BOMBARDIER

Toronto Site

PROPRIETARY INFORMATION

PPS 31.06

PRODUCTION PROCESS STANDARD

CLEANING OF COPPER AND COPPER ALLOYS

Issue 18
- This standard supersedes PPS 31.06, Issue 17.
- 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.

Signed original on file. Validation of paper prints is the responsibility of the user.

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Issue 18 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them; refer to the applicable sections of this PPS for detailed procedure and requirements.

- Added new Facilities Requirements section (i.e., this PPS has been categorized as a Controlled Special Process according to PPS 13.39).
- Specified that all testing and evaluation specified in PPS 31.06 must only be performed by Bombardier Toronto Materials Laboratory or by laboratories accredited according to BAERD GEN-018.
- Replaced alkaline cleaner, Turco 53, with Oakite 164.
- Revised Personnel Requirements section to refer to PPS 13.39 for additional requirements.

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the methods of removing flux, oil, grease, soil, oxides, scale and tarnish from unplated copper and copper alloy parts. After fabrication operations and assembly of fittings, clean copper oxygen lines according to PPS 6.10.

1.1.1 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.

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

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. do not supersede the procedure or requirements specified in 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 BAERD GEN-018 - Engineering Requirements for Laboratories.

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

3.3 PPS 6.10 - Cleaning of Fluid System Components.

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 31.02 - Cleaning Processes for Aluminum and Aluminum Alloys.

3.8 PPS 31.03 - Cleaning of Carbon and Low Alloy Steels.

3.9 PPS 31.04 - Degreasing Processes.

3.10 PPS 31.17 - Solvent Usage.

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials

4.1.1 Copper cleaning solutions as specified in Table I.

4.1.2 Solvents as specified in PPS 31.17.

4.1.3 Hard bristle brush.

4.2 Equipment

4.2.1 Bombardier Toronto approved safety chemical splash goggles.

4.2.2 Bombardier Toronto approved rubber gloves, boots and aprons.

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

4.2.4 Immersion tanks resistant to the chemicals and to the operating temperatures used (e.g., earthenware, hard rubber or polypropylene for the Bright-Dip bath) as well as suitable crates, racks, baskets and hooks of acid resistant material for immersion of parts.

4.2.5 Protective wrapping (e.g., Kraft paper).

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 the methods for removing flux, oil, grease, soil, oxides, scale and tarnish from unplated copper and copper alloy parts according to this PPS.

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

4.3.3 Facility approval must be based on a facility report, a facility survey and completion of a qualification test program, if required. The facility report must 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 must 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 must 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 the methods for removing flux, oil, grease, soil, oxides, scale and tarnish from unplated copper and copper alloy 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 must meet the requirements specified by Bombardier Toronto Engineering.

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

5 PROCEDURE

5.1 Preparation of Solutions

5.1.1 Prepare chemical solutions as follows:

Step 1. Fill the tank half full with water.

Step 2. Add the required amount of chemicals according to Table I slowly while gently stirring.

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

TABLE I - MAKE-UP OF SOLUTIONS

BATH TYPE	BATH MAKE-UP					OPERATING TEMPERATURE
	CHEMICALS	IMPERIAL UNIT	METRIC UNIT	U.S. UNIT	WATER	
ALKALINE CLEANING SOLUTIONS						
Oakite 164	According to PPS 31.02					
ACID CLEANING SOLUTIONS						
Chloroclean 6156	According to PPS 31.03					
Enplate AD-485	Enplate AD-485	14.4 wt oz/gal	90 g/L	12 wt oz/gal	De-ionized	70°F - 90°F
	Sulphuric acid 66° Bé	1 to 2% by volume				
Bright-Dip	Chromic acid A-A-55827	75 lbs/100 gal	7.5 Kg/100 L	62.5 lbs/100 gal	Tap	61°F - 90°F
	Sulphuric acid 66° Bé	10.5 fl oz/100 gal	65 mL/100 L	8.7 fl oz/100 gal		
HOT WATER FOR FLUX REMOVAL						
Hot-Water	—				Tap	140°F - 212°F

Note 1. It is acceptable to deviate from the specified make-up of solutions provided that the control requirements of Table II are met.
Note 2. Tap water shall not exceed a total solid requirement of 500 ppm.

