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

# PPS 2.40

**PRODUCTION PROCESS STANDARD**

# Installation of Blind Bolt Fasteners

Issue 12 - This standard supersedes PPS 2.40, Issue 11.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- 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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## 1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the installation of blind bolt fasteners.

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 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 (de Havilland) Specifications

3.2.1 PPS 1.09 - Drilling and Reaming.

3.2.2 PPS 1.33 - Countersinking for Flush Head Fasteners.

3.2.3 PPS 13.26 - General Subcontractor Provisions.

3.2.4 PPS 27.05 - Manual Edge Finishing.

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

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

### 3.3 Industry Specifications

3.3.1 AIA/NAS NASM81177 - Fasteners, Blind, High Strength, Installation Formed, Alloy Steel, General Specification for.

## 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 Blind bolt fasteners as specified on the engineering drawing. Refer to Figure 1 for a general description and part number breakdown of blind bolts.

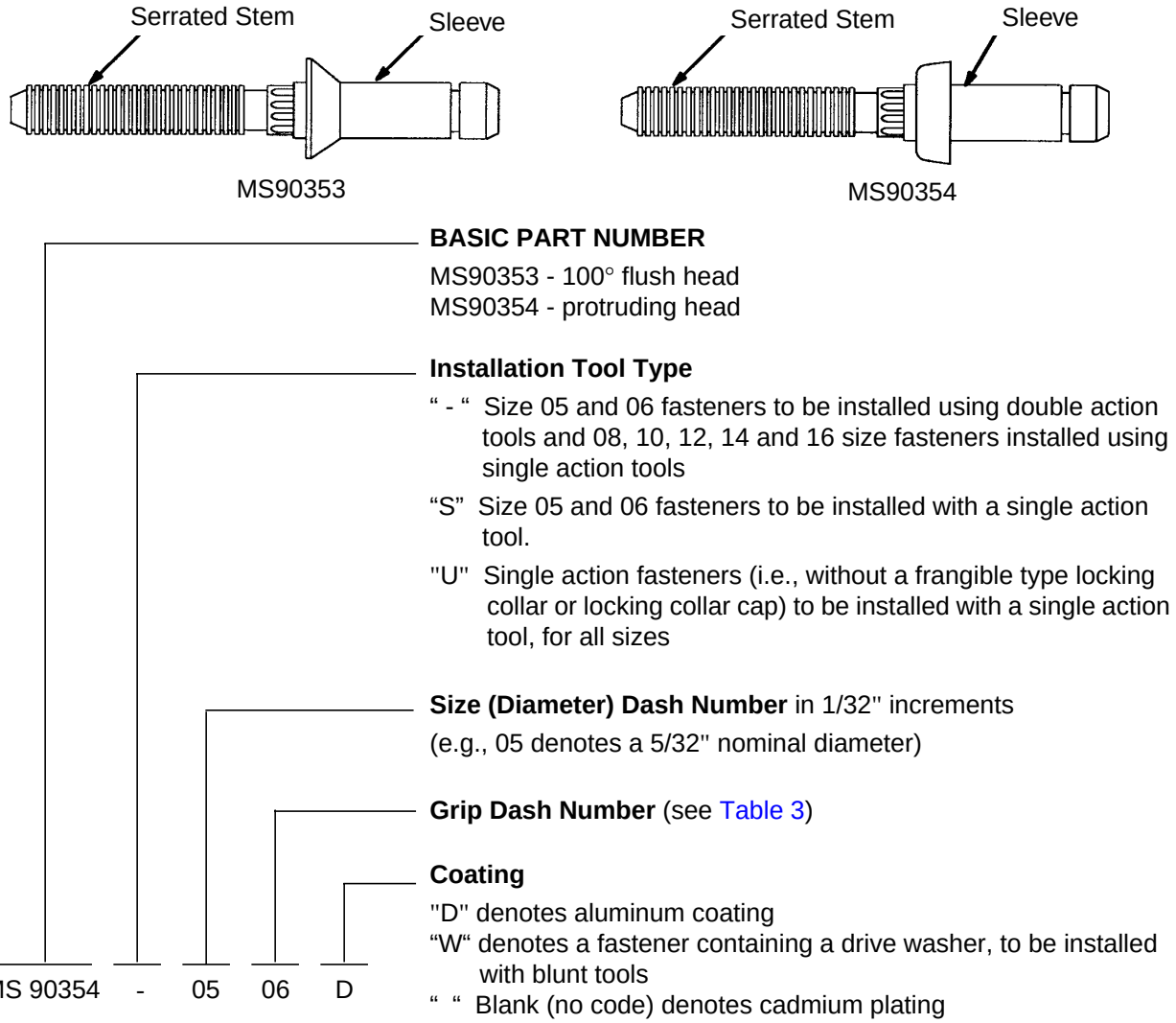



**Figure 1 - General Description and Part Number Breakdown of Blind Bolts**

### 4.2 Equipment

4.2.1 Single action and double action blind bolt installation tools (e.g., as specified in Table 4).

4.2.2 Blind bolt grip scale (e.g., Huck No. 105093).

## 5 Procedure

### 5.1 General

5.1.1 Blind bolt fasteners are high strength blind fasteners which are set and locked by means of a double action pulling tool which pulls the mandrel stem to form the blind head, form the spindle retaining lock ring in place and simultaneously break off the mandrel stem.

5.1.2 Blind bolt fasteners are used in highly loaded aircraft structures, and require access to only one side of an assembly during installation.

