BOMBARDIER

Toronto Site

PROPRIETARY INFORMATION

PPS 2.72

PRODUCTION PROCESS STANDARD

INSTALLATION OF "COMPOSI-LOK" TITANIUM BLIND FASTENERS FOR COMPOSITE APPLICATIONS

Issue 7
- This standard supersedes PPS 2.72, Issue 6.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS related questions to michael.wright@aero.bombardier.com or (416) 375-4365
- This PPS is effective as of the distribution date.

Signed original on file. Validation of paper prints is the responsibility of the user.

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Table of Contents

Sections **Page**

Figures

Tables

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the installation of B0207001 and B0207002 “Composi-Lok” titanium blind fasteners for use in composite applications.

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 Site), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier (Toronto Site) 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 Site) Environment, Health and Safety Department.

3 References

3.1 General

3.1.1 Unless a specific issue is indicated, the issue of the reference documents specified in this section in effect at the time of manufacture shall form a part of this specification to the extent indicated herein.

3.2 Bombardier (Toronto Site) Specifications

3.2.1 PPS 1.01 - Dimpling Aluminum Alloys.

3.2.2 PPS 1.07 - Dimpling of Ferrous, Nickel and Titanium Alloys.

3.2.3 PPS 1.09 - Drilling and Reaming.

3.2.4 PPS 1.33 - Countersinking for Flush Head Rivets.

3.2.5 PPS 13.26 - General Subcontractor Provisions.

3.2.6 PPS 27.05 - Manual Edge Finishing.

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

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

4 Materials and Equipment

4.1 Materials

4.1.1 Unless otherwise specified in this section, use only the materials specified; use of superseding or alternative materials is not allowed.

4.1.2 "Composi-Lok" titanium blind fasteners for use in composite applications as specified on the engineering drawing. Refer to Figure 1 for a breakdown of Bombardier fastener part numbers. Refer to Figure 2 for a general description.

BASIC PART NUMBER

B0207001 - Fastener blind, 130° flush head, titanium, composite applications
B0207002 - Fastener blind, low profile protruding head, titanium, composite applications

DIAMETER DASH NUMBER

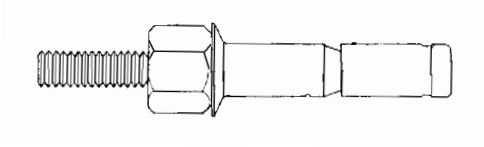
DIAMETER DASH NUMBER	NOMINAL DIAMETER	DIAMETER DASH NUMBER	NOMINAL DIAMETER
-5	0.1635"	-8	0.2585"
-6	0.1975"	-9	0.2885"
-7	0.2265"	-10	0.3105"

GRIP DASH NUMBER

GRIP NUMBER	GRIP RANGE	GRIP NUMBER	GRIP RANGE
-100	0.050" - 0.100"	-350	0.300" - 0.350"
-150	0.100" - 0.150"	-400	0.350" - 0.400"
-200	0.150" - 0.200"	-450	0.400" - 0.450"
-250	0.200" - 0.250"	-500	0.450" - 0.500"
-300	0.250" - 0.300"	-550	0.500" - 0.550"

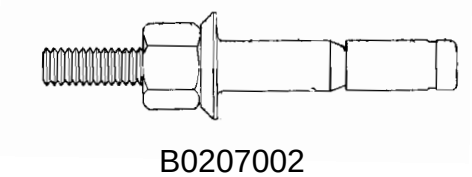
B0207001 -5 -100

Figure 1 - Breakdown of Bombardier Part Numbers



B0207001

Fastener blind, 130° flush head, titanium, composite applications



B0207002

Fastener blind, low profile protruding head, titanium, composite applications

Figure 2 - "Composi-Lok" Titanium Blind Fasteners for use in Composite Applications

4.2 Equipment

4.2.1 130° micro-stop countersink (e.g., Wesco Aircraft AT445CTE-8 or AT445CTG-8).

4.2.2 Fastener installation tools (see following examples):

- pneumatic pistol, Monogram Aerospace Fasteners MP550BF.
- pneumatic right angle, Monogram Aerospace Fasteners MR 550.
- pneumatic right angle close quarter, Monogram Aerospace Fasteners MRC 550.
- close quarter hand tool, Monogram Aerospace Fasteners MHC 75 A/B.

