BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.32

PRODUCTION PROCESS STANDARD

Installation of Hole Sizing Sleeves

Issue 9
- This standard supersedes PPS 2.32, 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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	Quality	

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Tables

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the installation of hole sizing sleeves.

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 BM9010.05 (EO7336) - Substitution and Replacement Engineering Order (SREO).

3.2 PPS 1.09 - Drilling and Reaming.

3.3 PPS 1.33 - Countersinking for Flush Head Fasteners.

3.4 PPS 13.26 - General Subcontractor Provisions.

3.5 PPS 34.02 - Application of Alkyd Zinc Chromate Primer (F1).

3.6 PPS 34.08 - Application of Epoxy-Polyamide Primer (F19 & F45).

4 Materials and Equipment

4.1 Materials

4.1.1 Hole sizing sleeves as specified on the engineering drawing. Refer to Figure 1 and Figure 2 for a breakdown of the sleeve part numbers. Refer to Figure 3 for a general description of the sleeves. Refer to BM9010.05 (EO7336) for the status of replacement sleeves.

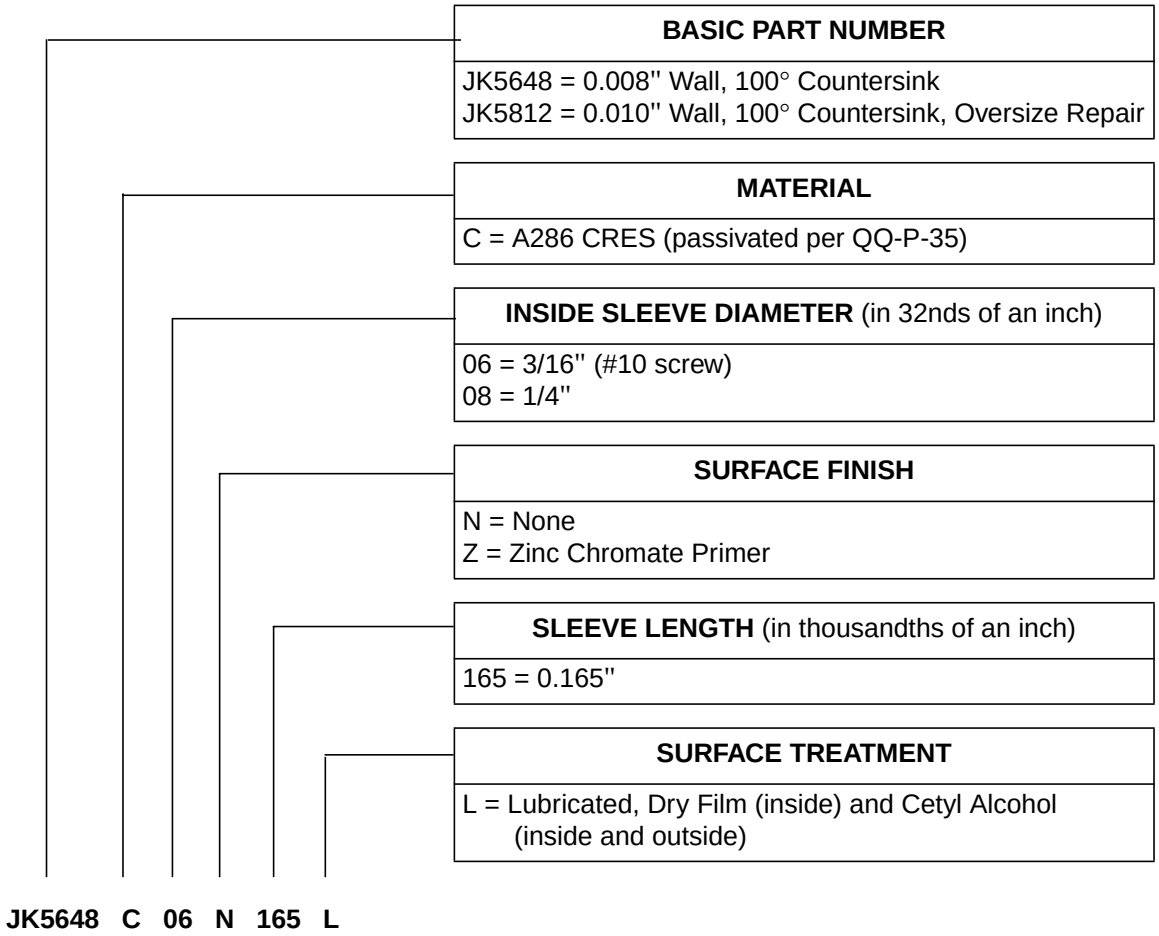


