**BOMBARDIER**
Toronto (de Havilland)
**PROPRIETARY INFORMATION**

# PPS 27.05

**PRODUCTION PROCESS STANDARD**

## Manual Edge Finishing

Issue 11
- This standard supersedes PPS 27.05, Issue 10.
- Vertical lines in the left hand margin indicate technical 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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|---|---|---|
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## 1 Scope

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

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS 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.

## 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 13.13 - Personal Protective Respiratory Equipment.

3.2 PPS 13.26 - General Subcontractor Provisions.

3.3 PPS 27.02 - Edge Finishing of Aluminum Alloys.

3.4 PPS 27.04 - Edge Finishing of Titanium Alloys.

3.5 PPS 27.08 - Edge Finishing of Magnesium Alloys.

3.6 PPS 27.10 - Edge Finishing of Steel, Nickel and Copper Alloys.

## 4 Materials and Equipment

### 4.1 Materials

4.1.1 180 - 400 grit aluminum oxide abrasive paper or cloth.

4.1.2 180 - 220 grit aluminum oxide abrasive straps.

4.1.3 120 - 220 grit aluminum oxide abrasive belts.

4.1.4 180 grit aluminum oxide abrasive cones (e.g., TS.561.22.23).

4.1.5 Abrasive pads (e.g., Scotch-Brite pads, 3M Canada Ltd., Type A Fine).

4.1.6 Polishing wheels (e.g., Scotch-Brite polishing wheel, 3M Canada Ltd., type A medium).

**4.2 Equipment**

4.2.1 Swivel blade edge finishing tool (e.g., J.B. Reid Industrial Sales).

4.2.2 Fish mouth scraper (e.g., J.B. Reid Industrial Sales, AT-514).

4.2.3 Knife sharpener type edge finishing tool (e.g., J.B. Reid Industrial Sales AT-541).

4.2.4 Scraper (e.g., J.B. Reid Industrial Sales Richard type scraper).

4.2.5 Vixen file (e.g.,SD 8066).

4.2.6 Countersink cutter (e.g., TS.561.31.14)

4.2.7 Offset angle drills (e.g., Zephyr ZT561, ZT562 or ZT563).

4.2.8 Unitized wheel, 220 - 400 grit (e.g., Scotch-Brite unitized wheel, 3M Canada Ltd.).

4.2.9 Hole deburring tool (e.g., TS.561.35.10).

4.2.10 Tube reamer (e.g., Wainbee Ltd. #208-FSS).

4.2.11 Pneumatic vibratory sander (e.g., National Air Sander Co.).

4.2.12 Pneumatic strap sander (e.g., Dynablade Co. Dynafile 55).

4.2.13 Belt sander (e.g., Rockwell Ltd., Delta Model).

4.2.14 Pneumatic de-lugging shears (e.g., Jiffy Air Tool Co., Model 650).

4.2.15 De-lugging shears (e.g., CAE-Morse Co., Beverly brand).

## 5 Procedure

### 5.1 General

5.1.1 Refer to PPS 27.02, PPS 27.04, PPS 27.08 or PPS 27.10 for the edge finishing requirements for particular materials.

5.1.2 For the purposes of this PPS, 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 the removal of upset metal (burrs) resulting from cutting operations during fabrication, to prevent personal injury and to facilitate subsequent fitting and assembly. When deburring, remove only the upset metal, so as to leave a clean edge.
- **Edge relief** (edge break) consists of chamfering or radiusing sharp edges to prevent stress cracking of aircraft parts.
- **Edge face polishing** consists of polishing edge faces to a smooth finish to prevent stress cracking and includes blending in 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.

### 5.2 Edge Finishing Practices

#### 5.2.1 Deburring

5.2.1.1 Refer to section 5.3 for suitable deburring tools.

5.2.1.2 When deburring holes, take care to avoid marking adjacent surfaces and excessive removal of material. Deburr only the hole or line of holes, not the whole surface of the part.

5.2.1.3 Deburr holes only on one side, as the burr is caused by the drill point or punch breaking through the material.

#### 5.2.2 Edge Relief (Edge Break)

5.2.2.1 Refer to section 5.3 for suitable edge relief tools.

5.2.2.1.1 Where edge relief (edge break) of fastener holes is specified, use a 90° countersink cutter according to section 5.3.10. Do not edge relieve fastener holes unless specified on the engineering drawing or fastener PPS.

5.2.2.1.2 Edge relieve tubes which have mitered, radiused or fish mouth ends using round or half-round fine cut metal files according to section 5.3.6.