4.2.3 Nose adaptors and wrench adaptors (e.g., as specified in Table 5 and Table 6).

4.2.4 Grip scale (e.g., Monogram BFS 1A).

4.2.5 Deburring tool (e.g., SD8066 Vixen file).

4.2.6 Aluminum oxide abrasive paper, 180 - 220 grit.

4.2.7 Fastener removal kit (e.g., Monogram Aerospace Fasteners RK5000).

4.2.8 Aluminum faced support blocks (e.g., SD8853).

5 Procedure

5.1 General

5.1.1 If possible, keep fasteners in their original containers. If this is not possible, store fasteners in non-absorbent containers.

5.1.2 B0207001 and B0207002 blind fasteners are lubricated by the manufacturer. Protect fasteners at all times from dust, dirt, moisture and excessive heat. Wiping with a dry cloth to remove shop soil such as swarf is acceptable provided that the lubricant applied by the manufacturer is not removed. Do not apply any additional lubricant to the fasteners.

5.1.3 Composites being used today are capable of sustaining high loads but are subject to delamination when fastened with conventional fasteners. This is especially true when blind fasteners are used or where high unit bearing stresses are imparted to the joint. B0207001 and B0207002 blind fasteners (commercially known as Composi-Lok II fasteners) overcome the damage to the composite part by providing a large blind side upset which distributes the bearing loads over a large area. A large blind side "foot print" permits the fastener to exert a very high clamp-up load to the structure without damaging the composite.

5.2 Preparation of Holes

5.2.1 Prepare holes as follows:

Step 1. Assemble the parts in the orientation specified on the engineering drawing.

Step 2. Drill pilot holes according to PPS 1.09 (see Table 1).

Table 1 - Preparation of Pilot Hole

FASTENER DIAMETER	RECOMMENDED PILOT DRILL	FASTENER DIAMETER	RECOMMENDED PILOT DRILL
-5 (0.1635")	#27 (0.144")	-8 (0.2585")	#1 (0.228")
-6 (0.1975")	#16 (0.177")	-9 (0.2885")	1/4" (0.250")
-7 (0.2265")	#11 (0.191")	-10 (0.3105")	L (0.290")

Step 3. For flush head fasteners, countersink the fastener holes to the countersink diameter specified in Table 2. If micro-stop countersink cutters with full size pilots are available, it is acceptable to countersink and drill the hole to final size specified in Table 3, simultaneously.

Table 2 - Countersink Diameter

FASTENER DIAMETER	130° COUNTERSINK DIAMETER	FASTENER DIAMETER	130° COUNTERSINK DIAMETER
-5 (0.1635")	0.325" - 0.332"	-8 (0.2585")	0.499" - 0.507"
-6 (0.1975")	0.378" - 0.385"	-9 (0.2885")	0.530" - 0.538"
-7 (0.2265")	0.409" - 0.416"	-10 (0.3105")	0.626" - 0.635"

Step 4. Unless previously drilled to final size using a micro-stop countersink, drill the fastener holes to final size specified in Table 3 according to PPS 1.09.

Table 3 - Final Hole Diameter

FASTENER DIAMETER	RECOMMENDED DRILL SIZE	HOLE SIZE
-5 (0.1635")	0.165"	0.165" - 0.168"
-6 (0.1975")	0.200"	0.199" - 0.202"
-7 (0.2265")	0.228"	0.228" - 0.231"
-8 (0.2585")	0.261"	0.260" - 0.263"
-9 (0.2885")	0.290"	0.290" - 0.293"
-10 (0.3105")	0.312"	0.312" - 0.315"

Step 5. On metallic parts, edge corner relieve the fastener hole (see Figure 3) according to PPS 27.05 to produce a slight chamfer. On composite parts, remove sharp hole edges or ridges of excess resin using abrasive paper (ref. para. 4.2.6); take care to avoid exposing the reinforcing fibres.