Figure 1 - Driving Washer Type Sleeve Part Number Breakdown

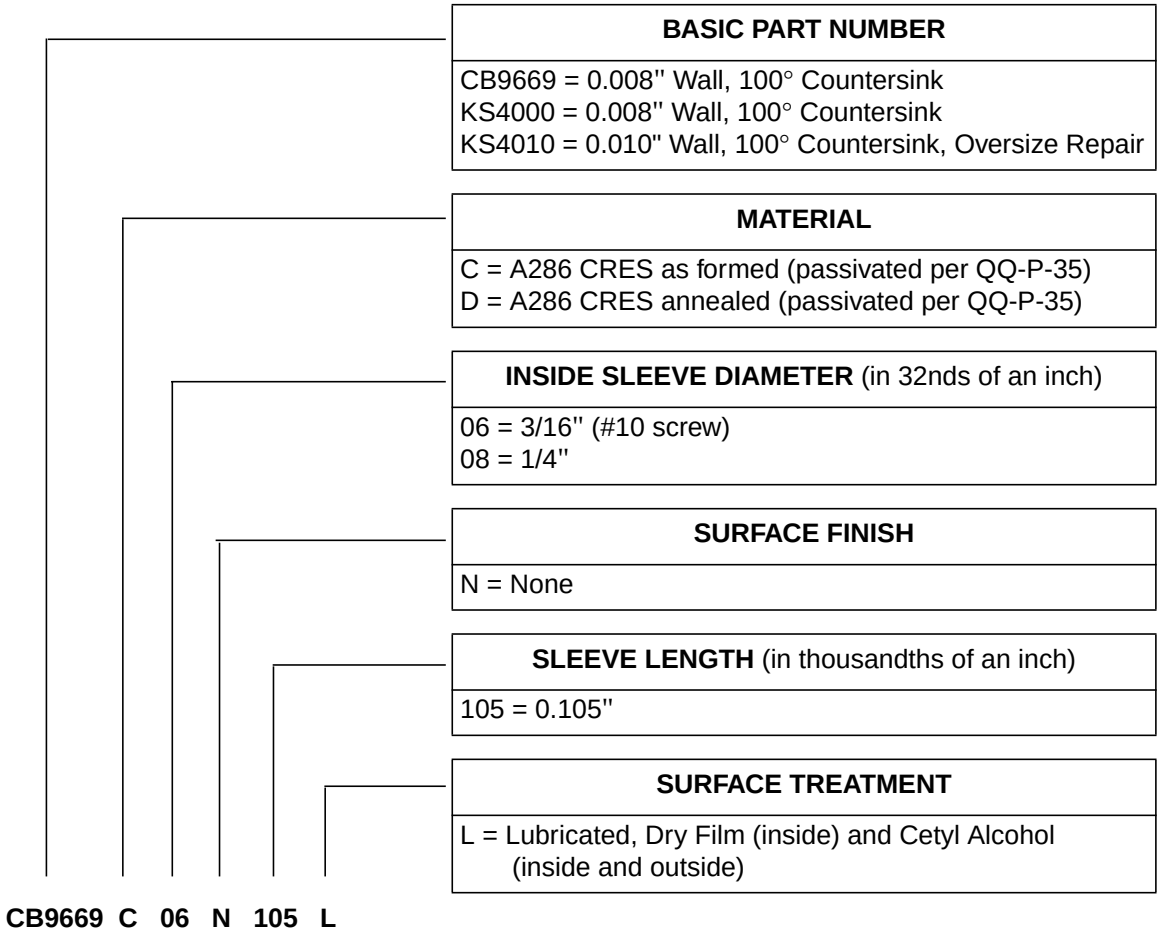


Figure 2 - Washerless Sleeve Part Number Breakdown

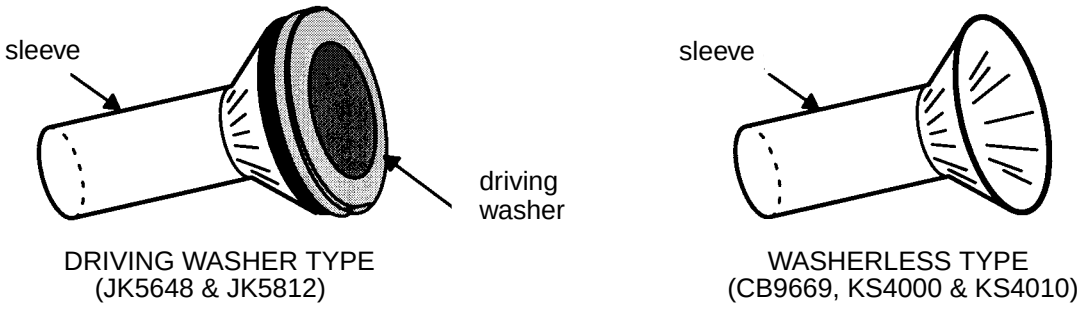


Figure 3 - Hole Sizing Sleeves

4.2 Equipment

4.2.1 Sleeve installation tools as specified in Table 2 and Table 4.

4.2.2 Sleeve punch (e.g., Acres #JK6536-xx).

4.2.3 Warding file, flat, smooth cut.

4.2.4 Sleeve removal tool (e.g., TS 465.10.17 MK3).

4.2.5 Plug gauges (e.g., Frank Cox Sales Ltd. P#####). Each plug gauge used at Bombardier Toronto (de Havilland) has a distinct inventory number. Plug sizes must be marked on the gauge ends.

4.2.6 Masking tape (e.g., 1/2" or 1" width).

5 Procedure

5.1 General

5.1.1 Hole sizing sleeves are specified for use where holes in fatigue sensitive, critical aircraft parts would be subject to damage from periodic removal of the fasteners.

5.1.2 There are two types of sleeves (see Figure 3), with washers (JK5648 and JK5812) and without washers (CB9669, KS4000 and KS4010).

5.1.3 Installation involves fitting the sleeve into a close tolerance hole and expanding the sleeve in place.