5.2.2.1.3 Face to length and chamfer control rods and structural assembly tubing inside and outside, and then polish on a rotary chuck sander according to section 5.3.14.

### 5.2.3 Edge Face Polishing

5.2.3.1 Refer to section 5.3 for suitable edge face polishing tools.

5.2.3.2 Smooth and blend tool chatter marks and remove metal pick-up on edge faces by draw filing with fine cut metal files according to section 5.3.6 or sanding with abrasive paper and then edge face polishing using a unitized wheel according to section 5.3.7. Note that it is not necessary to totally remove all visual indication of chatter marks.

### 5.2.4 De-Lugging

5.2.4.1 Refer to section 5.3 for suitable de-lugging tools.

5.2.4.2 After de-lugging, blend the de-lugged area into the finished part contour.

### 5.2.5 Rounding

5.2.5.1 For parts to be shot peened, except for holes which will be opened up to their final size after shot peening, round all edges and corners to the radius specified in PPS 27.02, PPS 27.04 or PPS 27.10, as applicable.

5.2.5.2 Refer to section 5.3 for suitable rounding tools.

5.2.5.3 If necessary, complete rounding of edges and corners by hand abrading using abrasive paper and a suitable sanding block, as applicable.

## 5.3 Edge Finishing Equipment

### 5.3.1 Swivel Blade Edge Finishing Tool (see Figure 1)

5.3.1.1 Use the swivel blade edge finishing tool (ref. para. 4.2.1) only for deburring or edge relief of holes (except fastener holes), keyways on machined parts and round or square tube ends (inside diameter only).

5.3.1.2 Use the swivel blade edge finishing tool on aluminum, magnesium, copper, brass or bronze parts only.

5.3.1.3 The blade of this tool has free circular motion and can be replaced by pressing down on the sleeve.

5.3.1.4 Adjust or replace the blade holder by pressing down on the knurled collar.

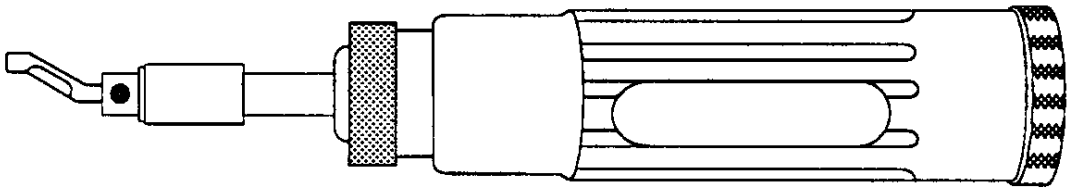

**Figure 1 - Swivel Blade Edge Finishing Tool**

### 5.3.2 Fish Mouth Scraper (see Figure 2)

5.3.2.1 Use the fish mouth scraper (ref. para. 4.2.2) for deburring or edge relief of outside perimeter and large cutouts on parts with a sheet thickness less than 0.125". Hold the tool straight and true to avoid marking the sheet surface.

5.3.2.2 Use the fishmouth scraper on aluminum, magnesium, copper, brass or bronze parts only.

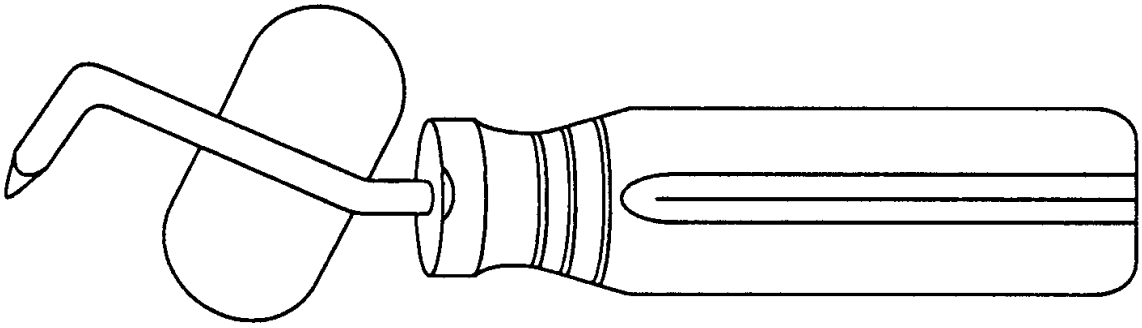

**Figure 2 - Fishmouth Scraper**

### 5.3.3 Knife Sharpener Type Edge Finishing Tool (see Figure 3)

5.3.3.1 Use the knife sharpener type edge finishing tool (ref. para. 4.2.3) for deburring or edge relief of outside perimeter and large cutouts on parts with a sheet thickness less than 0.125". Hold the tool straight and true to avoid marking the sheet surface.

