch. For such surfaces, touch-up according to paragraph 5.4.1.

Step 1. Prepare parts according to section 5.3.

Step 2. Check to ensure surface is water break-free (see Figure 1). Wipe surface with a clean lint-free cotton cloth to ensure complete removal of dislodged oxides.

Step 3. Remove protective cap. Do not twist.



Step 4. If necessary, the applicator tip can be cut to conform to any shape with a single edge razor blade.

Step 5. Hold unit with applicator tip down.

Step 6. To activate, press tip against a firm, clean test surface. This will open the valve allowing the conversion coating solution to reach the applicator tip. A new unit should charge in 30 to 45 seconds. When the solution wets the tip, release pressure. Unit is ready to use.

Step 7. Check to ensure that the surface to be coated is dry.

Step 8. Remove excess solution from the applicator tip by wiping excess off onto a solvent cleaned metal test piece or a clean lint-free cloth. The applicator tip should not be dripping or wet. The applicator tip should be damp to avoid pooling of solution or excessive amount of coating applied. Application should result in an even light coating.

Step 9. Apply Bonderite M-CR 1132 Aero marker to the prepared surface with firm, smooth, even strokes. Be sure to cover edges. For best results, the initial coating should be applied in one direction using a 10 to 25% overlap on each pass. After allowing the first coat to dry for approximately 5 minutes, apply a second coat at right angles to the first coat with a 10 to 25% overlap. Do not allow the solution to puddle (puddling may result in improper drying leading to paint adhesion failures, flaking, etc.). If puddling does occur, lightly wick solution off the surface with a clean lint-free cotton cloth to remove excess solution, but do not touch the treated surface. Do not wipe surface to remove excess solution. Do not use “Q-Tips” to remove excess solution as residue chloride may react with the chemical conversion coating solution. To recharge the applicator tip, repeat Step 6 and Step 8. Replace cap when not in use.

Step 10. Allow the C1 chemical conversion coating to air dry, force dry with warm air (e.g., hair dryer) or dry using a heat lamp (130°F maximum). ***Do not rinse***.

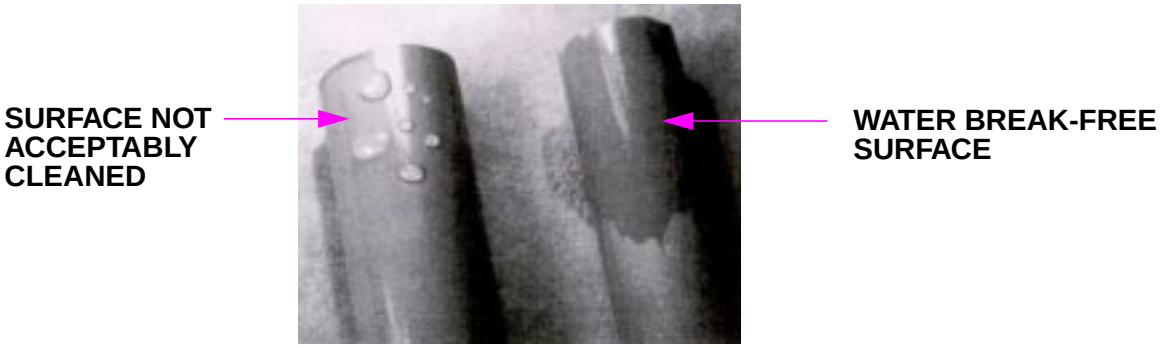


FIGURE 1 - WATER BREAK-FREE SURFACE

5.5 Application of C1 Chemical Conversion Coating (see Flow Chart 1)

5.5.1 Apply C1 chemical conversion coating solution to larger surface area of cleaned parts as follows:

Step 1. Prepare parts according to section 5.3.

Step 2. Check to ensure surface is water break-free (see Figure 1). Wipe surface with a clean lint-free cotton cloth to ensure complete removal of dislodged oxides.

Step 3. For aluminum parts, apply conversion coating solution to the surface from storage bottles using a clean cloth, brush or sponge. For titanium parts, scrub the cleaned surface in a circular motion, treating only small areas at a time using a clean abrasive pad soaked in the conversion coating solution. Maintain a continuous wet surface. Prevent excess solution from dripping onto the surrounding structure.

Step 4. Allow the solution to remain on the part surface for the dwell time specified in Table I before washing off. Do not allow the solution to dry on the surface. If drying does occur, re-wet the surface with solution before water rinsing.