5.1.4 The installation procedure cold works the hole, providing compressive strength around the hole.

5.1.5 Perform all drilling and/or reaming according to PPS 1.09.

5.2 Hole Preparation

5.2.1 Prepare holes as follows:

Step 1. Pre-drill according to Table 1 for the recommended pre-drill size.

Step 2. Countersink holes according to PPS 1.33, to the dimensions specified in Table 1.

Step 3. Ream or drill the holes to the final hole size specified in Table 1.

Step 4. Prime the countersunk surfaces with F1 zinc chromate primer according to PPS 34.02 or F19 Type 2 epoxy-polyamide primer according to PPS 34.08.

Table 1 - Hole Preparation Data

SLEEVE		RECOMMENDED PRE-DRILL DIAMETER	COUNTERSINK DIAMETER	FINAL HOLE DATA	
SLEEVE	SIZE			RECOMMENDED DRILL OR REAMER SIZE	HOLE LIMITS
CB9669, JK5648 or KS4000	-06	#11 (0.191")	0.280" - 0.290"	0.2030"	0.2025" - 0.2045"
	-08	#11 (0.191")	0.315" - 0.325"	0.2653"	0.2640" - 0.2665"

5.3 Preparation of Tools

5.3.1 Prepare installation tools as follows:

Step 1. Select the pulling gun and self-releasing nose assembly as specified in Table 2.

Step 2. Install the applicable nose adapter (see Figure 4) selected from Table 2 over the nose piece and if necessary secure with tape.