5.3.3.2 Use the knife sharpener type edge finishing tool on aluminum, magnesium, copper, brass or bronze parts only.

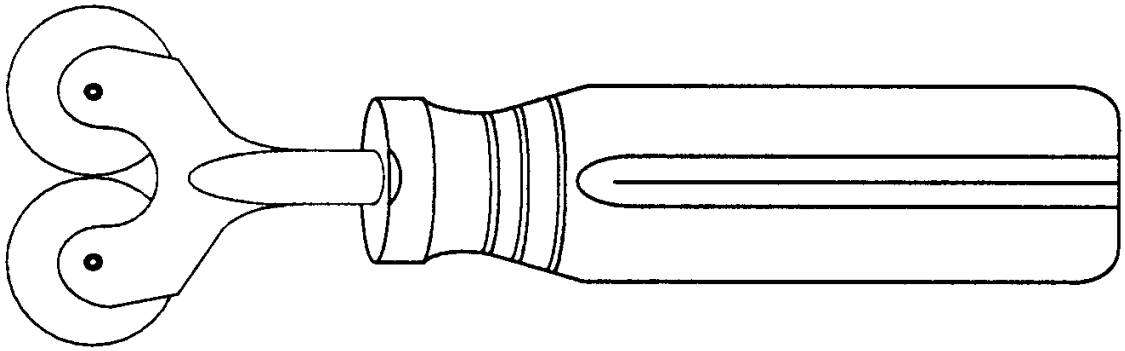

**Figure 3 - Knife Sharpener Type Edge Finishing Tool**

**5.3.4 Scraper** (see Figure 4)

5.3.4.1 Use the scraper (ref. para. 4.2.4) for deburring or edge relief of outside perimeter and large cutouts on sheet and keyways on machined parts only.

5.3.4.2 Before using a scraper, grind all 4 corners of the blades to a radius of approximately 3/32" to prevent scratching of adjacent surfaces.

5.3.4.3 Use the scraper on aluminum, magnesium, copper, brass or bronze parts only.

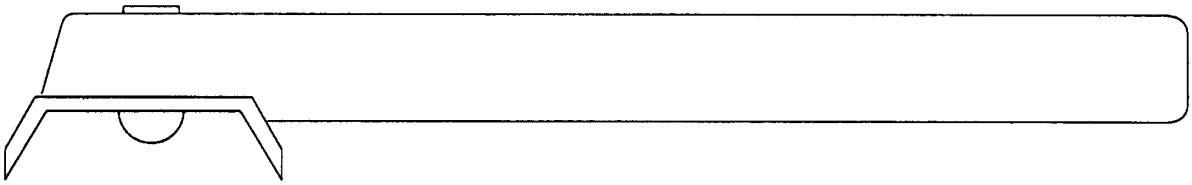

**Figure 4 - Richard Scraper**

**5.3.5 Vixen File** (see Figure 5)

5.3.5.1 Use the Vixen file (ref. para. 4.2.5) for surface deburring of drilled and punched fastener holes only.

5.3.5.2 Use Vixen files on aluminum or magnesium parts only.

5.3.5.3 When deburring a single hole or a pattern of small holes on painted or primed surfaces, use a modified Vixen file (see Figure 5). The modified Vixen file is made by cutting a piece from the Vixen blade approximately 1 1/2" long and glueing it onto a piece of wood.