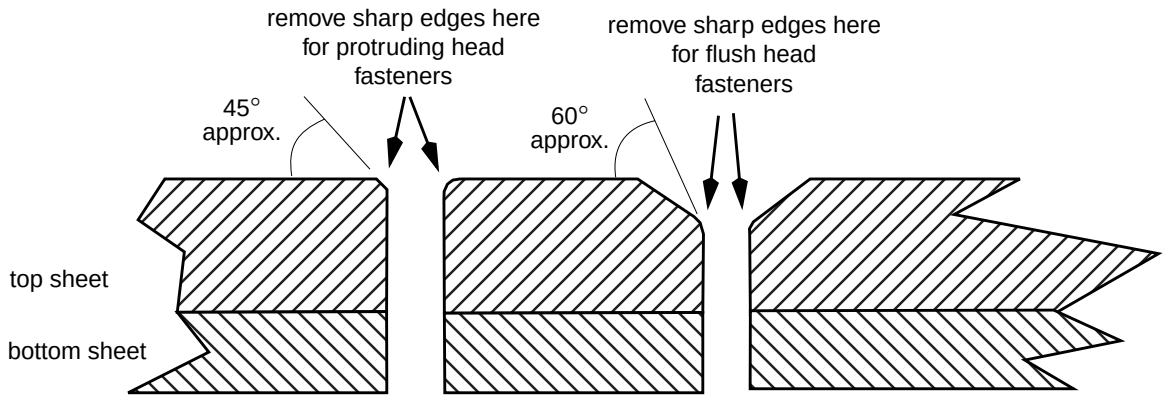


Figure 3 - Preparation of Hole Edges for Fastener Seating

Step 6. On metallic parts, disassemble the parts to remove chips and metal cuttings from the faying surfaces if possible.

Step 7. On metallic parts, remove the standing burr from the exit hole side of the part using a Vixen file (ref. para. 4.2.5).

Step 8. Prime the countersunk surfaces in metal parts with a coat of F1 zinc chromate primer according to PPS 34.02 or F19 Type 2 epoxy-polyamide primer according to PPS 34.08.

5.2.2 On a sample basis, check at random (across the entire pattern) the number of holes specified in Table 4 for conformance to the hole limit requirements of Table 3 using a GO/NO-GO gauge, a plug gauge or other hole measuring gauge. If any oversize holes are found in the sample, check every hole in the pattern. Refer all oversize holes to Bombardier (Toronto Site) MRB or Bombardier (Toronto Site) delegated MRB for disposition.

5.2.2.1 While checking holes using a GO/NO-GO gauge or other hole measuring gauge, also check visually for hole ovality. For holes with a visually evident oval or out of round shape, check the hole diameter at several positions using suitable hole measurement equipment (e.g., vernier calliper, hole micrometer, etc.) to determine the minor and major diameters of the hole. The minor and major diameters of the hole must be within the minimum and maximum hole diameter tolerances, respectively. If the minor or major diameters of any oval hole in the sample are not within the minimum and maximum hole diameter tolerance, check every hole in the pattern for conformance to the hole limit requirements and visually for ovality as specified herein. Refer all non-conforming holes to Bombardier (Toronto Site) MRB or Bombardier (Toronto Site) delegated MRB for disposition.