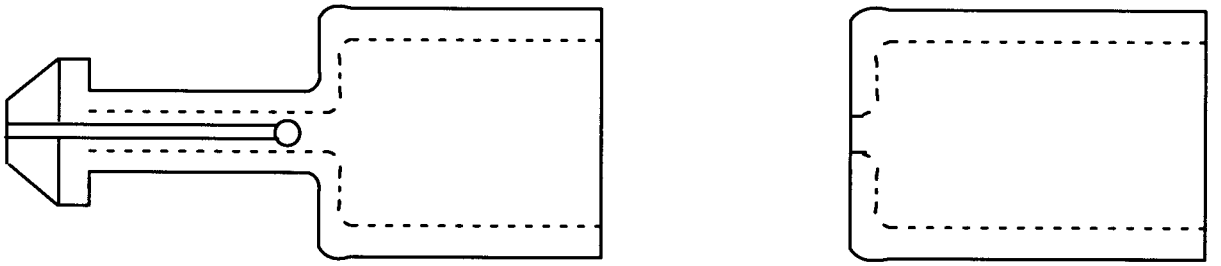
Step 3. Lubricate the gun spindle with a few drops of light machine oil.

Step 4. Check air line connections to ensure they are free of contamination. Inject a few drops of light machine oil into the air inlet of the gun and connect the air line. Keep the hose line as short as possible. Do not connect two air lines to the same outlet.

Step 5. Depress and release the gun trigger to check the gun action.

Table 2 - Installation Equipment

SLEEVE		NOSE ADAPTER	MANDREL	PULLING GUN	NOSE ASSEMBLY TYPE
TYPE	SIZE				
CB9669	-06	n/a	Note 1	Huck #352	Straight (self releasing type)
	-08	n/a	Note 1	Huck #353 or Cherry G83	
JK5648	-06	JK6550-06-.199	JK6540-06-.197	Huck #352	
KS4000	-06	KS1000-06	JK6540-06-.197	Huck #352	
	-08	KS1000-08	JK6540-08-.260	Huck #353 or Cherry G83	
Note 1. The CB9669 sleeves comes with a disposable mandrel used for sleeve installation purposes.					



COUNTERSUNK NOSE ADAPTER (KS1000-xx)

FLAT NOSE ADAPTER (JK6550-.199)

Figure 4 - Nose Adapters

5.4 Selection of Hole Sizing Sleeve Length

5.4.1 Select hole sizing sleeve length as follows:

Step 1. Select a sleeve of the approximate length required.

Step 2. Insert the sleeve into the prepared hole and while pressing firmly check the sleeve to ensure that the correct length has been selected. The protrusion limits of the sleeve shall be flush to 0.015" above flush (see Figure 5).

