BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 27.02

PRODUCTION PROCESS STANDARD

Edge Finishing Aluminum Alloy Parts

Issue 9
- This standard supersedes PPS 27.02, Issue 8.
- 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.

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Tables

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for edge finishing of aluminum alloy parts.

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.

1.1.4 For edge finishing of titanium alloy parts refer to PPS 27.04.

1.1.5 For edge finishing of magnesium alloy parts refer to PPS 27.08.

1.1.6 For edge finishing of steel, nickel or copper alloy parts refer to PPS 27.10.

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 - Automatic Belt and Rotary Disc Deburring.

4 Materials and Equipment

4.1 Materials

4.1.1 Material used for edge finishing of aluminum alloy parts shall be as specified in PPS 27.05, PPS 27.07, or PPS 27.11, as applicable.

4.2 Equipment

4.2.1 Equipment used for edge finishing of aluminum alloy parts shall be as specified in PPS 27.05, PPS 27.07, or PPS 27.11, as applicable.

4.2.2 Protective leather gloves (e.g., DSC 422-3).

5 Procedure

5.1 General

5.1.1 For the purposes of this standard, edge finishing shall be considered to include deburring, edge relief, edge face polishing, de-lugging 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 Table 1 to determine the applicability of edge finishing operations relevant to material type and its application. Perform delugging on parts with tooling lugs according to section 5.2.

5.1.3 Deburr all sheet metal parts up to and including 0.125” thick according to section 5.3 on all cut edges.

5.1.4 Edge relieve all bar, rod, plate and sheet material over 0.125” thick according to section 5.4.

5.1.5 Edge relieve all extrusions, castings and forgings according to section 5.4 on all edges resultant from fabrication cutting operations.

5.1.6 For all lightning holes, stretch flanges and bend relief areas, edge relieve according to section 5.4 and then edge face polish according to section 5.6.

5.1.7 For all 7000 series alloys and all exterior skins, edge relieve according to section 5.4 and then edge face polish according to section 5.6.

5.1.8 Edge relieve all tubing according to section 5.5.

5.1.9 For parts to be shot peened only, round all edges and corners according to section 5.7.

5.1.10 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 to smooth and blend the chatter marks. Note that it is not necessary to totally remove all visual indication of the chatter marks. Use of a suitable comparator reference/shop aid to evaluate the depth of chatter marks is recommended.

Table 1 - Applicability of Edge Finishing Operations

DEBURR	EDGE RELIEVE	EDGE FACE POLISH
- all sheet metal parts up to and including 0.125” thick	- sheet material over 0.125” thick - plate material (over 0.250” thick) - all bar and rod - all extrusions, castings and forgings - all lightning holes, stretch flanges and bend relief areas - all 7000 series alloys - all exterior skins - all tubing	- all lightning holes, stretch flanges and bend relief areas - all 7000 series alloys - all exterior skins - parts with chatter marks exceeding 0.010" in depth (ref. paragraph 5.1.10)

5.2 De-Lugging

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

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

5.3 Deburring

5.3.1 The preferred method of deburring flat sheet metal parts is automatic belt/rotary disc machine deburring according to PPS 27.11. Refer to Table 2 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.

Table 2 - 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.

5.3.2 The preferred method of deburring formed sheet metal parts (including CS sections) 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. Deburr formed sheet metal parts which can not be deburred via vibratory tumble deburring due to their size or shape manually deburred according to PPS 27.05.

5.4 Edge Relief - Except Tubing

5.4.1 For each of the following parts/areas, edge relieve to the dimension shown in Table 3 is required on edges resulting from fabrication cutting operations:

- Sheet material over 0.125" thick.
- Plate material (over 0.250" thick).
- Bar and rod.
- Extruded sections (including CV sections).
- All castings and forgings.
- For CS sections and sheet material up to and including 0.125" thick: lightening holes, stretch flanges, bend relief areas, all 7000 series alloys and all exterior skins.

Table 3 - Edge Relief

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

5.4.2 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.

5.4.3 Edge relieve parts which are not suitable for vibratory tumble edge finishing due to their size or shape manually according to PPS 27.05. Edge relief of holes is only necessary if specified by the engineering drawing or fastener PPS. Edge relieve final size fastener holes as specified by the engineering drawing or fastener PPS 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 aluminum alloy tubing manually according to PPS 27.05 to the dimension specified in Table 3.

- Face rigid fluid lines (other than welded assemblies) to length and edge relieved according to PPS 6.01.
- Edge relieve tubing for magneformed assemblies according to PPS 1.08.
- Edge relieve tubing to be swaged according to PPS 1.06.

5.6 Edge Face Polishing

5.6.1 Except as noted paragraph 5.6.1.1, edge face polishing is required for the following parts:

- all lightning holes, stretch flanges and bend relief areas
- all 7000 series alloys and all exterior skins
- parts with chatter marks exceeding 0.010" in depth

5.6.1.1 Except for parts with chatter marks exceeding 0.010" in depth, parts which have undergone a vibratory tumble finishing operation do not require edge face polishing. Parts with chatter marks exceeding 0.010" in depth, must be edge face polished according to PPS 27.05 to smooth and blend the chatter marks (note that it is not necessary to totally remove all visual indication of the chatter marks).

5.6.2 When edge face polishing, polish edge faces according to PPS 27.05 to achieve a surface finish of 125 RMS or finer. It is recommended that a suitable comparator/shop aid be used to ensure a surface finish of 125 RMS or finer.

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 0.020" - 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 De-lugged areas must be blended into the finished part contour.

6.2 For deburred parts, all upset metal resulting from cutting operations must have been removed so as to leave a sharp, clean edge.

6.3 For edge relieved parts, sharp edges shall have been chamfered or radiused to the dimension specified in Table 3.

6.4 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.

6.5 For edge face polished parts, a surface finish on the polished face of 125 RMS or finer is required. Chatter marks in excess of 0.010" deep which have been edge face polished must have been smoothed and blended with the edge face. It is not necessary to remove all visual indication of such marks.

7 Safety Precautions

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

7.2 Wear protective leather gloves where handling sheet material.

8 Personnel Requirements

8.1 Personnel responsible for edge finishing of aluminum alloy parts 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.