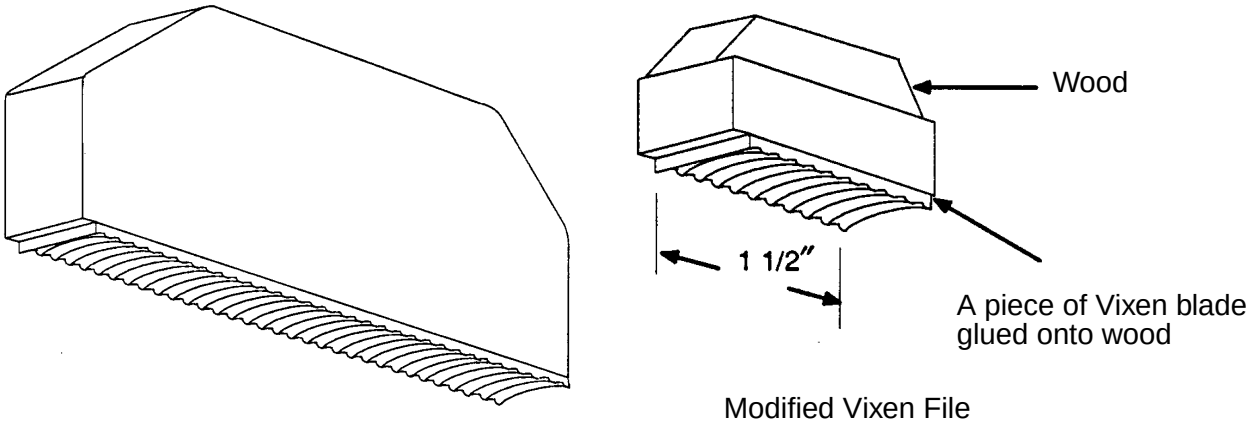


**Figure 5 - Vixen File**

**5.3.6 Metal Files** (see Figure 6)

5.3.6.1 Use metal files for deburring, edge relieving and rounding.

5.3.6.2 When using a metal file, use the draw method followed by light sanding if required.

5.3.6.3 Metal files may be used on all metal parts.

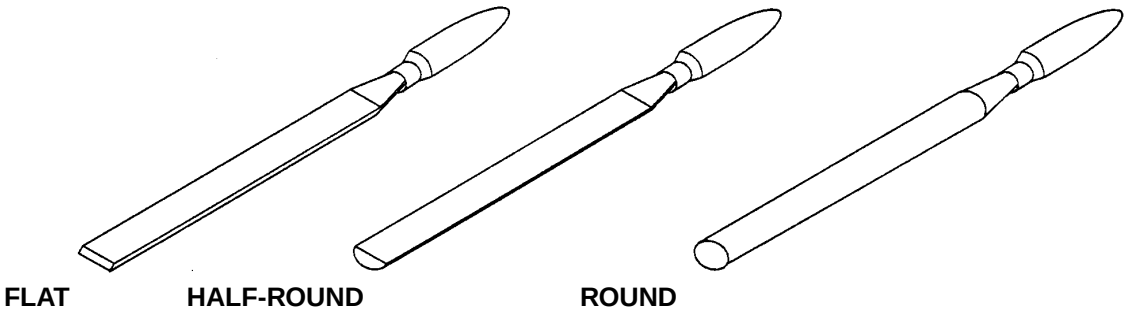


**Figure 6 - Metal Files**

**5.3.7 Unitized Wheel** (see Figure 7)

5.3.7.1 Use the unitized wheel (ref. para. 4.2.8), driven by a suitable drillmotor, for edge face polishing only.

5.3.7.2 The unitized wheel may be used on all metal parts.

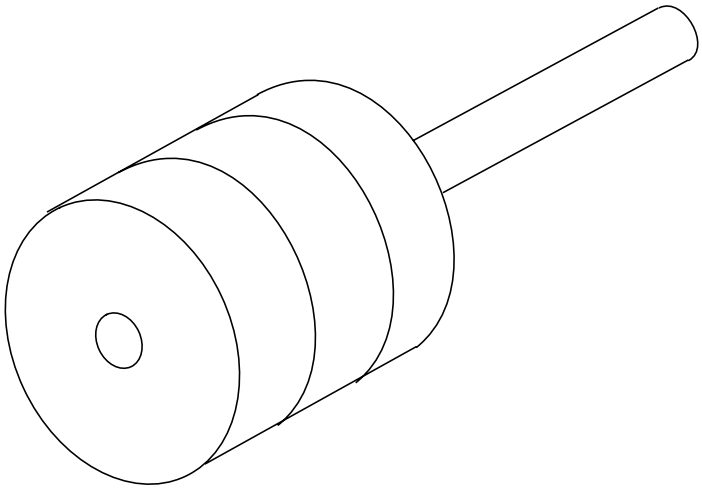

**Figure 7 - Unitized Wheel**

**5.3.8 Tube Reamer** (see Figure 8)

5.3.8.1 Use the tube reamer (ref. para. 4.2.10) for deburring or edge relieving of tubing having squared ends.

5.3.8.2 Use the tube reamer on aluminum or steel parts only.

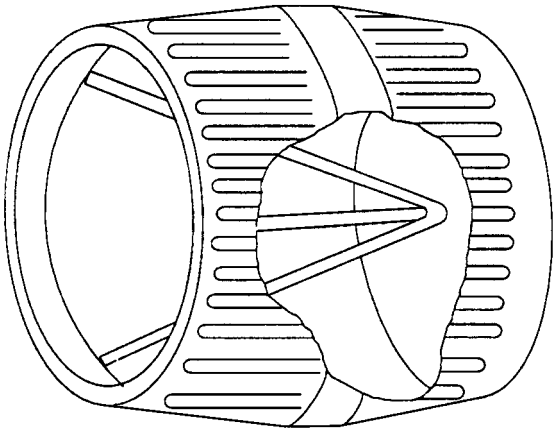