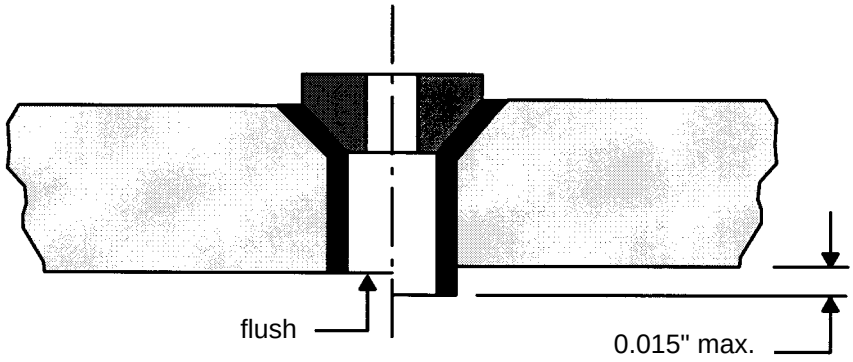


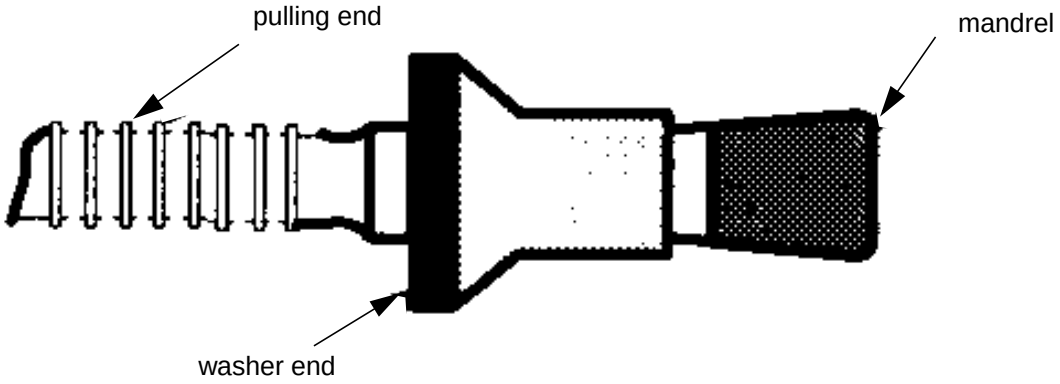
Figure 5 - Sleeve Protrusion Limits

5.5 Installation of Sleeves

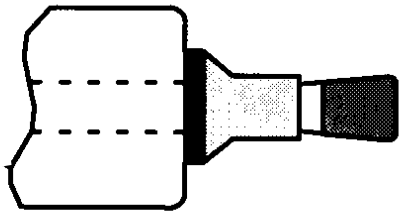
5.5.1 Install hole sizing sleeves as follows:

Step 1. Select the required tools from Table 2, for the type of sleeve to be installed.

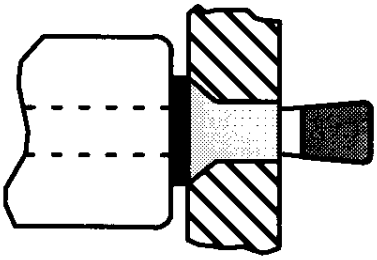
Step 2. Slide the mandrel through the sleeve until the sleeve bottoms on the mandrel taper. Ensure that the sleeve is correctly oriented on the mandrel, with the washer end or the flange end, as applicable, towards the pulling grooves.



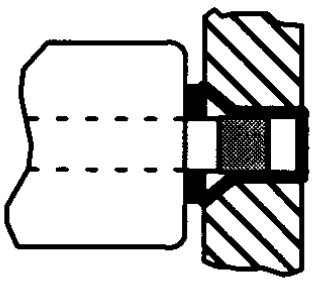
Step 3. Insert the mandrel into the gun until the washer (for JK5648 and JK5812 type) or the flange (for CB9669, KS4000 and KS4010 type) bottoms against the nose adapter (fitted on the gun nose piece).



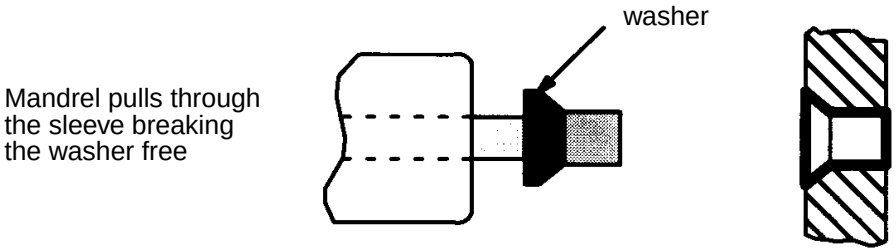
Step 4. Fit the mandrel end through the hole, pressing firmly and squarely against the work to ensure the sleeve seats properly.



Step 5. Squeeze and hold the gun trigger until the mandrel pulls completely through the sleeve before releasing the trigger. When installing JK5648 type sleeves, observe the sleeve countersink to ensure that the driving washer in the sleeve is removed after the installation. If necessary the washer may be removed by prying it off using a pointed tool.



Step 6. Using minimum force, pull the mandrel from the gun nose piece and, if necessary, remove the driving washer.



5.6 Repair

5.6.1 If the sleeve flare is above flush or, a visible gap exists between the flare and the prepared countersink, repair as follows (see Figure 6).

Step 1. Insert the end of a sleeve punch into the sleeve, bottoming the shoulder against the sleeve flare.

Step 2. Tap the punch end lightly with a hammer until the sleeve flare is fully seated.

Step 3. Carefully file the sleeve flares that are completely seated and remain above flush, using a 4" Warding file, until the flare is flush with the surrounding surface.

5.6.2 If the sleeve flare is below the flush limit requirements specified in Figure 8, remove the sleeve according to section 5.7 and check the countersink dimensions. If the countersink confirms to the dimensions specified in Table 1, select another sleeve according to section 5.4 and install according to section 5.5. Refer oversize countersinks to Liaison Engineering for disposition.