5.1.3 Blind bolt fasteners are intended for use in shear applications if the fastener is a permanent part of the assembly but not in fluid tight applications.

### 5.2 Preparation of Holes

5.2.1 Prepare holes as follows:

Step 1. Pre-drill the fastener holes according to PPS 1.09. Refer to Table 1 for the recommended pre-drill size.

**Table 1 - Hole Preparation Data**

| BLIND BOLT NOMINAL DIAMETER | RECOMMENDED PRE-DRILL SIZE | FINAL HOLE DATA | | RECOMMENDED COUNTERSINK DIAMETER |
|---|---|---|---|---|
| | | RECOMMENDED CUTTER SIZE | HOLE LIMITS | |
| 5/32" | #27 (0.144") | 0.165" | 0.164" - 0.167" | 0.321" - 0.333" |
| 3/16" | #16 (0.177") | 0.200" | 0.199" - 0.202" | 0.376" - 0.386" |
| 1/4" | #1 (0.228") | 0.261" | 0.260" - 0.263" | 0.497" - 0.507" |

Step 2. For flush head fastener installations, countersink using a micro-stop countersink fitted with the correct size pilot according to PPS 1.33 to the countersink diameter recommended in Table 1.

Step 3. Open the fastener hole to the final size specified in Table 1 according to PPS 1.09.

Step 4. For protruding head fasteners, manually break the edge of the hole on the side that the fastener head will seat as shown in Figure 2 according to PPS 27.05.

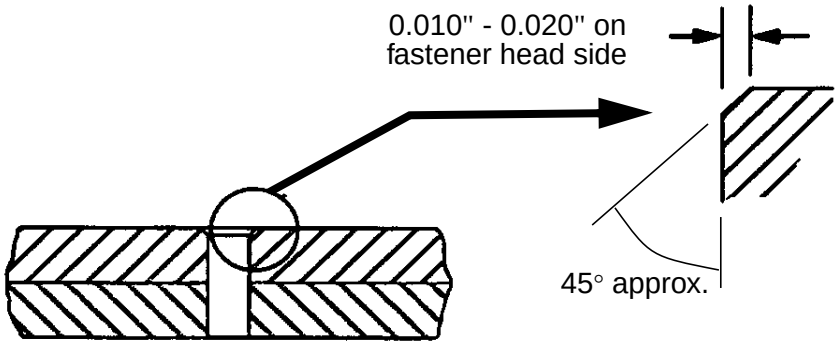



**Figure 2 - Edge Relief (Edge Break) for Protruding Head Fasteners**

Step 5. Prime all countersinks with 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 2 for conformance to the hole limit requirements, using a go/no-go 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 (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

**Table 2 - Hole Size Verification Sample Requirement**

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

| NUMBER OF HOLES IN PATTERN | REQUIRED SAMPLE SIZE |
|---|---|
| 91 - 150 | 11 |
| 151 - 280 | 13 |
| 281 - 500 | 16 |
| more than 500 | 19 |

