BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 1.16

PRODUCTION PROCESS STANDARD

Roller Burnishing

Issue 3
- This standard supersedes PPS 1.16, Issue 2.
- 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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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for microroll burnishing a previously machined surface.

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 13.26 - General Subcontractor Provisions.

4 Materials and Equipment

4.1 Materials

4.1.1 Light lubricating oil.

4.2 Equipment

4.2.1 Burnishing tools as listed in Table 2.

5 Procedure

5.1 General

5.1.1 The ideal surface for roller burnishing is a peak and valley pattern which has been generated by a single point cutting tool. A fine finish is obtained by simply displacing the peaks into the valleys. An extremely smooth bore before roller burnishing is not necessary but it is important that the bore has a uniform peak and valley surface.

5.1.2 Ductility of the workpiece material dictates the degree of surface preparation before roller burnishing. Materials such as brass, aluminum and annealed steels can have a rough machined surface. Less ductile materials such as cast iron and heat treated steels above 35 Rockwell C must have a smother machine surface and have less stock allowance before roller burnishing.

5.1.3 If the bore diameter of a bushing is found to be undersized after installation, a microroll burnishing operation may be used to remove up to 0.0002" maximum from a previously honed surface.

5.2 Lubrication

5.2.1 The burnishing tool requires lubrication, therefore a light lubricating oil or a rich soluble oil mixture is recommended.

5.2.2 Feed lubricant to the tool in a steady stream of ample volume to provide a flushing and cleaning action.

5.3 Stock Allowance

5.3.1 When machining a surface before roller burnishing, stock must be allowed for metal displacement. The amount of stock allowance left on the surface to be burnished will vary depending on the material and its condition before burnishing (refer to Table 1 for approximate allowances). An exact stock allowance can best be determined by roller burnishing an actual workpiece to the desired surface finish and then measuring the amount of material displaced. Remove the minimum amount of material required to produce the desired surface finish, as excessive roller burnishing may produce flaking of the burnished surface.

Table 1 - Typical Stock Allowance for Microroll Burnishing (Note 1)

MATERIAL TYPE	WORKPIECE DIAMETER	"AS MACHINED" SURFACE FINISH (microinches RA)	SURFACE FINISH AFTER ROLLER BURNISHING (microinches RA)	STOCK ALLOWANCE
High Ductility (Note 2)	0.125" - 0.484"	80	8	0.0004"
		125	8	0.0007"
	0.500" - 1.000"	60	8	0.0007"
		125	8	0.0015"
	1.031" - 2.000"	60	8	0.0010"
		125	8	0.0020"
	2.031" - 6.500"	60	8	0.0015"
		125	8	0.0020"
		200	8	0.0030"
Low Ductility (Note 3)	0.125" - 0.484"	80	18	0.0004"
		100	18	0.0007"
	0.500" - 1.000"	90	18	0.0007"
		125	18	0.0010"
	1.031" - 2.000"	125	18	0.0010"
		180	20	0.0015"
	2.031" - 6.500"	120	18	0.0015"
		200	24	0.0020"

Note 1. This table is a guide to indicate the stock allowance needed for burnishing a machined surface (e.g., for burnishing high ductility material with a workpiece diameter of 0.500" - 1.000" and a machined surface finish of 125 microinches RA, a stock allowance of 0.0015" is needed).
Note 2. Materials with high ductility have more than 18% elongation and less than Rc 32. They include annealed steel, stainless steel, aluminum, brass, bronze and malleable iron.
Note 3. Materials with low ductility have less than 18% elongation and less than Rc 32. They include grey cast iron, modular iron, heat treated steels, magnesium alloys and hard copper alloys.

5.4 Tool Operation

5.4.1 Operate the burnishing tool as follows:

Step 1. Select the appropriate burnishing tool according to Table 2.

Step 2. Adjust the tool to a size that will allow the cage and roll to clear the diameter to be burnished (see Figure 1).

Table 2 - Tool Selection

DIAMETER SIZE RANGE	TOOLSERIES	DRIVE SHANK	
		STRAIGHT	MORSE TAPER
0.125" - 0.484"	6418	1/2" x 1 1/2"	NUMBER 1
0.500" - 0.625"	6419		
0.656" - 0.937"	6433		
0.968" - 1.187"	6444		
1.218" - 1.375"	6405		
1.406" - 1.812"	6406	3/4" X 1 1/2"	NUMBER 2
1.843" - 2.187"	6407		
2.218" - 2.687"	6408	1" X 1 1/2"	NUMBER 3
2.718" - 3.312"	6409		
3.343" - 4.062"	6410		
4.093" - 5.000"	6411		
5.031" - 5.875"	6412	1 1/2" X 5"	NUMBER 4
5.906" - 6.500"	6413		

Step 3. Gradually change the tool diameter while slowly sliding the tool deeper into the workpiece. An increase in resistance to the sliding motion indicates that the rolls are in contact with the diameter to be burnished. The setting achieved at this time is approximately the correct one to be used.

Step 4. Select and set the required machine speed and feed as listed in Table 3. If the drive machine for the roller burnishing tool does not have an automatic feed, allow the burnishing tool to feed at its natural rate.

Table 3 - Speed and Feed Rates

WORKPIECE DIAMETER	SPEED (RPM)	FEED (INCH/REV)
0.125 - 0.500"	900 - 750	0.004 - 0.011
0.500" - 1.500"	750 - 300	0.011 - 0.045
1.500" - 2.625"	300 - 160	0.045 - 0.070
2.625" - 3.750"	160 - 140	0.045 - 0.070
3.750" - 6.500"	140 - 90	0.070 - 0.115

Step 5. Test burnish a workpiece at the current setting.

Step 6. Examine the test workpiece and compare the results to the size and surface finish requirements. If the results do not meet the requirements, then adjust the tool accordingly, and recommence the test procedure. Do not burnish the test workpiece more than two times; if required, use a new test workpiece.

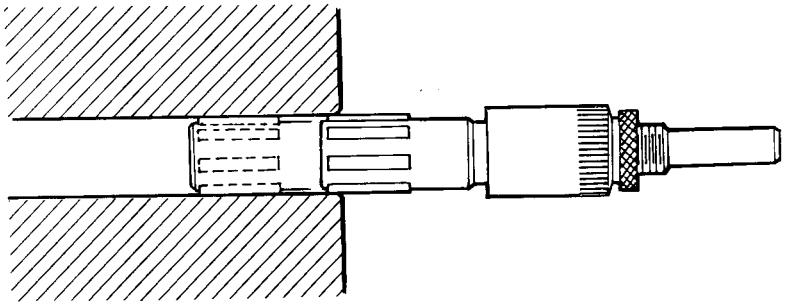

Figure 1 - Setting Burnishing Tool Diameter

6 Requirements

6.1 The burnished surface must be free of flaking caused by excessive material removal.

7 Safety Precautions

7.1 Wear approved safety glasses and hearing protection at all times while operating power tools.

8 Personnel Requirements

8.1 Personnel responsible for microroll burnishing must have a good working knowledge of the procedure and requirements as specified herein and must have exhibited their familiarity to their supervisor.