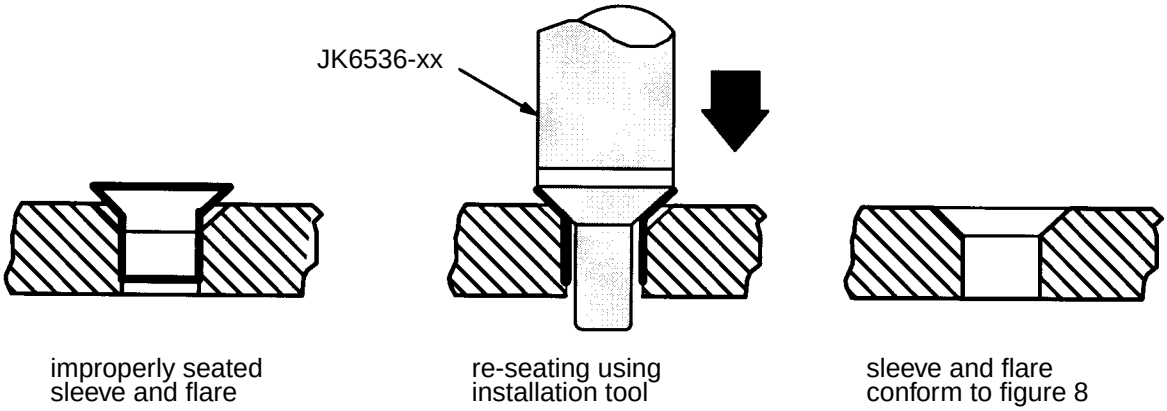


Figure 6 - Repair of Sleeve Flares

5.6.3 If the sleeve tail exceeds the protrusion limits shown in Figure 8, file the tail to length as follows:

Step 1. Apply 3 strips of masking tape, one over the other, at two locations, on either side of the sleeve (see Figure 7).

Step 2. Apply additional strips of tape to the surrounding structure to prevent it from being damaged by the file end.

Step 3. Using a 4" Warding file, gently file across the tail until the amount of protrusion meets the requirements of Figure 8.

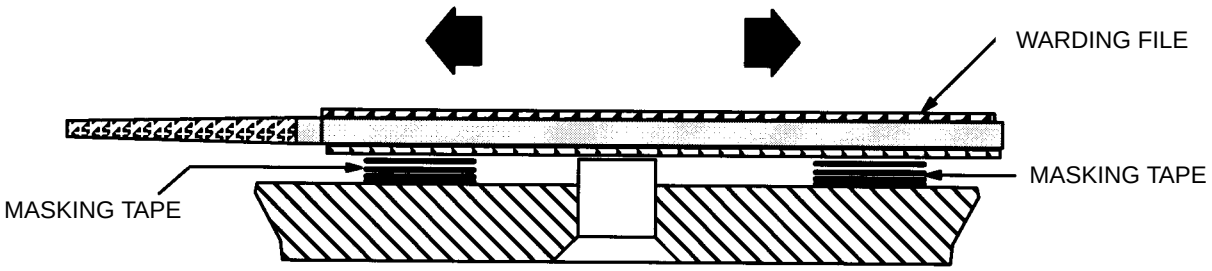


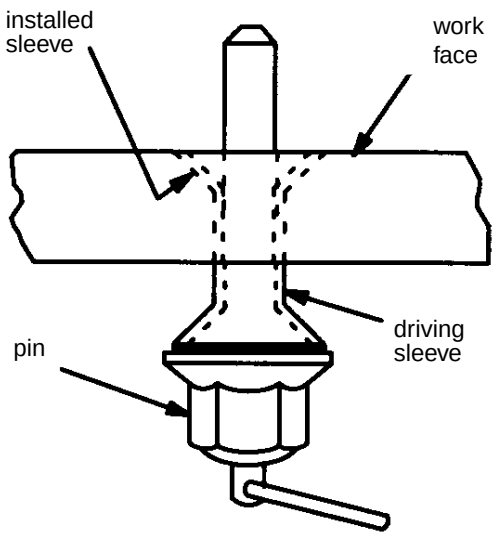
Figure 7 - Filing Sleeve Tails

5.6.4 If the sleeve tail is below flush as shown in Figure 8, remove the sleeve according to section 5.7 and select a new sleeve according to section 5.4 and install according to section 5.5.

