BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 1.47

PRODUCTION PROCESS STANDARD

Set-Up and Operation of Hand Routers

Issue 4
- This standard supersedes PPS 1.47, Issue 3.
- 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 the set-up and operation of DOTCO 10L4018A and DOTCO 10T4318 hand routers. It is acceptable to use alternative equipment to that specified herein provided that all the requirements of this specification are met.

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. 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

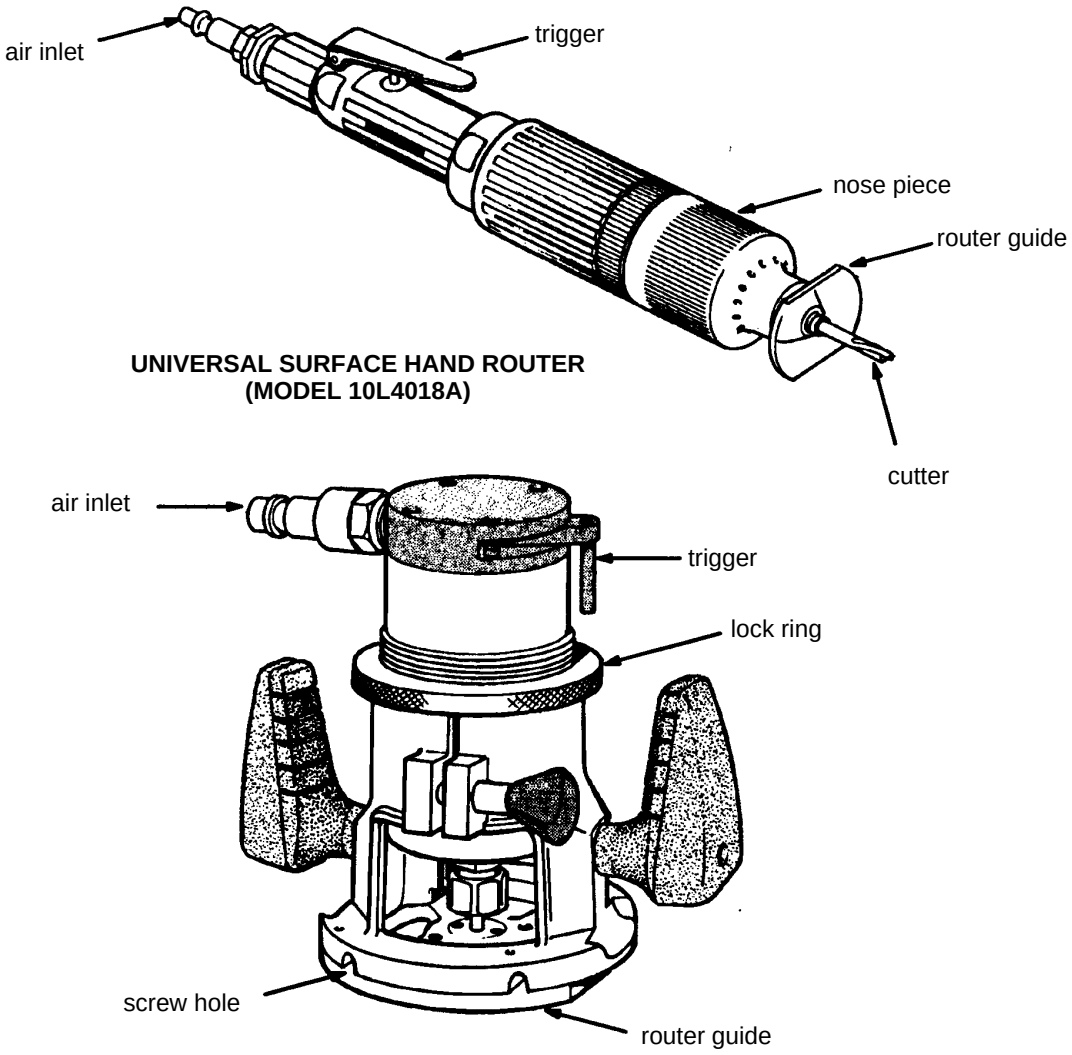
4.1.1 Cutting lubricant (e.g., Boelube, solid 70200 or liquid 70106).