**Figure 8 - Tube Reamer**

### 5.3.9 Hole Deburring Tool (see Figure 9)

5.3.9.1 Use a hole deburring tool (e.g., TS.561.35.10) for deburring holes and the inside diameter of tubing. Use caution to avoid excessive material removal when using the hole deburring tool. The hole deburing tool may be used on all metal parts. Do not use the hole deburring tool for edge relief (edge break) of fastener holes; for edge relief (edge break) of fastener holes use a 90° countersink cutter according to section 5.3.10.

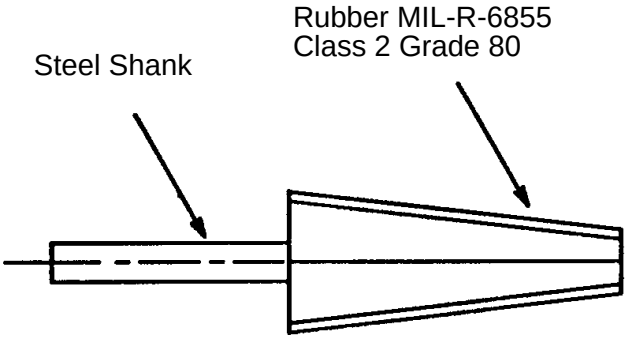


**Figure 9 - TS.561.35.10 Hole Deburring Tool**

### 5.3.10 Countersink Cutter (see Figure 11)

5.3.10.1 Use a 90° countersink cutter (e.g., TS.561.31.14) for edge relief (edge break) of fastener holes where specified by the engineering drawing or fastener PPS. Take care to avoid excessive material removal when using the 90° countersink cutter. A TS.561.31.14 countersink cutter may be used on all metal parts. In limited access areas an offset angle drill (e.g, Zephyr ZT561, ZT562 or ZT563) may be used with a 90° countersink cutter.