Table 4 - Hole Size Verification Sample Requirements

NUMBER OF HOLES IN PATTERN	REQUIRED SAMPLE SIZE
5 or less	all
6 - 50	5
51 - 90	7
91 - 150	11

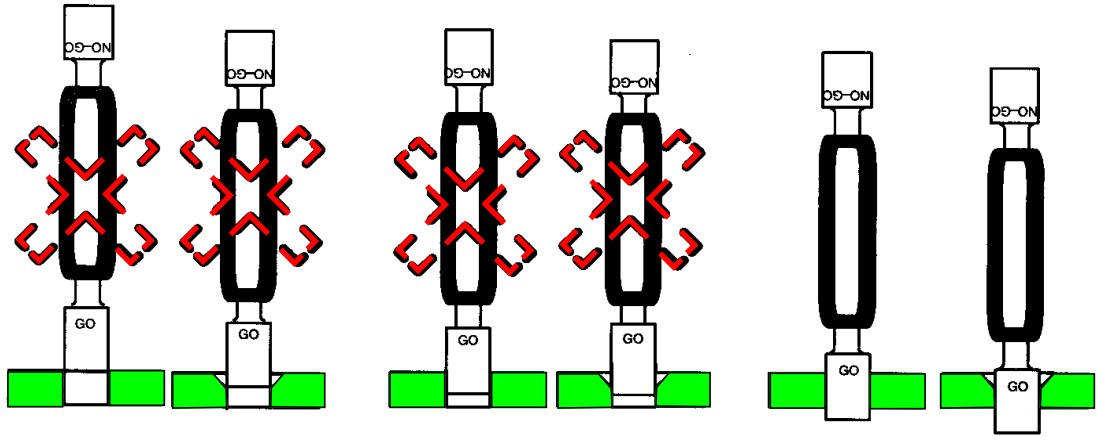
NUMBER OF HOLES IN PATTERN	REQUIRED SAMPLE SIZE
151 - 280	13
281 - 500	16
more than 500	19

5.3 Use of GO/NO-GO Gauges

5.3.1 Check selected fastener holes for conformance to the requirements of Table 3 using the applicable GO/NO-GO gauge as follows (see Figure 4):

Step 1. Taking care not to force or rotate the go/no-go gauge, lightly insert the go end of the gauge into the fastener hole. If the go end of the gauge goes in only partially or does not go into the hole at all, the hole is **undersize**. Open undersize holes to the final diameter specified in Table 3.

Step 2. Lightly insert the no-go end of the gauge in the fastener hole. If the gauge goes completely into the hole, the hole is **oversize**; oversize holes are not acceptable and must be referred to Bombardier (Toronto Site) MRB or Bombardier (Toronto Site) delegated MRB for disposition.

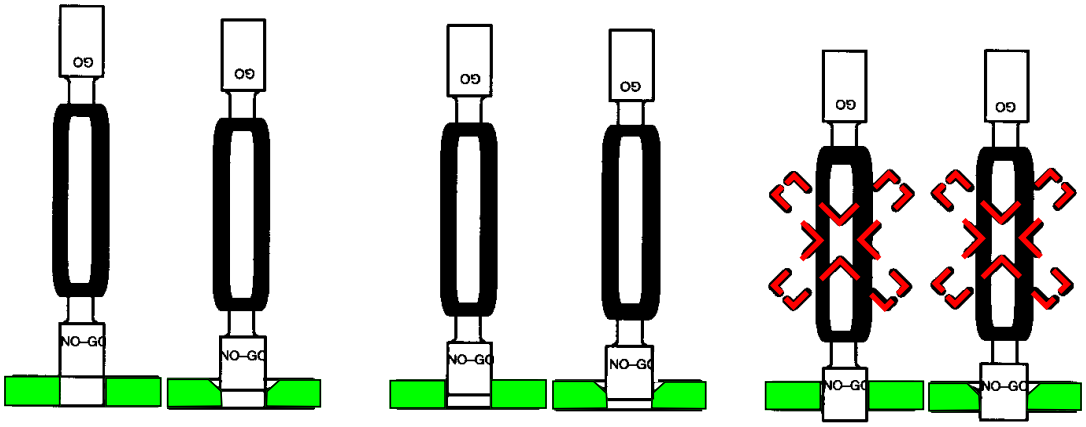


Does not go in.
UNDERSIZE HOLE

Goes only partially in.
UNDERSIZE HOLE

Goes in completely.
ACCEPTABLE

USE OF GO END



Does not go in.
ACCEPTABLE

Goes only partially in.
ACCEPTABLE

Goes in completely.
OVERSIZE HOLE

USE OF NO-GO END

Figure 4 - Use of Go/No-Go Gauges

5.3.2 Fastener Selection

5.3.3 Install only the type and diameter of fastener specified on the engineering drawing.

5.3.4 In order to verify that the grip length specified is correct, measure the combined material thickness, after final drilling, using a grip gauge (ref. para. 4.2.4) as shown in Figure 5. The fastener grip length specified on the product specification, shop order or assembly manual is only a reference length, and if the grip length determined by measurement does not agree with the specified grip length, use the measured grip length. Always read to the next higher number as shown in Figure 5 (i.e., if the reading is past the **end** of the -200 marking then use a -250 fastener). If a tapered sheet condition exists, use the grip length indicated for the thickest section.

