BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 27.10

PRODUCTION PROCESS STANDARD

Edge Finishing Steel, Nickel and Copper Alloy Parts

Issue 6
- This standard supersedes PPS 27.10, Issue 5.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS related questions to PPS.Group@aero.bombardier.com or (416) 375-4365.
- 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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1 Scope

1.1 This standard specifies the procedure and requirements for the deburring and edge finishing of carbon steels, low alloy steels, corrosion resistant steels, nickel alloys and copper alloys. Copper alloys include pure copper (commercial grade), brass and bronze alloys.

- For edge finishing of aluminum alloy parts, refer to PPS 27.02.
- For edge finishing of titanium alloy parts, refer to PPS 27.04.
- For edge finishing of magnesium alloy parts, refer to PPS 27.08.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction and the procedure specified must 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.

2 Hazardous Materials

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) 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 (de Havilland) Environment, Health and Safety Department.

3 References

3.1 PPS 1.06 - Tube Swaging.

3.2 PPS 1.08 - Magnetic Pulse Forming of End Fittings to Tubes.

3.3 PPS 6.01 - Fabrication of Rigid Fluid Lines.

3.4 PPS 13.26 - General Subcontractor Provisions.

3.5 PPS 27.05 - Manual Edge Finishing Equipment.

3.6 PPS 27.07 - Vibratory Tumble Deburring.

3.7 PPS 27.11 - Rotary Disc Deburring.

4 Materials and Equipment

4.1 Materials

4.1.1 All materials used for edge finishing of steel, nickel and copper alloys shall be as specified in PPS 27.05, PPS 27.07 or PPS 27.11, as applicable.

4.2 Equipment

4.2.1 Leather gloves (e.g., DSC 422-3).

4.2.2 All equipment used for edge finishing of steel, nickel and copper alloys shall be as specified in PPS 27.05, PPS 27.07 or PPS 27.11, as applicable.

5 Procedure

5.1 General

5.1.1 For the purposes of this standard, edge finishing shall be considered to include de-lugging, deburring, edge relief, edge face polishing and rounding.

- **De-lugging** includes removal of tooling lugs and the subsequent blending of the de-lugged areas into the finished part contour.
- **Deburring** consists of removing upset metal (burrs) resulting from cutting operations during fabrication, to prevent personal injury and to facilitate subsequent fitting and assembly. Deburring shall only include the removal of the upset metal so as to leave a sharp, clean edge.
- **Edge relieving** consists of chamfering or radiusing sharp edges to prevent stress cracking of structural aircraft parts.
- **Edge face polishing** consists of polishing edge faces to a smooth finish, to prevent stress cracking of structural aircraft parts, and includes the blending in of nicks and tool marks.
- **Chatter marks** are riblike markings caused by vibration (chattering) of the cutting tool against the surface of the work.
- **Rounding** of edges and corners consists of radiusing sharp edges and corners on parts to be shot peened to prevent rollover or bulging.

5.1.2 Refer to Flow Chart 1 to determine the applicability of edge finishing operations relevant to material type and its application.

5.1.3 The presence of chatter marks on edge faces is acceptable provided that they do not exceed 0.010" in depth. Edge face polish parts with chatter marks exceeding 0.010" in depth according to section 5.6 to smooth and blend the chatter marks. Use of a suitable comparator reference/shop aid to evaluate the depth of chatter marks is recommended.

5.2 De-Lugging

5.2.1 Except for tooling lugs required for subsequent assembly or fabrication operations, on completion of part fabrication and before deburring or edge finishing crop tooling lugs. Crop tooling lugs required for subsequent assembly or fabrication operations on completion of such operations.

5.2.2 Carry out de-lugging and blending of the de-lugged areas into the finished part contour according to PPS 27.05.

5.3 Deburring

5.3.1 Deburr all sheet metal parts up to and including 0.100" thick on completion of all fabrication cutting operations.

5.3.2 The preferred method of deburring flat sheet metal parts is automatic belt/rotary disc machine deburring according to PPS 27.11. Refer to Table 1 for the part size limits for the Timesavers Inc. Series 2200 deburring machine used at Bombardier Toronto (de Havilland). For flat sheet metal parts which cannot be deburred via machine deburring due to part size limitations or machine unavailability, deburr parts by vibratory tumble deburring according to PPS 27.07 or manually deburr according to PPS 27.05.

5.3.2.1 The preferred method of deburring formed sheet metal parts is vibratory tumble deburring according to PPS 27.07. As a general rule, parts up to 60” x 3” can be satisfactorily deburred by vibratory tumble deburring. Manually deburr sheet metal parts which can not be deburred via vibratory tumble deburring due to their size or shape according to PPS 27.05.