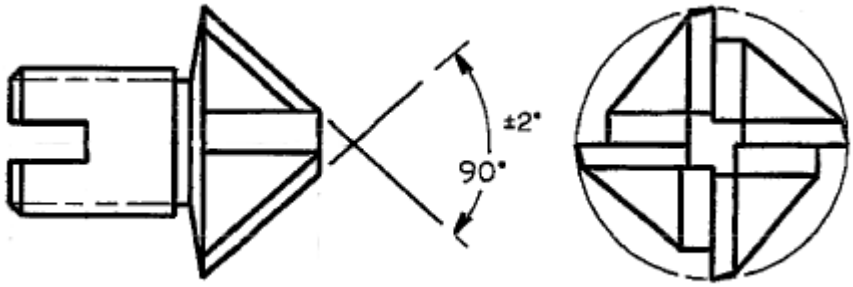


**Figure 10 - TS.561.31.14 Countersink Cutter for Edge Relief (Edge Break) of Fastener Holes**

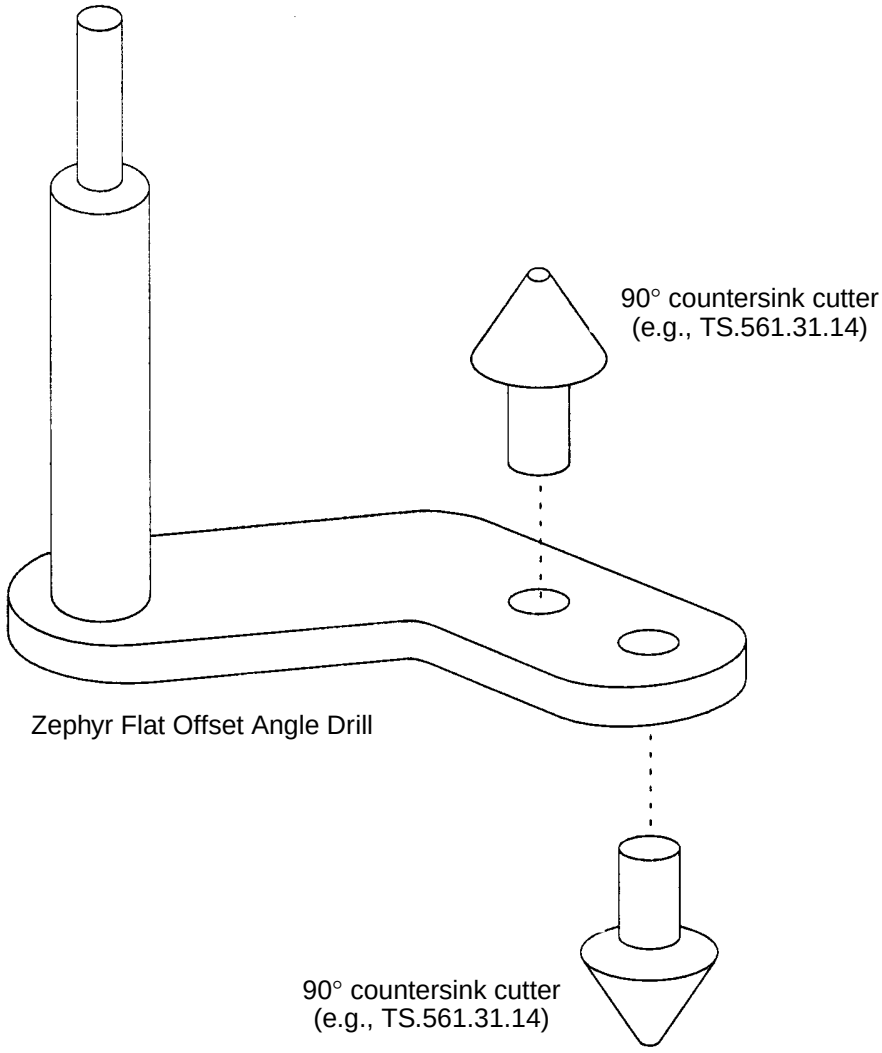


**Figure 11 - Zephyr Flat Offset Angle Drill**

**5.3.11 Vibratory Sander** (see Figure 12)

5.3.11.1 Use the vibratory sander (ref. para. 4.2.11) for surface deburring of drilled or punched fastener holes, edge face polishing of outside perimeters, blending of de-lugged areas after cropping of lugs and rounding of part edges before shot peening.

5.3.11.2 The vibratory sander utilizes abrasive pads (ref. para. 4.1.5) or abrasive paper (ref. para. 4.1.1).

5.3.11.3 The vibratory sander may be used on all metal parts.

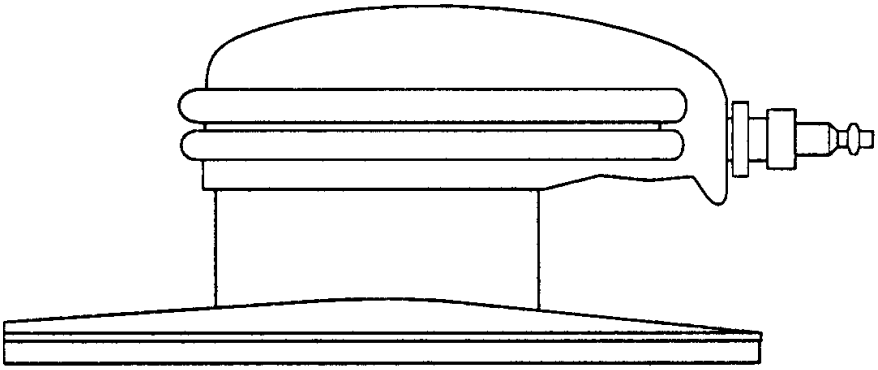

**Figure 12 - Vibratory Sander**

**5.3.12 Strap Sander** (see Figure 13)

5.3.12.1 Use the strap sander (ref. para. 4.2.12) for edge relief of outside perimeters, cutouts and the outside diameters of tube ends, edge face polishing of outside perimeters and cutouts, blending of de-lugged areas after cropping of lugs and rounding of part edges before shot peening.