Step 5. Gently wipe all surfaces with a clean cloth soaked in the conversion coating solution just before rinsing.

Step 6. Rinse parts thoroughly with clean water (see paragraph 5.1.8). Chemical salts trapped under a paint film will eventually result in blistering or corrosion problems.

Step 7. Wipe all part surfaces dry using a clean lint-free cloth. Use clean compressed air (see paragraph 4.2.6) to blow dry treated surfaces such as lap joints, seams, pockets, etc.

Step 8. Carefully inspect all treated surfaces and if necessary, re-apply the solution to bare or starved areas according to steps 1 through 5 in order to get the desired coating thickness. The coating colour ranges from light gold to tan depending on the metal type, temperature, solution concentration and number of applications. Ensure that the coating is not powdery.

Step 9. For aluminum parts, prime parts as soon as possible after drying. For titanium parts, dry the parts for a minimum of 8 hours before priming.

6 REQUIREMENTS

6.1 The treated surfaces shall be free from bare or starved areas.

6.2 The coating shall be continuous and free from powder, imperfections and excessive blotches which may result in poor paint adhesion.

6.3 The coating shall be light gold to tan in colour.

7 SAFETY PRECAUTIONS

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

7.2 Wear protective rubber or neoprene gloves (see paragraph 4.2.10), 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 during application.

7.4 Take care to prevent the powder from being distributed into the air. Air borne powder is a serious health hazard. Wear protective respiratory equipment according to PPS 13.13 when handling conversion coating chemicals.

7.5 Avoid skin contact with C1 chemical conversion coating. 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.

7.8 Refer to PPS 31.17 for the safety precautions for handling and using solvents.

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 specified in paragraph 8.1.1 and paragraph 8.1.2), as applicable.

8.1.1 Upon completion of this training, the operators and supervisors will be familiar with and have a good working knowledge of the following, as applicable:

- the function of C1 chemical conversion coating
- the theory behind the coating application procedure
- engineering drawing notations regarding manual application of C1 chemical conversion coatings
- material and part handling requirements
- how to process production parts
- procedure and requirements for the preparation of surfaces for manual application of C1 chemical conversion coatings
- methods of applying C1 chemical conversion coatings
- requirements of surface cleaning, pre-treatment and the effects of improperly cleaned part surfaces on the performance of the coating
- restrictions on various alloys with reference to this process
- importance of proper solution preparation and control
- engineering requirements for coating appearance, paint adhesion and resistance to corrosion and how these properties are evaluated or measured

8.1.2 Upon completion of this training, the inspectors will be familiar with and have a good working knowledge of the following, as applicable:

- engineering requirements for both immersion and manual application of C1 chemical conversion coating appearance, paint adhesion properties and corrosion resistance and how these properties are evaluated and measured
- engineering drawing notations regarding both immersion and manual application of C1 chemical conversion coatings
- procedure and requirements for the preparation of aluminum surfaces for both immersion and manual application of C1 chemical conversion coatings
- how to process production parts
- materials and part handling requirements
- how to identify processed test specimens
- relevant safety precautions

9 STORAGE

9.1 Store Bonderite M-CR 1200S Aero in a cool dry area away from organic compounds or easily oxidizable materials. Bonderite M-CR 1200S Aero is an acidic oxidizing agent and is not affected by freezing.

9.2 Store Bonderite M-CR 1201 Aero at above 32°F to avoid freezing. However, if the chemical did freeze, thaw it in a warm place and stir before application.

9.3 Store Bonderite M-CR 600 Aero and Bonderite M-CR 1200 Aero in a cool dry area and away from incompatible materials. Keep container closed when not in use.

9.4 Store Bonderite M-CR 1132 Aero markers away from incompatible materials. Bonderite M-CR 1132 Aero contains chromate. Protect from freezing. Do not tamper with packaging and do not try to refill used markers. Unopened markers has a shelf life of 24 months.