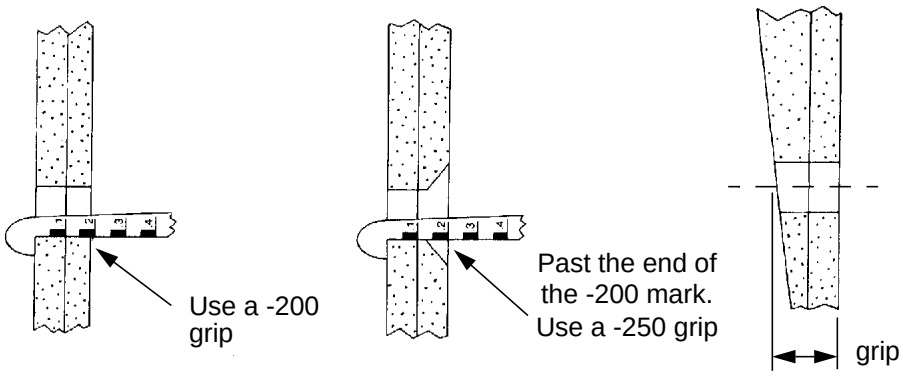


Figure 5 - Use of Grip Gauge

5.4 Selecting Installation Tools

5.4.1 Install B0207001 and B0207002 blind fasteners using installation tools specified in Table 5 or Table 6. Close quarter tooling (i.e., MRC 550) is intended for use in limited access areas.

Table 5 - Pneumatic Installation Tools

FASTENER DIAMETER	PNEUMATIC MOTOR MP550BF		PNEUMATIC RIGHT ANGLE MR 550		PNEUMATIC RIGHT ANGLE CLOSE QUARTER MRC 550	
	NOSE ADAPTOR	WRENCH ADAPTOR	NOSE ADAPTOR	WRENCH ADAPTOR	NOSE ADAPTOR	WRENCH GEAR
-5 (0.1635")	MPPBF-8	MPBF-5	MRPDN-1	MRBFDN-5	MRCPDN-1	MRCBF-5
-6 (0.1975")		MPBF-6		MRBFDN-6		MRCBF-6
-7 (0.2265")		MPBF-7	MRPDN-2	MRBFDN-7	MRCPDN-2	MRCBF-7
-8 (0.2585")		MPBF-8		MRBFDN-8		MRCBF-8
-9 (0.2885")	MPP-12	MPTBF-10	N/A		N/A	
-10 (0.3105")						

Note 1. Refer to Figure 6 for general descriptions of installation tools.

Table 6 - Hand Installation Tools

FASTENER DIAMETER	HAND TOOL MHC 75 A		HAND TOOL MHC 75 B	
	NOSE ADAPTOR	WRENCH ADAPTOR	NOSE ADAPTOR	WRENCH ADAPTOR
-5 (0.1635")	MHCPDN-1	MHCBF-5	N/A	
-6 (0.1975")		MHCBF-6		
-7 (0.2265")	N/A		MHCPDN-2	MHCBF-7
-8 (0.2585")				MHCBF-8
-9 (0.2885")			MHCPDN-3	MHCBF-9
-10 (0.3105")				MHCBF-10
Note 1. Refer to Figure 6 for general descriptions of installation tools.				