5.3.12.2 The strap sander utilizes abrasive straps (ref. para. 4.1.2).

5.3.12.3 The strap sander may be used on all metal parts.

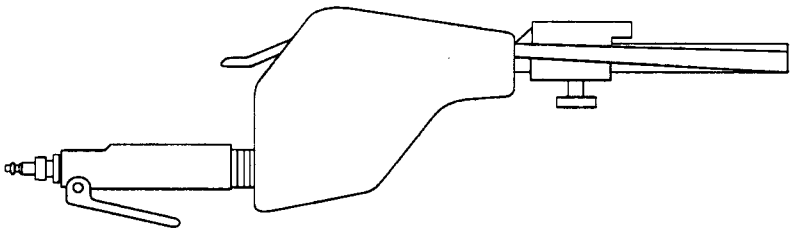

**Figure 13 - Strap Sander**

**5.3.13 Belt Sander** (see Figure 14)

5.3.13.1 Use the belt sander (ref. para. 4.2.13) only for blending of de-lugged areas after cropping of lugs.

5.3.13.2 The belt sander utilizes abrasive belts (ref. para. 4.1.3).

5.3.13.3 The belt sander may be used on all metal parts.

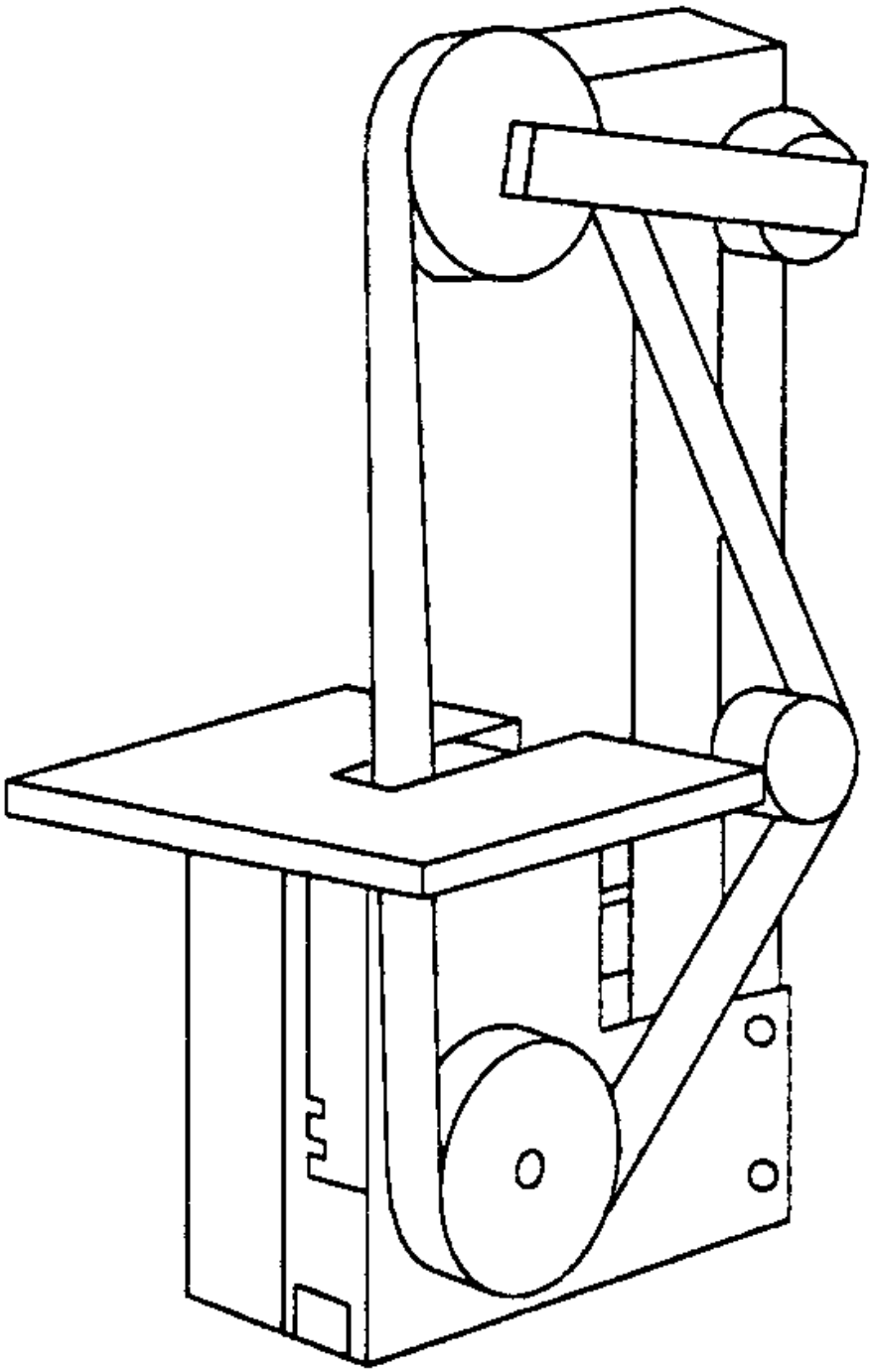

**Figure 14 - Belt Sander**

### 5.3.14 Rotary Chuck Sander (see Figure 15)

5.3.14.1 Use the rotary chuck sander only for edge relieving of the inside diameter of tubing or edge face polishing of lightening holes before forming.