Table 1 - Timesavers Inc. Series 2200 Deburring Machine Capacity

THICKNESS LIMITS	WIDTH LIMITS	MINIMUM SURFACE AREA
0.020"- 0.125"	0.75" - 36"	0.6 sq. in.

5.4 Edge Relief - Except Tubing

5.4.1 Edge relief is required on edges resultant from fabrication cutting operations for the following parts:

- sheet material over 0.100" thick
- all plate material
- all bar and rod
- all castings
- all forgings

5.4.2 Edge relieve all parts (except tubing) requiring edge relief to the dimension shown in Table 2 on all edges resultant from fabrication cutting operations.

Table 2 - Edge Relief

MATERIAL THICKNESS	EDGE CHAMFER/RADIUS	
	MINIMUM	MAXIMUM
less than 0.100"	0.005"	25% of thickness
0.100" and greater	0.005"	0.025"

5.4.3 The preferred method of relieving edges is by means of vibratory tumble finishing according to PPS 27.07. As a general rule, parts up to 60” x 3” can be satisfactorily edge relieved by vibratory tumble finishing. Manually edge relieve parts which are not suitable for vibratory tumble edge finishing due to their size or shape according to PPS 27.05.

5.4.4 Edge relieve fastener holes only if specified on the engineering drawing or fastener PPS. For such holes, edge relieve on assembly of the applicable fastener.

5.5 Edge Relief of Tubing

5.5.1 Except as noted below, edge relieve all round and square type tubing of steel or copper alloy manually according to PPS 27.05 to the dimension specified in Table 2.

- For rigid fluid lines (other than welded assemblies), face to length and edge relieve according to PPS 6.01.
- Prepare tubing for magneformed assemblies according to PPS 1.08.
- Prepare tubing to be swaged according to PPS 1.06.

5.6 Edge Face Polishing

5.6.1 Except as noted below, edge face polish all parts having an edge face roughness in excess of 125 RMS according to PPS 27.05 to achieve a surface finish of 125 RMS or finer.

- Parts which have undergone a vibratory tumble finishing operation, do not require subsequent edge face polishing.
- Isolated machining marks on polished edges are acceptable provided they are smoothly blended.

5.6.2 The presence of chatter marks on edge faces is acceptable provided that they do not exceed 0.010" in depth. Smooth and blend chatter marks deeper than 0.010" by buffing parallel to the edge according to PPS 27.05. Note that it is not necessary to totally remove all visual indication of the chatter marks. Ensure a surface finish of 125 RMS or finer on polished edge faces.

5.7 Rounding of Edges and Corners

5.7.1 Unless otherwise specified by the engineering drawing, perform rounding of edges and corners on parts to be shot peened.

5.7.2 For parts to be shot peened, except for holes which will be opened up to their final size after shot peening, round all part edges to the following radius:

- For edges and corners where the part thickness is 0.100" or less at the part edge, round the edges and corners to a radius of approximately 25% of the edge thickness.
- For edges and corners where the part thickness is greater than 0.100" at the part edge, round the edges and corners to a radius of 0.010" - 0.040".

5.7.3 Round edges and corners to the required radius by machining or by manual edge finishing according to PPS 27.05. The required part surface finish must also be maintained on rounded edges and corners.

6 Requirements

6.1 All sheet metal parts up to and including 0.100" thick shall be deburred according to section 5.3 on all cut edges.

6.2 Except as noted, sheet material over 0.100" thick, all bar, all rod and all plate material shall have all edges relieved according to section 5.4. Fastener holes need only be edge relieved if specified on the engineering drawing or fastener PPS. Final size fastener holes must be edge relieved as specified on the engineering drawing or fastener PPS on assembly of the applicable fastener.

6.3 All castings and forgings must be edge relieved according to section 5.4 on all edges resultant from fabrication cutting operations.

6.4 All tubing shall be edge relieved according to section 5.5.

6.5 The surface finish on all cut edge faces shall not exceed 125 RMS. Isolated machining marks are acceptable provided they are smoothly blended into the edge face.

6.6 Unless otherwise specified by the engineering drawing, all edges and corners of parts to be shot peened (except for holes which will be opened up to their final size after shot peening) shall have been rounded to the dimensions specified in paragraph 5.7.2.

6.7 The presence of chatter marks on edge faces is acceptable provided that they do not exceed 0.010" in depth. Chatter marks deeper than 0.010" must be smoothed and blended (note that it is not necessary to remove all visual indication of the chatter marks).

