BOMBARDIER
Toronto Site
PROPRIETARY INFORMATION

PPS 33.07

PRODUCTION PROCESS STANDARD

SATIN FINISH DECORATIVE CHROMIUM PLATING (E5 & E6)

Issue 8
- This standard supersedes PPS 33.07, Issue 7.
- 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.

Prepared By:	(Christie Chung)	March 23, 2016
	PPS Group	
Approved By:	(*K. Quon*, for Bruce Campbell)	March 25, 2016
	Materials Technology	
	(Stephen Pitt)	March 27, 2016
	Quality	

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the application of dull and bright satin finish decorative chromium plating on steel parts.

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. 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 Dull and bright satin finish decorative chromium plating are identified by Protective Treatment Code E5 and E6, respectively.

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 PPS 13.26 - General Subcontractor Provisions.

3.2 PPS 13.39 - Bombardier Toronto Engineering Process Manual.

3.3 PPS 27.06 - Decorative Surface Finishing.

3.4 PPS 30.04 - Steel Heat Treatment - Carbon and Low Alloy Steels.

3.5 PPS 30.06 - Heat Treatment of Precipitation Hardenable (PH) Stainless Steels.

3.6 PPS 30.08 - Heat Treatment of Martensitic Stainless Steels.

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

3.8 PPS 33.02 - Removal of Metallic Coatings.

3.9 PPS 33.03 - Electro-Deposited Nickel Plating (E3).

3.10 PPS 33.05 - Copper Plating (E7).

4 MATERIALS, EQUIPMENT AND FACILITIES

4.1 Materials and Equipment

4.1.1 All materials and equipment employed in carrying out the processes specified herein shall be approved by Bombardier Aerospace as meeting the requirements of this standard.

4.2 Facilities

4.2.1 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 application of dull and bright satin finish decorative chromium plating on steel parts according to this PPS.

4.2.2 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.

4.2.3 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.

4.2.3.1 For approval of subcontractor facilities to perform the application of dull and bright satin finish decorative chromium plating on steel 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 by Bombardier Toronto Engineering.

5 PROCEDURE

5.1 General

5.1.1 Refer to Flow Chart 1 for the processing sequence.

5.1.2 Carry out decorative chromium plating after all welding, brazing, soldering, machining and heat treatment (except for embrittlement relief according to section 5.4).

5.2 Preparation of Parts

5.2.1 Surface finish parts to be satin finish decorative chromium plated according to PPS 27.06 for the applicable SF code specified on the engineering drawing.

5.2.2 Before cleaning for plating, all parts having a tensile strength range of 180-200 ksi or greater, which have been machined, cold formed, cold straightened or ground in the finish temper condition, shall be stress relieved according to PPS 30.04, PPS 30.06 or PPS 30.08 as applicable, as soon as possible after such operations.

5.2.3 Immediately before plating, thoroughly clean all parts to PPS 31.03. Wear clean cotton gloves when handling cleaned parts.

5.3 Decorative Chromium Plating

5.3.1 Deposit satin finish chromium plating directly onto the base metal without any preliminary coating. However, if the engineering drawing specifies a copper flash and nickel plate, refer to PPS 33.05 and PPS 33.03 respectively.

5.3.2 Plating thickness shall be as specified in section 6.1.3.

5.4 Embrittlement Relief

5.4.1 Except as noted in paragraph 5.4.1.1, embrittlement relieve the following parts according to PPS 30.04, PPS 30.06 or PPS 30.08, as applicable, within 4 hours of plating:

- Aircraft parts with a tensile strength range of 150 - 170 ksi or greater
- Springs with a tensile strength of 200 ksi or greater

5.4.1.1 If more than one type of plating is required on a part, it is not necessary to embrittlement relieve between plating processes provided that the part is embrittlement relieved after the final plating cycle within 4 hours of the first plating process.

5.5 Removal of Plating

5.5.1 If required, strip plating according to PPS 33.02.

6 REQUIREMENTS

6.1 Production Parts

6.1.1 For visual inspection according to section 6.1.2 and non-destructive plating thickness tests according to section 6.1.3, select a sample from each lot by taking, at random from the lot, not less than the number of items indicated in Table I. If the number of non-conforming items in any sample exceeds the acceptance number specified in Table I, reject the represented lot and disposition according to section 6.2.

TABLE I - VISUAL AND PLATING THICKNESS SAMPLING SCHEDULE

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

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

6.1.2 Visual Appearance

6.1.2.1 The chromium deposit shall be smooth, uniform in appearance, free from pin holes, pits and other apparent defects.

6.1.2.2 Dull satin finish chromium plating (E5) shall be a dull silver in colour, closely resembling standard samples held by Inspection and by the subcontractor.

6.1.2.3 Bright satin finish chromium plating (E6) shall be a bluish white in colour, and shall be of medium lustre closely resembling standard samples held by Inspection and by the subcontractor.