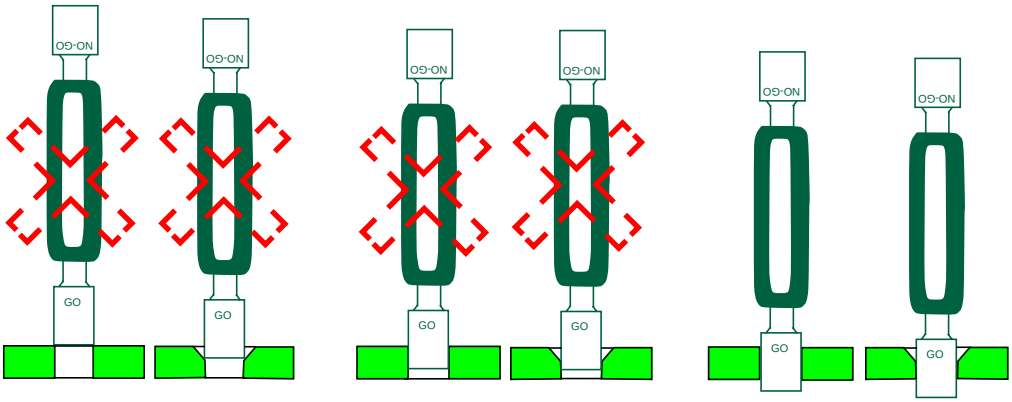
5.2.2.1 While checking holes using a GO/NO-GO gauge or other hole measuring gauge, also check visually for hole ovality. For holes with a visually evident oval or out of round shape, check the hole diameter at several positions using suitable hole measurement equipment (e.g., vernier calliper, hole micrometer, 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 (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

### 5.3 Use of Go/No-Go Gauges

5.3.1 Check selected fastener holes for conformance to the requirements of Table 1 using the applicable go/no-go gauge as follows (see Figure 3):

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 1.

Step 2. Lightly insert the no-go end of the plug 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 (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

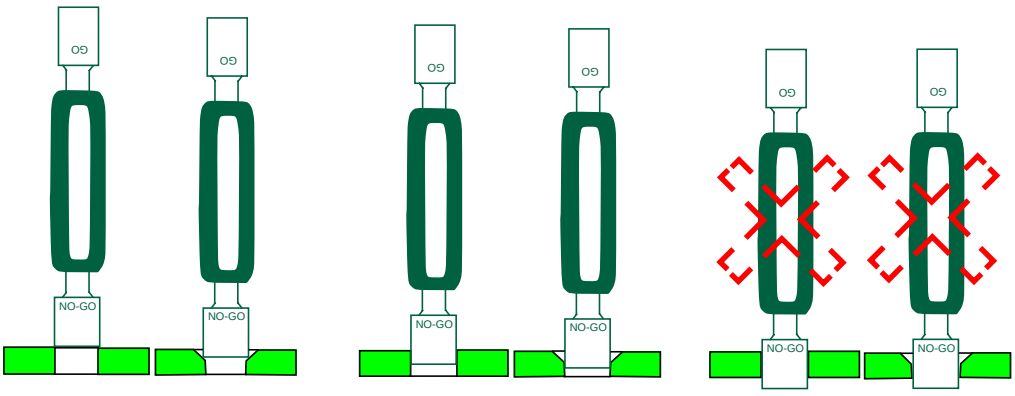



Does not go in.
UNDERSIZE HOLE

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 3 - Use of Go/No-Go Gauges**

### 5.4 Fastener Selection

5.4.1 The fastener grip length specified on the engineering drawing, work order or assembly manual is only a reference length. To verify that the specified grip length is correct, ensure that the sheets are pulled up such that no gap exits and measure the hole depth using a grip scale. The hole depth number shown on the grip scale corresponds to the blind bolt grip length dash number as shown in Figure 4. If the reading is past the **end** of a particular marking then use the next longer blind bolt, even if it is only slightly beyond the end of the marking. If a tapered sheet condition exists, use the grip length indicated for the thickest section. Refer to Table 3 for a listing of the grip length ranges for each grip dash number. For protruding head blind bolts only, if the required length of blind bolt is not available, it is acceptable to use the next longer pin length and shim to the correct length, together with a washer not exceeding a thickness of 0.0625", if authorized in writing by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB.