5.3.14.2 The rotary chuck sander utilizes abrasive cones (ref. para. 4.1.4) or unitized wheels (ref. para. 4.2.8) according to section 5.3.7.

5.3.14.3 Use the rotary chuck sander only on aluminum and titanium parts.

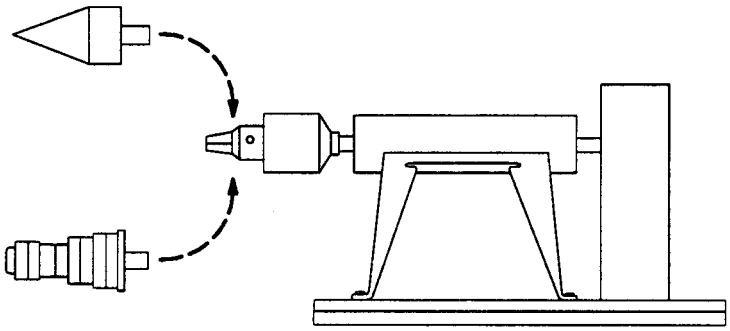

**Figure 15 - Rotary Chuck Sander**

### 5.3.15 Pneumatic De-Lugging Shears (see Figure 16)

5.3.15.1 Use pneumatic de-lugging shears (ref. para. 4.2.14) only for cropping of tooling lugs on straight edges of sheet metal parts up to 0.125" thick.

5.3.15.2 The pneumatic de-lugging shears may be used on all metal parts.

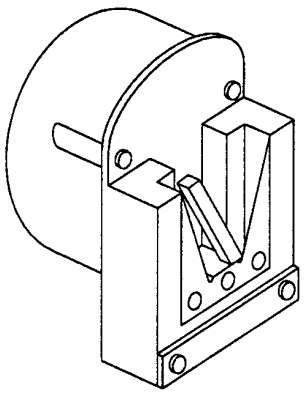

**Figure 16 - Pneumatic De-Lugging Shears**

**5.3.16 Manual De-Lugging Shears** (see Figure 17)

5.3.16.1 Use manual de-lugging shears (ref. para. 4.2.15) only for cropping of tooling lugs on curved edges of flat or formed sheet metal parts up to 0.125" thick.

5.3.16.2 The manual de-lugging shears may be used on all metal parts.

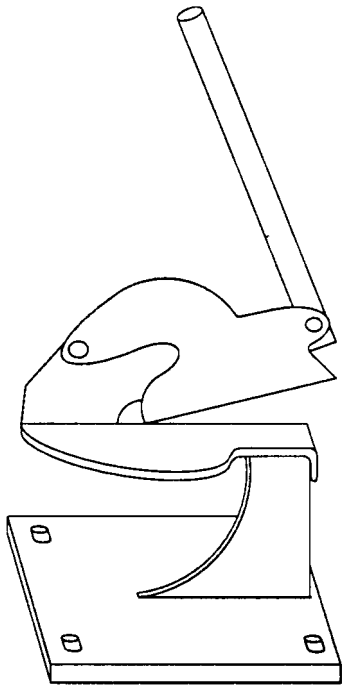

**Figure 17 - Manual De-Lugging Shears**

## 5.4 Care of Equipment

5.4.1 Keep tools sharp and in good order. Return tools to the Tool Stores when they require cleaning, repair or replacement.

5.4.2 When replacing an abrasive belt or strap, ensure that the arrow on the belt or strap is pointing in the direction of rotation.

# 6 Requirements

6.1 Manual edge finishing using the materials and equipment listed herein shall be carried out to remove a minimum amount of material so as to meet the specific edge finishing requirements of PPS 27.02, PPS 27.04, PPS 27.08 or PPS 27.10, as applicable.

6.2 The required part surface finish must also be maintained on rounded edges.

## 7 Safety Precautions

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

**7.2 Disconnect the electric or air power supply when replacing abrasive material on power tools.**

**7.3 Wear suitable protective respiratory equipment according to PPS 13.13 at all times when edge finishing using power driven tools.**

## 8 Personnel Requirements

8.1 Personnel responsible for manual edge finishing must have a good working knowledge of the procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.

## 9 Maintenance of Equipment

9.1 It is recommended that edge finishing equipment (especially bench and floor tools) be appropriately maintained on a regular basis.