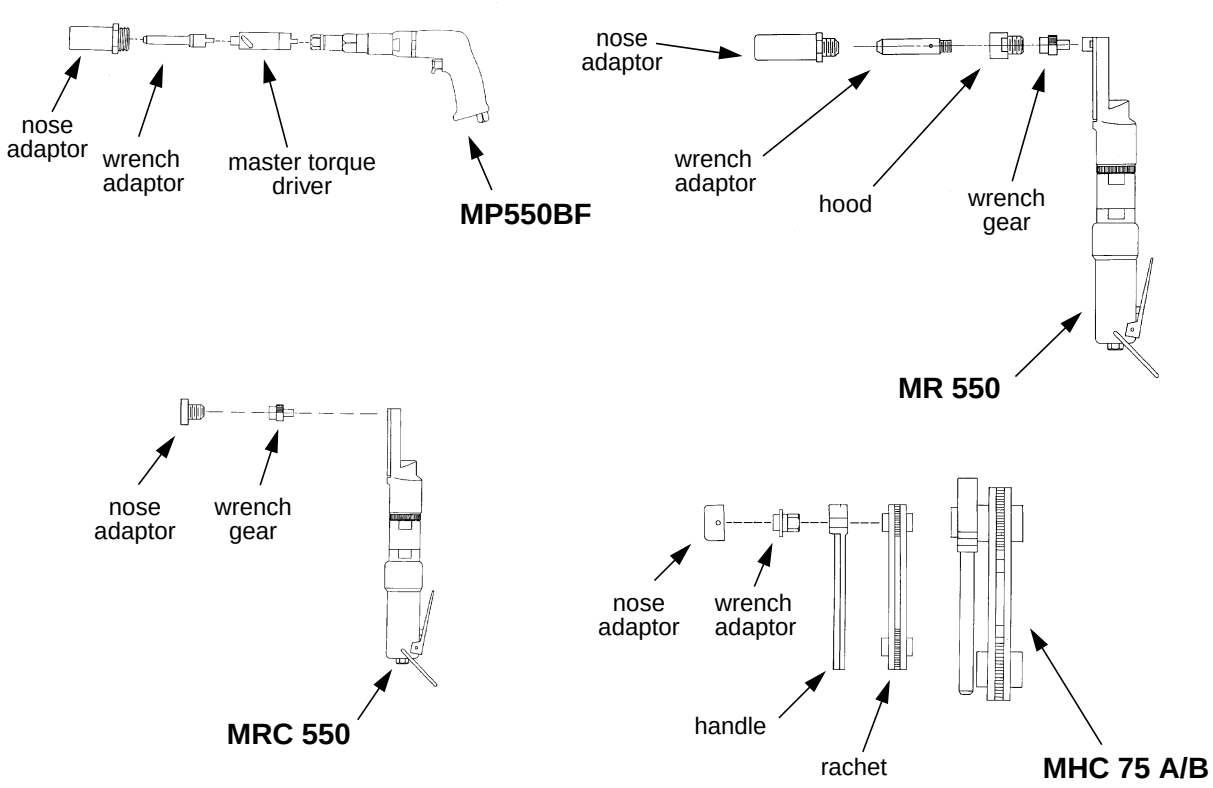


Figure 6 - Installation Tools

5.5 Installation of Fasteners

5.5.1 Install fasteners as follows (see Figure 7):

Step 1. Clamp parts to be riveted tightly using Cleco type temporary fasteners in every 4th to 6th rivet hole. Ensure all holes are in alignment with no excessive gaps existing between sheets.

Step 2. Insert the first fastener into the prepared hole.

Step 3. Place the nose piece of the installation tool over the screw so that the wrench flats and drive nut are engaged.

Step 4. Squeeze the trigger of the installation tool, applying torque to the screw while holding the drive nut stationary.

Step 5. If the drive nut was not already threaded down tight then both the screw and the fastener body will rotate until the drive nut is jammed against the fastener body, restraining further rotation of the fastener body.

Step 6. As the screw advances through the fastener body, the sleeve will be drawn up over the tapered nose of the fastener body to begin formation of the blind head.

Step 7. Continued tightening will remove sheet gap, complete the large blind head and clamp the sheets together.

Step 8. When the fastener is fully installed the screw will automatically fracture at its break groove, allowing the installation tool to be removed.

Step 9. Remove and discard the pin tail/drive nut assembly.

Step 10. Install the remaining fasteners according to Step 2 through Step 9.