5.2 Cleaning

5.2.1 Except when an approved dispositioned Report of Non-Conformance (RNC) specifies in-situ cleaning, clean unplated copper and copper alloy parts according to Flow Chart 1 and as follows:

Step 1. For parts contaminated with residual flux, remove flux by immersing the parts in clean hot water (140°F - 212°F) for a minimum of ten minutes. Remove clinging flux particles by scrubbing with a hard bristle brush. After removing flux, remove the parts from the water tank, drain, and allow to dry.

Step 2. Degrease all parts according to PPS 31.04.

Step 3. Immerse parts in the alkaline solution for 10 to 15 minutes.

Step 4. Remove parts from the alkaline cleaning solution and rinse in cold water.

Step 5. Allow water to drain off parts for 1 minute.

Step 6. Immerse parts in Chloroclean 6156 or Enplate AD-485, as applicable. For parts with heavy scale, immerse for 10 to 15 minutes. For parts which do not have heavy scale, immerse in Chloroclean 6156 for 20 to 30 seconds or Enplate AD-485 for 1 to 2 minutes.

Step 7. Rinse parts thoroughly in cold running water.

Step 8. Allow water to drain for 1 minute.

Step 9. If parts were immersed in Chloroclean 6156 in Step 6, immerse parts in a Bright-Dip or Enplate AD-485 bath for 2 to 3 seconds. If parts were immersed in Enplate AD-485 in Step 6 immersion in a Bright-Dip or Enplate AD-485 bath is not necessary.

Step 10. For parts immersed in a Bright-Dip or Enplate AD-485 bath, rinse parts thoroughly in cold running water.

Step 11. If desirable to expedite drying, immerse parts in hot water for approximately 30 seconds.

Step 12. Allow parts to dry.

5.2.2 If an approved dispositioned Report of Non-Conformance (RNC) specifies in-situ cleaning according to this PPS, clean the parts as follows. Take extreme care at all times to prevent ingress and/or seepage of cleaning solutions/rinse water, and to prevent contact with sealant and/or materials sensitive to cleaning solutions/rinse water.

Step 1. Suitably protect the surrounding structure (e.g., mask) around the area to be cleaned to prevent contamination with cleaning materials (e.g., solvent, alkaline cleaners, acid cleaning solutions, etc.).

Step 2. Solvent clean the area to be cleaned according to PPS 31.17.

Step 3. Locally apply Oakite 164 to the area to be cleaned using a brush or swab. Allow the Oakite 164 to dwell for 10 - 15 minutes, applying additional alkaline cleaner as needed to prevent drying during the dwell time. Take care to prevent contamination (e.g., splashing) of the surrounding structure.

Step 4. Locally rinse the area to be cleaned using a brush, or swab, and cold water. Take care to ensure thorough rinsing to remove all trace of the alkaline cleaner without adversely affecting the surrounding structure.

Step 5. Locally apply acid cleaning solution (i.e., Chloroclean 6156 or Enplate AD-485, as applicable) to the area to be cleaned using a brush or swab. Allow the acid cleaning solution to dwell for the time specified in the below table. During the dwell time, apply additional acid cleaning solution as needed to prevent drying during the dwell time. Take care to prevent contamination (e.g., splashing) of the surrounding structure with acid cleaning solution.

SOLUTION	SITUATION	DWELL TIME
Chloroclean 6156	General	20 to 30 seconds
	Heavy Scale	10 to 15 minutes
Enplate AD-485	General	1 to 2 minutes
	Heavy Scale	10 to 15 minutes

Step 6. Locally rinse the area to be cleaned using a brush, or swab, and water. Take care to ensure thorough rinsing to remove all trace of acid cleaning solution without adversely affecting the surrounding structure. If Enplate AD-485 was used as an acid cleaning solution and it is desirable to expedite drying, use warm water for rinsing.

Step 7. If Chloroclean 6156 was used as an acid cleaning solution in Step 5, locally apply Bright-Dip or Enplate AD-485 bath using a brush or swab and allow to dwell for 2 - 3 seconds. If Enplate AD-485 was used as an acid cleaner in Step 5, application of Bright-Dip or Enplate AD-485 at this step is not necessary. Take care to prevent contamination (e.g., splashing) of the surrounding structure with Bright Dip or Enplate AD-485.