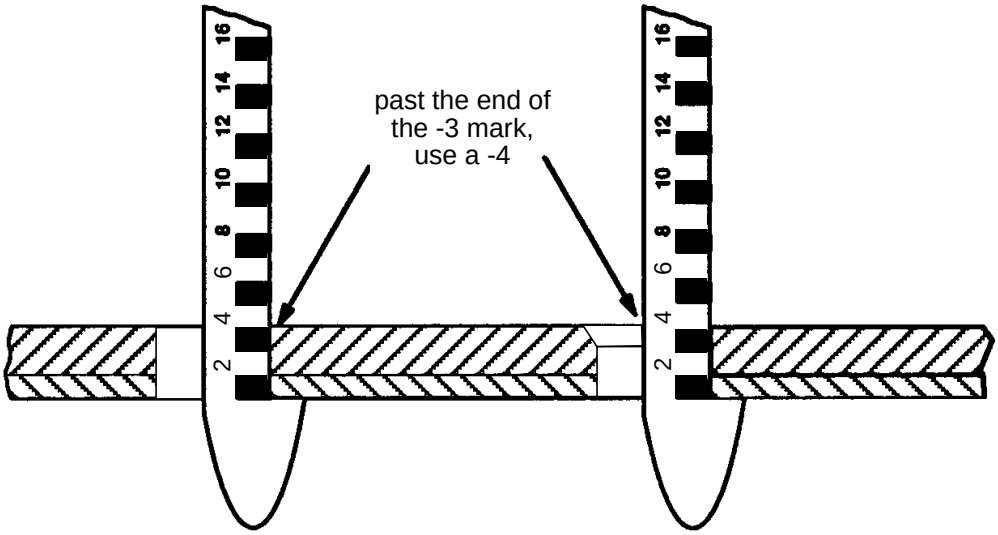



**Figure 4 - Use of Grip Scale**

**Table 3 - Blind Bolt Grip Range**

| FASTENER NOMINAL DIAMETER | GRIP DASH NUMBER | GRIP RANGE |
|---|---|---|
| 5/32", 3/16" & 1/4" | 04 | 0.219" - 0.282" |
| | 05 | 0.281" - 0.345" |
| | 06 | 0.344" - 0.407" |
| | 07 | 0.405" - 0.470" |

### 5.5 Preparation of Installation Tools

5.5.1 Prepare installation guns as follows:

Step 1. Check the air line connectors to ensure they are free of contamination.

Step 2. Inject a few drops of light machine oil into the air inlet of the gun and connect the air line (e.g., see Figure 5). Keep hose lines as short as possible. Ensure that a minimum number of air lines are connected to the same outlet.

Step 3. Depress and release the trigger to check the gun action.