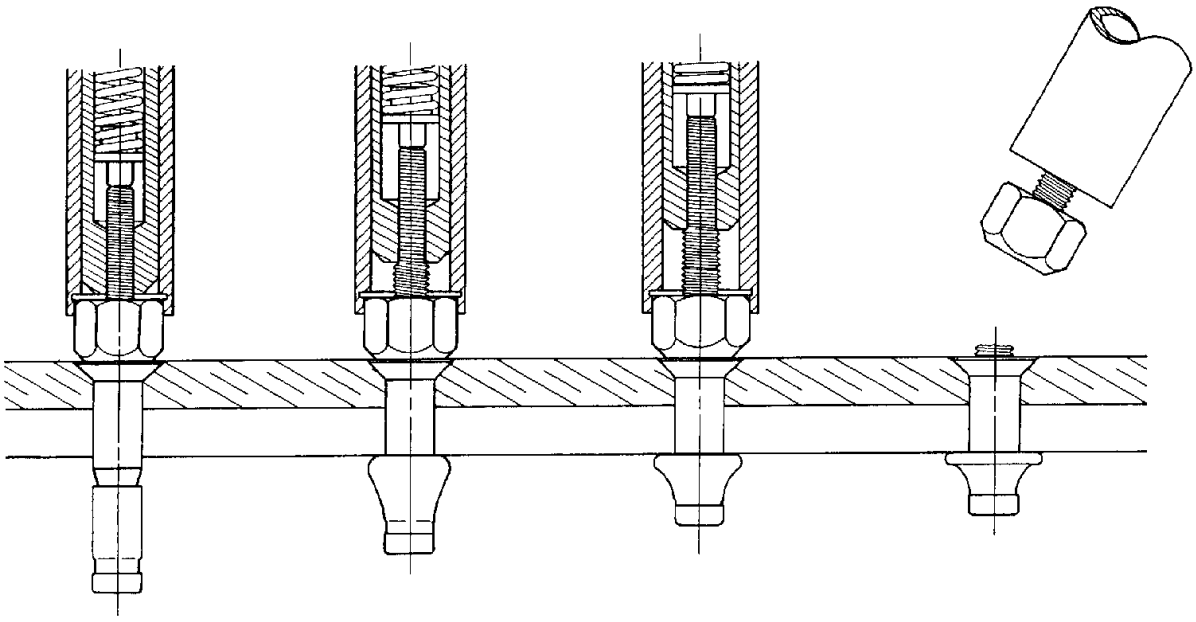


Figure 7 - Typical Fastener Installation

5.6 Removal of Installed Fasteners

5.6.1 If available, use an RK5000 fastener removal kit to remove installed fasteners. If an RK5000 kit is not available remove installed fasteners as follows:

Step 1. Place a drill guide block equipped with a target over the fastener head. Refer to PPS 1.09 for guide block selection.

Step 2. Align the centre of the target with the centre of the fastener head.

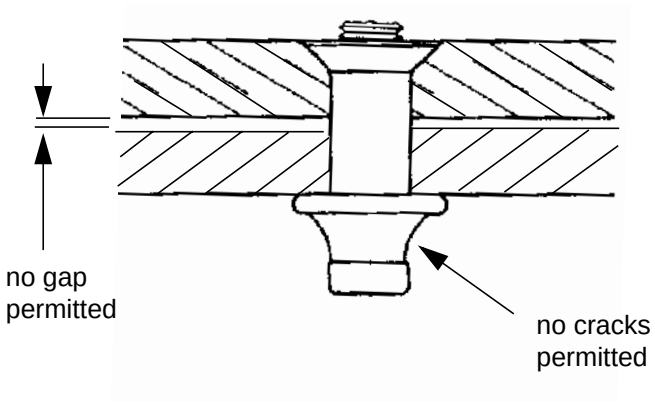
Step 3. Assemble the appropriate renewable slip bushing into the drill guide block. Refer to PPS 1.09 for bushing selection.

Step 4. Using a centre drill approximately 1/8" diameter larger than the fastener hole, drill off the fastener head. Take care to avoid damaging the walls of the fastener hole.

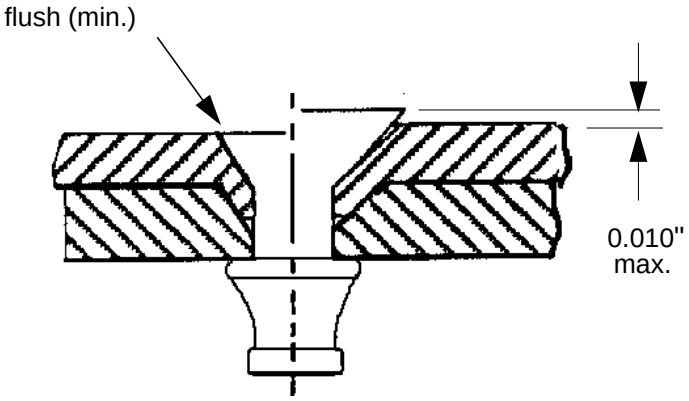
Step 5. Remove the fastener shank by lightly tapping the shank of the fastener with a flat punch with slightly rounded corners. If possible, support the opposite side of the structure using an aluminum faced support block (ref. para. 4.2.8).