9.5 Always use the oldest stock first (i.e., first in/first out (FIFO) basis).

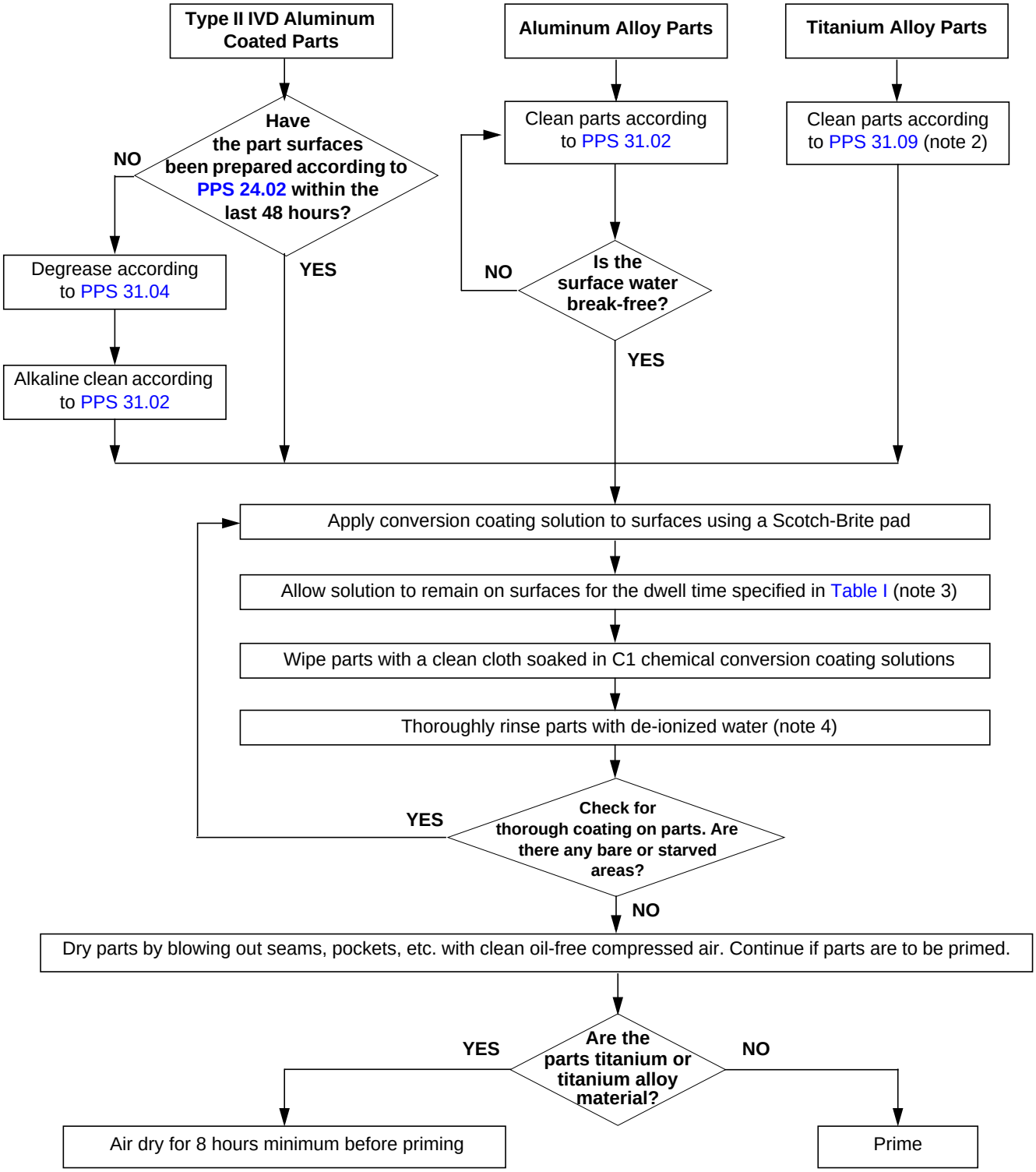
10 DISPOSAL OF SOLUTIONS

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

10.2 At Bombardier Toronto, dispose of chemical contaminated work clothes, rags, etc., into Red Containers labelled “Waste Rags”.

10.3 Dispose of used Bonderite M-CR 1132 Aero markers by re-packaging used markers and mail back to supplier for disposal (mailing label is supplied in original packaging).

FLOW CHART 1 - MANUAL APPLICATION OF C1 CHEMICAL CONVERSION COATING (NOTE 1)



Note 1. This flow chart applies to chemical conversion coating larger surface areas. For smaller areas (e.g., touch-ups, spotfacing, countersinks, etc.), apply according to section 5.4.
Note 2. C1 chemical conversion coat within 5 minutes surface cleaning.
Note 3. Do not allow the solution to dry on the surface.
Note 4. It is acceptable to rinse with water not exceeding a conductivity limit of 600 μmhos and pH of 5.0 to 8.0.