4.2 Equipment

4.2.1 Hand routers (e.g., DOTCO 10L4018A or DOTCO 10T4318 as shown in Figure 1).

4.2.2 Router cutters (e.g., as specified in Table 1 or Table 2).

4.2.3 Router guides (e.g., as specified in Table 3 or Table 4).



UNIVERSAL SURFACE HAND ROUTER (MODEL 10L4018A)

HAND ROUTER - MODEL 10T4318 (for flat surfaces)

Figure 1 - DOTCO Hand Routers

5 Procedure

5.1 General

5.1.1 Hand routers are air operated, portable, high speed tools used primarily in assembly areas for making cut-outs such as window openings in metal skins, panels, or bulkheads. Hand routers may also be used for edge trimming.

5.1.2 Two of the types of hand routers available at Bombardier Toronto (de Havilland) are the DOTCO model 10L4018A with nose piece attachment and the DOTCO model 10T4318 with router base attachment. The model 10L4018A router may be used on all surfaces while the model 10T4318 router may only be used only on flat surfaces.

5.1.3 The router cutters are designed to perform in a specific material. Typical cutter sizes are 1/8" - 3/8" in diameter.

5.1.4 Router guides are available at Bombardier Toronto (de Havilland) in a range of tip diameters to suit the required setback.

5.1.5 Guide hand routers assembled with router guides by means of a template, a fixture, or a straight edge to control the shape required and to provide a means of holding the router square to the work surface.

5.1.6 Control the cutting action by moving the router either quickly or slowly on the work piece, as required.

5.2 Set-Up of Hand Routers

5.2.1 Set-up of the DOTCO model 10L4018A hand router (may be used on all surfaces) as follows:

Step 1. Select a cutter from Table 1 or Table 2, as applicable.

Step 2. Insert the cutter into the Erickson collet chuck and tighten firmly using suitable open end wrenches.

Step 3. Thread the nose piece onto the body of the hand router and tighten firmly.

Step 4. Select the applicable router guide from Table 3. Select a router guide with the largest usable base flange.

Step 5. Thread the router guide onto the nose piece attachment and tighten firmly.

5.2.2 Set-up of the DOTCO model 10T4318 hand router (used only on flat surfaces) as follows:

Step 1. Select a cutter from Table 1 or Table 2, as applicable.

Step 2. Insert into the Erickson collet chuck and tighten firmly using suitable open end wrenches.

Step 3. Select the applicable router base from Table IV. If required, install the applicable guide from Table IV on to the base by tightening the four screws.

Step 4. Assemble the router base attachment onto the body of the router, tighten it firmly by turning the lock ring and the screw type key.

5.3 Operation of Hand Routers

Step 1. Place the applicable template on the work surface and clamp the template and work piece securely.

Step 2. Firmly grasp the router and, with the cutter clear of the work piece, start the router by pressing the trigger.

Step 3. Slowly ease the cutter into the work piece until it is fully engaged in the cut.

- Make router cuts at the maximum spindle speed.
- The cutters may be lubricated using Boelube to improve the cutting action.
- For roughing, feed the router as fast as it will accept the work (approximately 1 - 3 feet/minute) without excessive slowing or chattering of the cutter. For finishing, feed the router at the fastest rate that will produce the required finish. For a smooth finish, make the feed rate approximately 3 - 4 four times higher than that of the roughing cut.
- Always maintain firm, continuous contact with the template.
- If edge trimming, move the router in the same direction as the cutter rotation at the point of contact (see Figure 2); this is vital to maintaining control of the tool.
- Do not allow the router cutter to slow down, as this will result in chattering and chip welding.