Step 8. If Bright-Dip or Enplate AD-485 was applied to the area to be cleaned, locally rinse the area to be cleaned using a brush, or swab, and water. Take care to ensure thorough rinsing to remove all trace of Bright-Dip or Enplate AD-485 without adversely affecting the surrounding structure. If desirable to expedite drying, use warm water for rinsing.

Step 9. Remove materials used to protect the surrounding structure.

Step 10. Allow the area to dry.

5.3 Handling of Cleaned Parts

5.3.1 Always wear clean gloves when handling cleaned parts.

5.3.2 Ensure that the delay between cleaning and further processing is kept to a minimum. Wrap or interlace parts with Kraft paper to protect them from contamination.

6 REQUIREMENTS

6.1 General

6.1.1 After cleaning, part surfaces shall be clean and shall exhibit a uniform surface appearance.

6.1.2 Evidence of scale, oxide or residual cleaning chemicals is not acceptable. Re-clean such parts according to section 5.2.

6.1.3 Evidence of pitting, etching or surface erosion resulting from cleaning solutions is not acceptable. Refer such parts to Bombardier Toronto MRB or Bombardier Toronto delegated MRB for disposition.

6.2 Maintenance of Solutions

6.2.1 Maintain bath temperatures during part processing operations as specified in Table I.

6.2.2 Maintain cleaning solution concentration according to Table II. Maintain records of the solution tests; if additions are required, then indicate the amount to be added. Re-analyze the solution within 24 hours of any adjustment.

6.2.3 Remove scale build up in the tanks every 3 months or more frequently if necessary.

6.2.4 Dispose of scale and un-correctable contaminated cleaning solution according to EHS-OP-005.

7 SAFETY PRECAUTIONS

7.1 The safety precautions specified herein are specific to Bombardier Toronto to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is strongly recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

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

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

7.4 Wear rubber gloves, boots and aprons when carrying out all cleaning operations. Operators with any broken skin or open wounds on the hands shall not work with the cleaning baths specified herein.

7.5 Take special attention when working with Chloroclean 6156, Bright-Dip or Enplate AD-485 solutions to prevent contact with the bare skin. If this occurs, wash the affected area of the skin with copious quantities of clean water. If irritation of the skin occurs, contact the Health Center immediately.

7.6 Wash hands thoroughly after working with the cleaning baths specified herein.

7.7 Do not keep, handle or eat food in the vicinity of cleaning baths. Do not use cleaning baths, including hot water baths, for heating or cooling food or drinks.

7.8 Do not keep clothes in the vicinity of chemical baths.

7.9 Wear safety glasses when working with the materials specified herein. 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.

7.10 Ensure that sufficient ventilation is provided when using the chemical solutions specified herein. Consult the Health and Safety Department for the threshold limit values.