6 Requirements

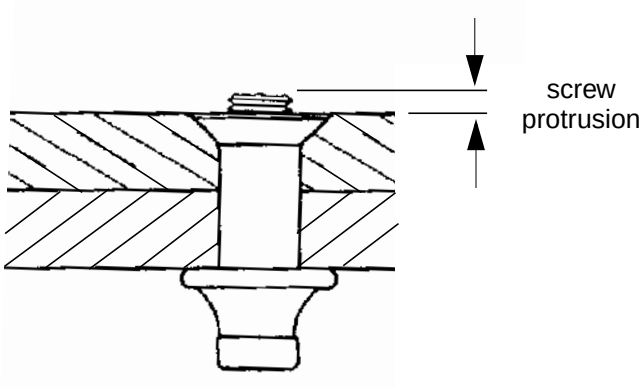
6.1 There must not be any gap between the sheets and no cracks in the shop head.



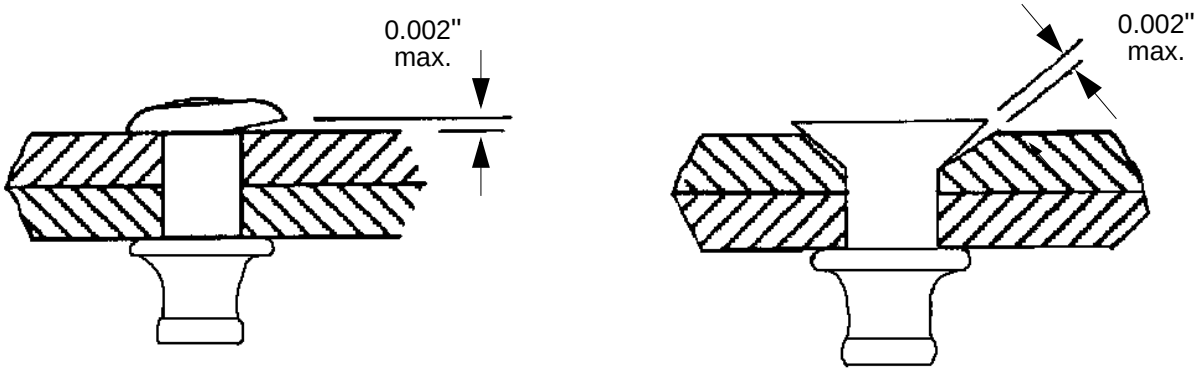
6.2 The head of flush type fasteners must not be below flush or more than 0.010" above flush.



6.3 The screw thread must not be below flush or protrude more than 0.103" above flush. On protruding head fasteners measure the screw break-off limits from the surface. On flush head fasteners measure the screw break-off limits from the head of the fastener. If specified (e.g., for safety or aerodynamic purposes), shave or file **acceptable** screw protrusions flush with the fastener head. Any marking of the fastener head when shaving or filing is unacceptable.



6.4 Any gap under the head of the fastener must be on one side only, not extend to the shank and be less than 0.002" (i.e., it must not be possible to insert the edge of a 0.002" feeler gauge into the gap).



7 Safety Precautions

7.1 The safety precautions specified herein are specific to Bombardier Toronto to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

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

8 Personnel Requirements

8.1 Personnel responsible for the installation of Composi-Lok blind fasteners for use in composite applications must have a good working knowledge of the procedure and requirements as specified herein and shall have exhibited their familiarity to their supervisor.

9 Maintenance of Equipment

9.1 It is recommended that a few drops of light machine oil be injected into the air inlet of air tools daily. Repair damaged or worn tools, as required. Do not rework or alter tooling without proper authorization.