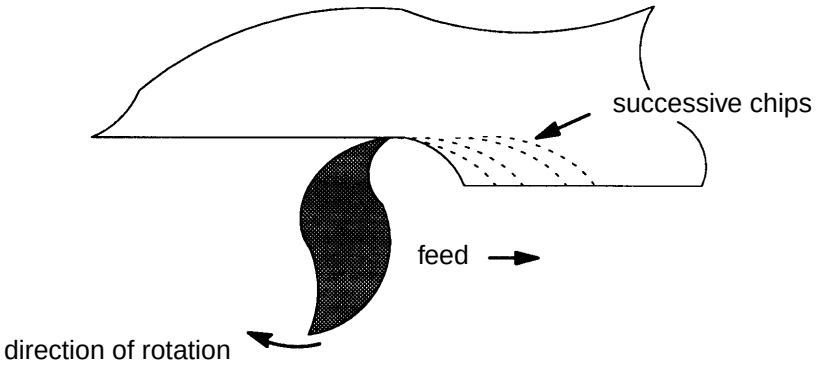


Figure 2 - Router Cutter Feed Direction

6 Requirements

6.1 Routed or trimmed aircraft skins must meet the requirements of edge distance and finish as specified by the engineering drawing or PPS.

7 Safety Precautions

7.1 Disconnect the air line before changing the cutting tool, and when the router is not in use.

7.2 Wear Bombardier Toronto (de Havilland) approved safety glasses and hearing protectors at all times while operating hand routers.

7.3 Keep hands clear of the partly exposed cutter at all times.

7.4 Do not place the router in such a manner that the trigger may be accidentally engaged.

7.5 Take care when operating the hand router. If operated incorrectly it may damage the work surface or injure the operator.

8 Personnel Requirements

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

9 Recommended Maintenance of Equipment

9.1 Repair routers experiencing uneven cutting, cutter wobble, etc. according to the manufacturer's instructions.

9.2 Every day a particular router will be used in production, insert a few drops of light machine oil into the air inlet of the router.

9.3 Replace damaged or badly worn parts, as necessary.

9.4 Rework or alter routing tools only if appropriately authorized.

Table 1 - Router Cutters, Down Cut Spiral for Aluminum Alloy

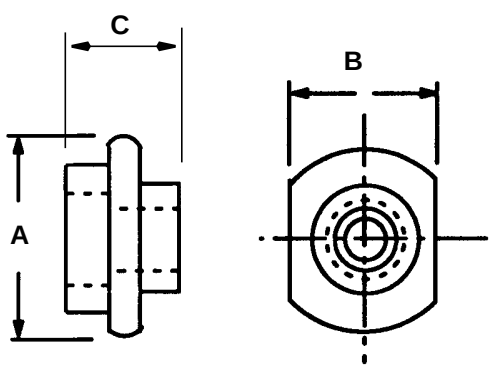
CUTTER DIAMETER	EFFECTIVE CUTTING LENGTH	OVERALL LENGTH	ROUTER CUTTER
0.125"	0.37"	2.31"	TS.521.15.10 MK 3
0.187"	1.00"	2.25"	TS.521.15.10 MK 2
0.250"	0.50"	2.25"	TS.521.15.10 MK 1
		3.00"	TS.521.15.10 MK 7
	0.62	1.68"	TS.521.16.10 MK 1
0.312"	0.50"	2.75"	TS.521.15.10 MK 8
	0.70"	3.00"	TS.521.15.10 MK 10
	0.87"	2.12"	TS.521.15.10 MK 4
		2.50"	TS.521.15.10 MK 5
0.375"	0.50"	2.75"	TS.521.15.10 MK 9
		5.00"	TS.521.15.10 MK 12
	0.87"	2.75"	TS.521.15.10 MK 6
		4.00"	TS.521.15.10 MK 11
0.4375"	1.00"	2.68"	TS.521.16.10 MK 2
0.5000"	1.25"	3.25"	TS.521.16.10 MK 3
0.6250"	1.37"	3.75"	TS.521.16.10 MK 4
0.6875"	1.62"	3.62"	TS.521.16.10 MK 5

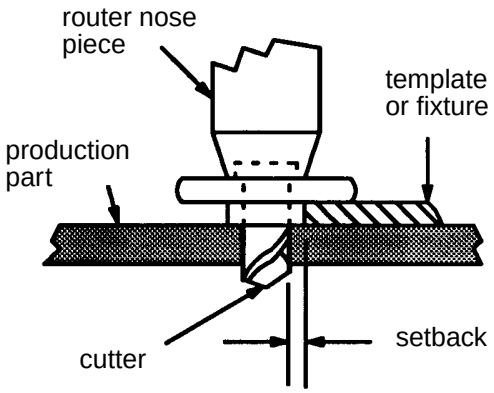
Note 1. TS.521.16.10: Four flute, centre cutting, end mil type.