5.7 Sleeve Removal

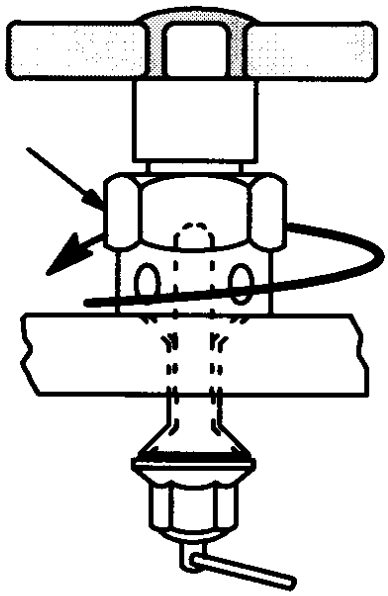
5.7.1 If required, remove installed sleeves using a sleeve removal tool as follows:

Step 1. Disengage the ball lock pin from the tool body and insert through the sleeve from the back of the installation. Ensure that the driving sleeve is correctly positioned on the pin.



Step 2. Fit the tool body to the face of the work surface, over the pin and engage the ball lock as shown.

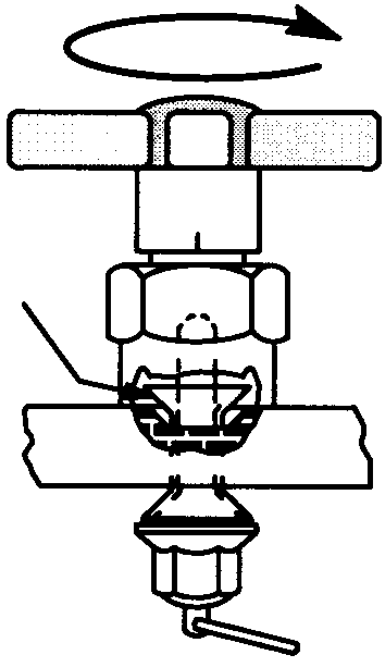
Step 3. Rotate the tool body up the work surface until it is snug.



Step 4. While holding the tool body, turn the knob clockwise 2 - 3 rotations. Observe the installed sleeve while turning the knob, pull out the sleeve sufficiently to permit gripping with pliers.

Step 5. Release the lock pin from the tool and remove the pin from the sleeve.

Step 6. Using suitable pliers, grip the sleeve flare and gently pull from the hole.



5.8 Installation of Oversize Sleeves

5.8.1 Installation of oversize sleeves is only acceptable if authorized in writing (e.g., via fastpath RNC) by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB. If authorized, install the specified oversize sleeve as follows:

Step 1. Prepare the hole according to Table 3.

Step 2. Install the oversize sleeve according to section 5.5 in the same manner as specified for standard sleeves using the tooling specified in Table 4. Before installation, grind or file the sleeve to the approximate length and after installation, file as required according to section 5.6.

Table 3 - Oversize Sleeve Hole Preparation Data

SLEEVE		COUNTERSINK DIAMETER	FINAL HOLE DATA	
TYPE	SIZE		RECOMMENDED DRILL OR REAMER SIZE	HOLE LIMITS
JK5812 or KS4010	-06	0.280" - 0.290"	0.2090"	0.2080" - 0.2130"

Table 4 - Oversize Sleeve Installation Equipment

SLEEVE		NOSE ADAPTER	MANDREL	PULLING GUN	NOSE ASSEMBLY TYPE
TYPE	SIZE				
JK5812	-06	JK6550-06-.199	JK6540-06-.197	Huck #352	Straight (self releasing type)
KS4010	-06	KS1000-06			

6 Requirements

6.1 Installed sleeves must meet the visual examination requirements specified in Figure 8.

6.2 Installed sleeves exhibiting evidence of cracking or deformation are not acceptable.

6.3 The flared sleeve end must be fully seated in the countersink and flush to 0.010" below flush with the part surface.

6.4 The inside diameter of the sleeves must be within the hole size specified on the engineering drawing.

6.5 Examine the tail of installed sleeves to ensure that the end is flush to 0.015" above flush with the part surface. Tail protrusion can be measured using a Craco G-21440 gauge (supplied with the kits) by aligning the 16 MILS mark on the gauge with the sleeve tail and drawing the gauge across the protrusion; the installation is acceptable if the gauge clears the tail protrusion.