6.1.3 Plating Thickness

6.1.3.1 The thickness of E5 or E6 chromium plating shall be 0.0001 to 0.0008 inches.

6.1.3.2 If copper flash is specified, the thickness shall be 0.0005 inches maximum.

6.1.3.3 If nickel plate is specified, the thickness shall be 0.0001 to 0.0005 inches. It may be necessary to limit the nickel plate to the low end of the thickness range to achieve a dull chromium finish (E5).

6.1.3.4 Calculate the plating thickness from direct measurement using a micrometer at a known position or by means of a suitable magnetic gauge.

6.2 Disposition

6.2.1 Any rejected lots shall be 100% inspected. Accept all parts that meet the above requirements. For every part that does not meet the requirements, strip the plating according to section 5.5, re-plate and re-inspect the parts as specified herein. If the plated part fails to meet the requirements a second time after having already been stripped and re-processed once, refer the part to Bombardier Toronto Material Review Board (MRB) or Bombardier Toronto delegated MRB for disposition. Determine the cause of failure and take corrective action prior to commencing processing productions parts.

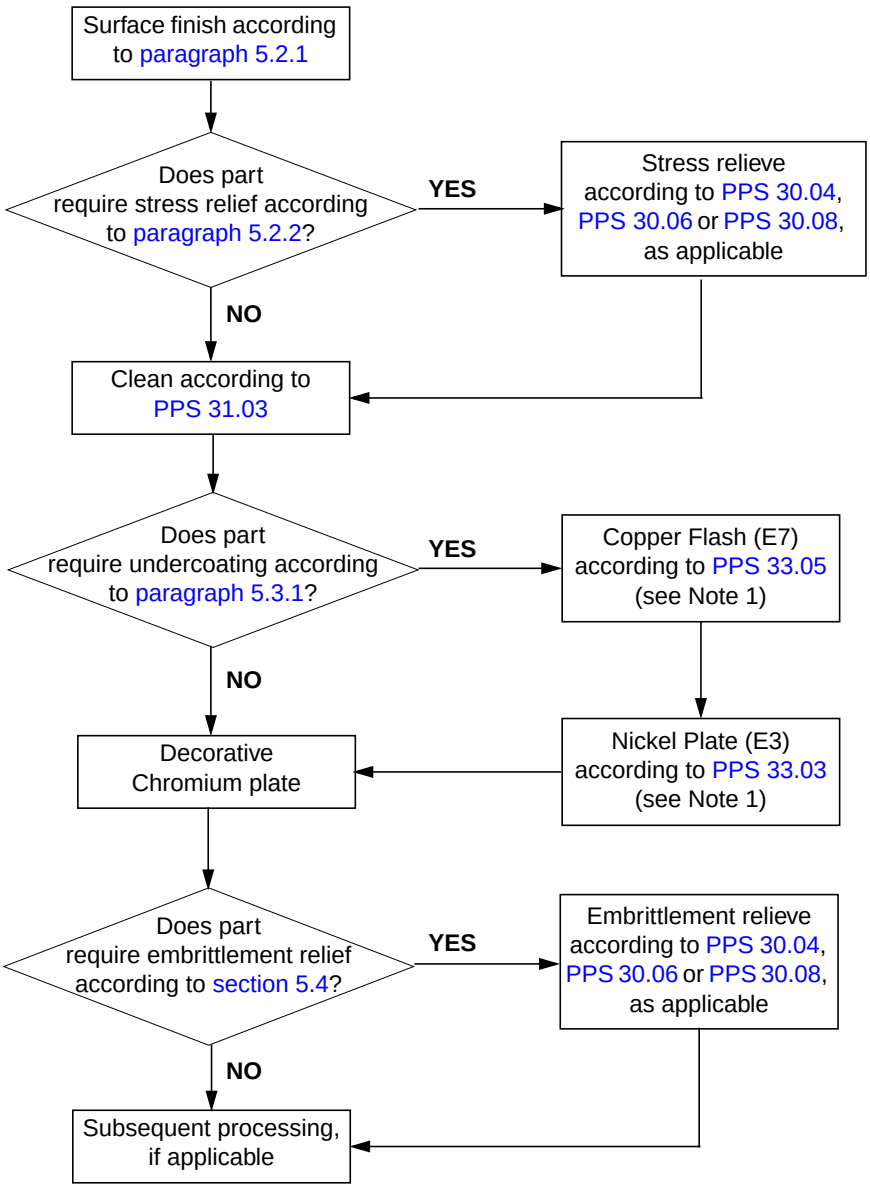
7 SAFETY PRECAUTIONS

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

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.

FLOW CHART 1 - DECORATIVE CHROMIUM PLATING



Note 1. Perform this operation only if specified on the engineering drawing.