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

8 PERSONNEL REQUIREMENTS

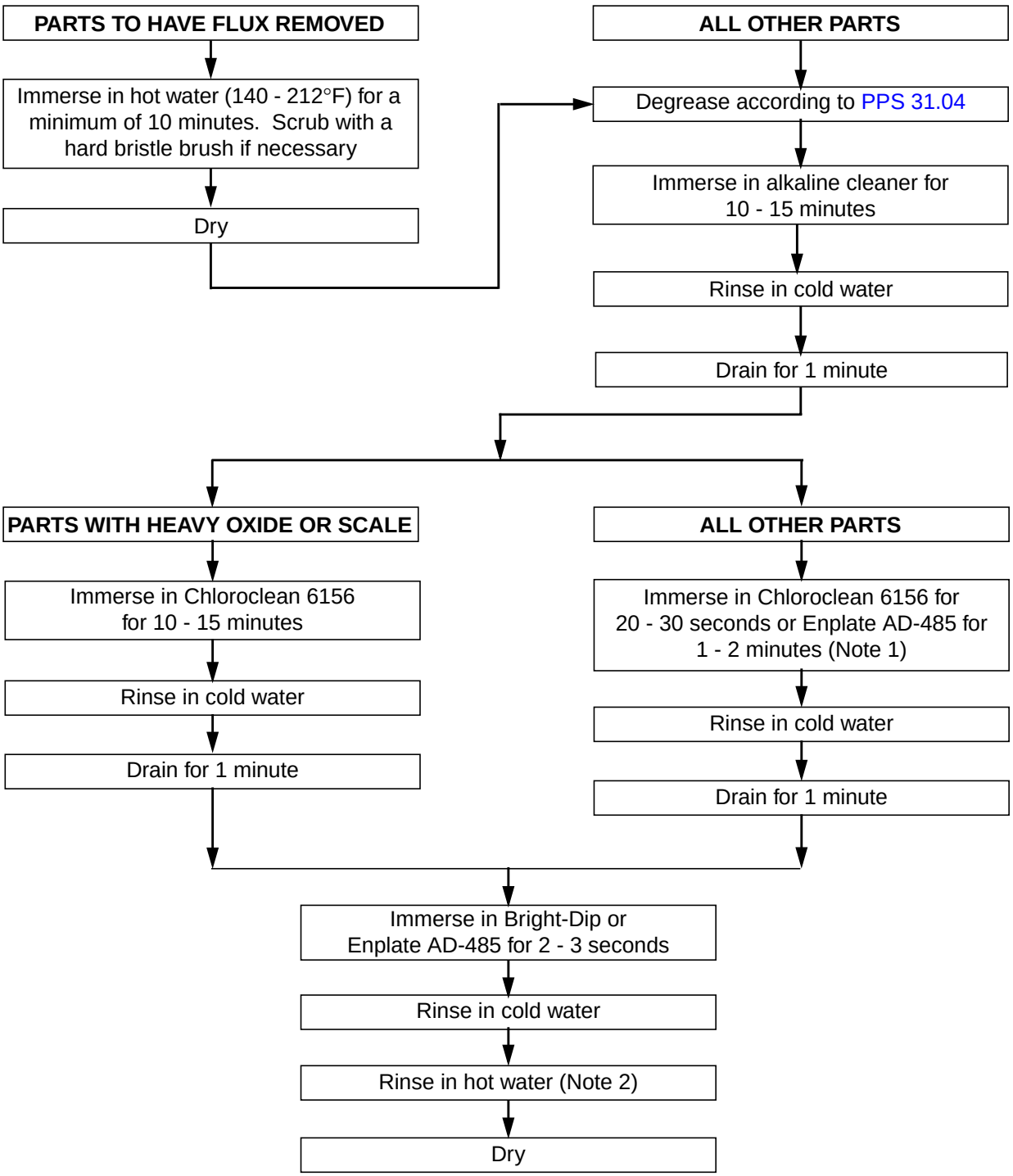
8.1 This PPS has been categorized as a Controlled Special Process according to PPS 13.39. Refer to PPS 13.39 for personnel requirements.

TABLE II - CONTROL OF SOLUTIONS

SOLUTION	SOLUTION COMPONENT	CONCENTRATION			ANALYSIS FREQUENCY (NOTE 1)	
		IMPERIAL UNIT	METRIC UNIT	U.S. UNIT	STANDARD	EXTENDED
ALKALINE CLEANING SOLUTION						
Oakite 164	Oakite 164	According to PPS 31.02			Weekly	Monthly
ACID CLEANING SOLUTIONS						
Chloroclean 6156	Chloroclean 6156	According to PPS 31.03			Monthly	Quarterly bath analysis
Enplate AD-485	Enplate AD-485	9.6 - 19.2 wt oz/gal	60 - 120 g/L	8 - 16 wt oz/gal		
	Sulphuric acid	1 - 2% by volume				
Bright Dip	Chromic acid A-A-55827	10.9 - 13.0 wt oz/gal	68 - 81 g/L	9.1 - 10.8 wt oz/gal		
	Sulphuric acid 66° Bé	0.16 - 0.40 wt oz/gal	1.0 - 2.5 g/L	0.13 - 0.33 wt oz/gal		
HOT WATER FOR FLUX REMOVAL						
Hot Water	Tap water	—			n/a	n/a

Note 1. 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.

FLOW CHART 1 - CLEANING COPPER AND COPPER ALLOYS



Note 1. If parts are immersed in Enplate AD-485, proceed with rinsing and omit immersion in the Bright Dip bath and dry.

Note 2. Hot water rinsing is optional. This rinse step helps expedite drying.