6.8 Finishing marks running perpendicular to the edges on polished edge faces are not acceptable.

7 Safety Precautions

7.1 Observe general shop safety precautions when performing the procedure specified herein.

7.2 Wear protective leather gloves when handling sheet material.

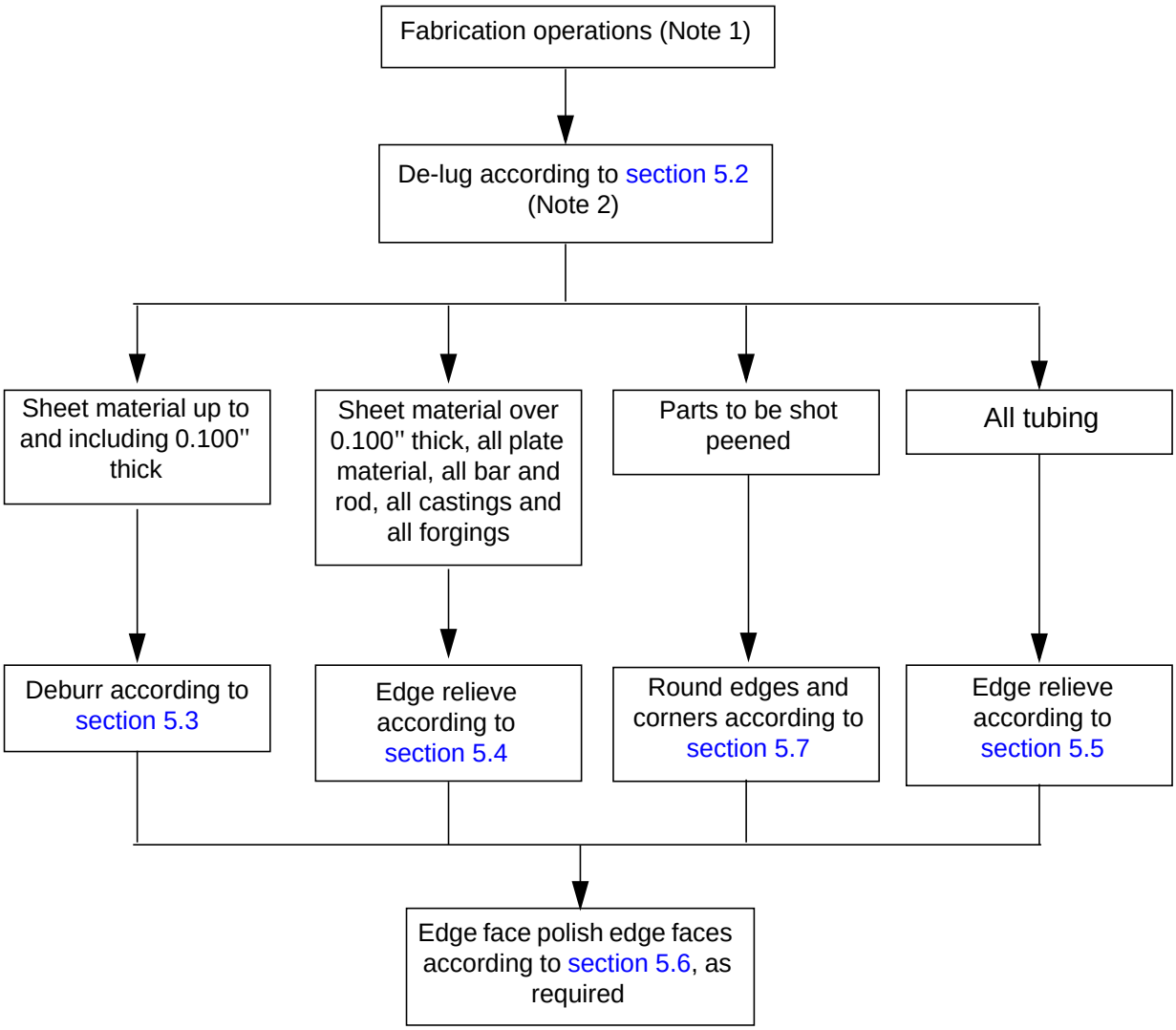
8 Personnel Requirements

8.1 Personnel responsible for edge finishing of carbon steels, low alloy steels, corrosion resistant steels, nickel alloys and copper alloys must have a good working knowledge of the procedure and requirements as specified herein and must have exhibited their competency to their supervisor.

9 Additional Information

9.1 A surface finish of 125 RMS is an average grade machine finish, typical of smooth disc grinding or smooth filing. It is recommended that a suitable comparator/shop aid be used to ensure a surface finish of 125 RMS or finer.

Flow Chart 1 - Edge Finishing of Aluminum Alloy Parts



Note 1: For the purposes of this standard, fabrication includes machining, routing, drilling, shearing, blanking, piercing, sawing, etc.

Note 2: Tooling lugs shall be cropped before edge finishing, except where such lugs are required in order to carry out subsequent fabrication or forming operations.