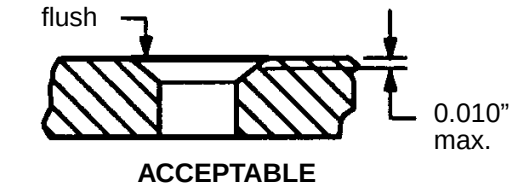
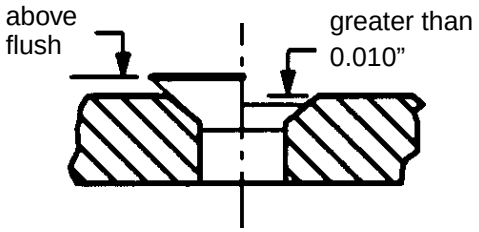
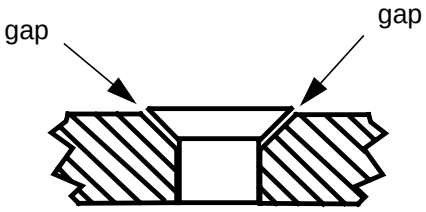
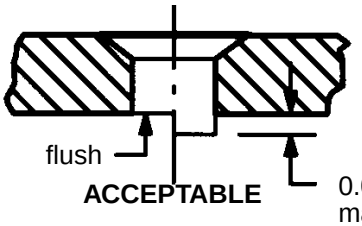
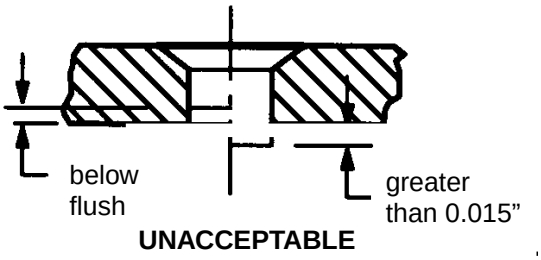
VISUAL APPEARANCE	DESCRIPTION	CORRECTIVE ACTION
 **ACCEPTABLE**  **UNACCEPTABLE**	**ACCEPTABLE** - Sleeve is flush to 0.010" below flush	NONE REQUIRED
	UNACCEPTABLE - Sleeve is above flush - Sleeve is more than 0.010" below flush	- ABOVE FLUSH - File flush according to section 5.6 - MORE THAN 0.010" BELOW FLUSH - Remove sleeve according to section 5.7 and check the countersink. If the countersink is correct, install a new sleeve. If the countersink is oversize refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB.
	**UNACCEPTABLE** - Sleeve flare not fully seated in countersink	- RESEAT using repair tools according to section 5.6
 **ACCEPTABLE**	**ACCEPTABLE** - Tail is flush to 0.015" above flush	NONE REQUIRED
 **UNACCEPTABLE**	**UNACCEPTABLE** - Tail is more than 0.015" above flush - Tail is below flush	- MORE THAN 0.015" ABOVE FLUSH - file flush according to section 5.6 - BELOW FLUSH - Remove the sleeve according to section 5.7 and install a longer sleeve

Figure 8 - Visual Examination of Installed Sleeves

7 Safety Precautions

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

8 Personnel Requirements

8.1 Personnel responsible for installation of hole sizing sleeves must have a good working knowledge of the procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.

9 Recommended Maintenance of Equipment

9.1 Keep Installation tools clean and dry; lightly oil or grease moving parts.

9.2 Check installation tools periodically. Replace damaged or badly worn parts.

9.3 Alterations or rework of installation tools or accessories require approval.

9.4 Check nose piece chuck jaws periodically and clean the grooves thoroughly.

9.5 At Bombardier Toronto (de Havilland), tool kits have been prepared (see Table 5) containing the necessary cutting tools, mandrel and nose adapter required for the installation of certain hole sizing sleeves (see Table 2).

Table 5 - Bombardier Toronto (de Havilland) Tool Kits

SLEEVE		DE HAVILLAND KIT NUMBER
TYPE	SIZE	
JK5648	-06	SD 6138
KS4000	-06	4557000001-001-84
	-08	85713500-001-84