Table 2 - Router Cutters for Routing Kevlar

CUTTER DIAMETER	EFFECTIVE CUTTING LENGTH	ROUTER CUTTER	
		TS.561.11.21	J.B. REID PART NO.
0.125"	---	MK 1	n/a
0.187"	---	MK 2	n/a
0.250"	0.75"	MK 3	B 1411
	1.25"	MK 4	B 1410
	1.50"	MK 5	n/a

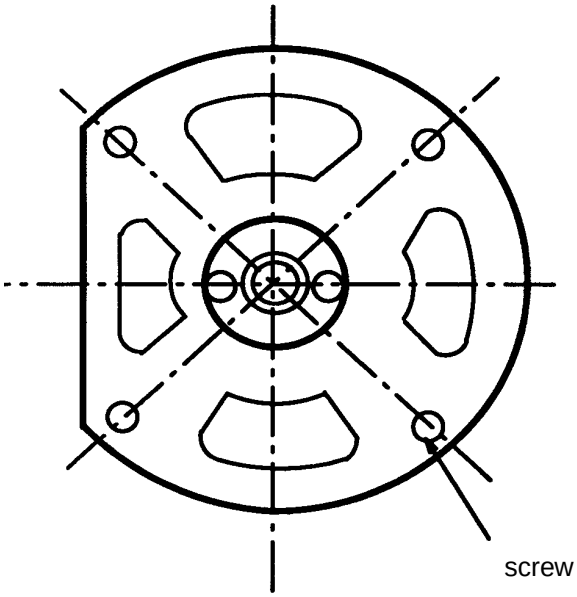
Table 3 - Router Guide Assembly for DOTCO Model 10L4018A

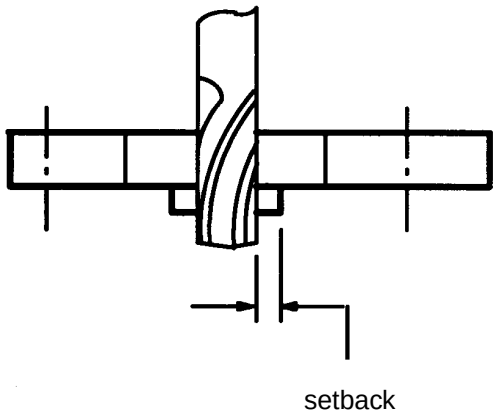




CUTTER DIAMETER	SETBACK	DIMENSION "A"	DIMENSION "B"	DIMENSION "C"	ROUTER GUIDE TS.521.19.11
0.250"	1/32" (0.031")	1.0"	0.86"	0.75"	MK 1
		2.0"	1.75"	0.75"	MK 2
			1.75"	1.70"	MK 5
	1/16" (0.062")	2.0"	1.75"	0.56"	MK 6
		6.0"	4.00"	0.56"	MK 9
	3/32" (0.094")	2.0"	1.75"	0.56"	MK 13
	1/8" (0.125")	2.0"	1.75"	0.56"	MK 7
				0.63"	MK 14
		6.0"	4.00"	0.56"	MK 8
	5/32" (0.156")	2.0"	1.75"	0.56"	MK 12
0.312"	1/32" (0.031")	1.0"	0.86"	0.75"	MK 3
	0.420"	1.58"	1.17"	0.80"	MK 11
	0.462"	1.85"	1.65"	0.75"	MK 10
0.375"	1/32" (0.031")	1.0"	0.86"	0.75"	MK 4

Table 4 - Router Base and Guides for DOTCO Model 10T4318





ROUTER BASE	SETBACK	ROUTER GUIDE
TS.521.04.10	0.055"	TS.521.04.14 MK 1 (height 0.6")
		TS.521.04.14 MK 2 (height 0.7")
	0.086"	TS.521.04.14 MK 3
	0.1175"	TS.521.04.14 MK 4
TS.521.04.13	0.239"	TS.521.04.18
TS.521.04.20	0.175"	TS.521.04.19