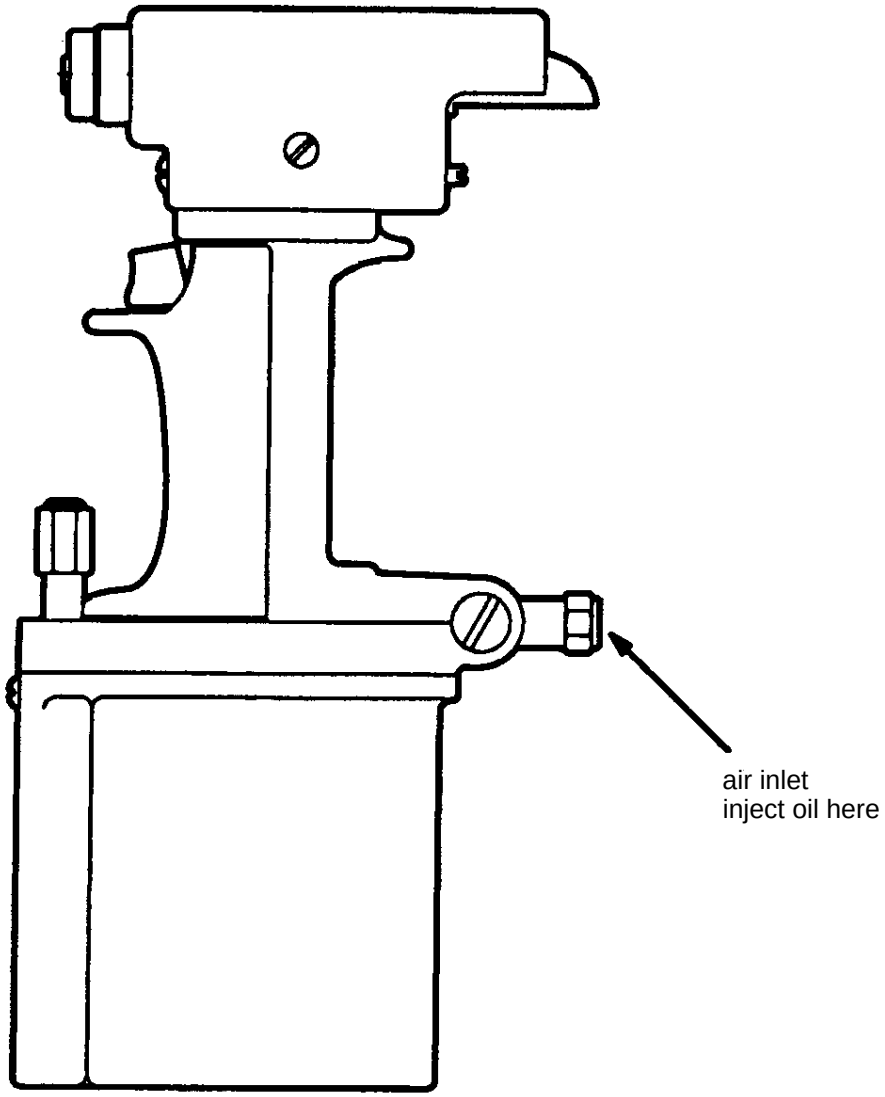



**Figure 5 - Huck Model 200 Installation Gun**

### 5.6 Installation of Blind Bolts

5.6.1 Before installing blind bolts, clamp parts tightly using Cleco type temporary fasteners in every 4th to 6th hole.

5.6.2 Install blind bolts as follows (see Figure 6):

Step 1. Insert the blind bolt into the prepared hole.

Step 2. Place the installation tool pulling head fully onto fastener stem so that pulling head rests against driving anvil of fastener. If available, use the installation tooling recommended by the blind bolt manufacturer or NASM81177. Use of alternative equipment (e.g., from a different manufacturer) is acceptable provided that the fastener installation meets the requirements specified in section 6. Refer to Table 4 for a listing of installation tools available at Bombardier Toronto (de Havilland).

Step 3. Holding the gun square to the surface of the work, push the pulling head firmly against work.

Step 4. Squeeze and hold the trigger to form blind end and break off fastener stem.

Step 5. Release the trigger to eject the fastener stem.

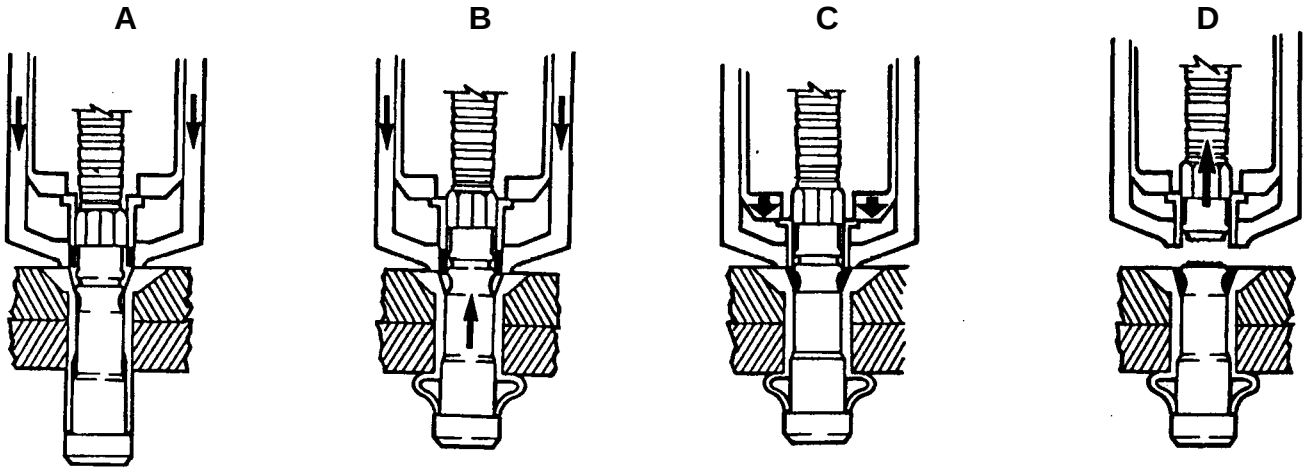



**Figure 6 - Double Action Installation Sequence**

**Table 4 - Installation Tools Available at Bombardier Toronto (de Havilland)**

| TOOL | BLIND BOLT | | | | | | |
|---|---|---|---|---|---|---|---|
| | -05 | U05 | | -06 | U06 | | -08 or U08 |
| Installation Gun | Huck 200 | Cherry G85D or G87D | Cherry G744 | Huck 200 | Cherry G85D or G87D | Cherry G744 | Cherry G87D |
| Nose Assembly | Huck 99-600 | Huck 99-680 or 99-2701with a 552 adaptor | Huck 99-680 or 99-2701with a 744B25 adaptor | Huck 99-598 | Huck 99-681 with a 552 adaptor | Huck 99-681 with a 744B25 adaptor | Huck 99-591 |

## 5.7 Removal of Installed Blind Bolts

5.7.1 If necessary, remove installed blind bolts as follows (see Figure 7):

Step 1. Using a drill slightly smaller in diameter than the bolt shank diameter, drill through the centre of the manufactured head to the depth of the bolt head shank juncture.

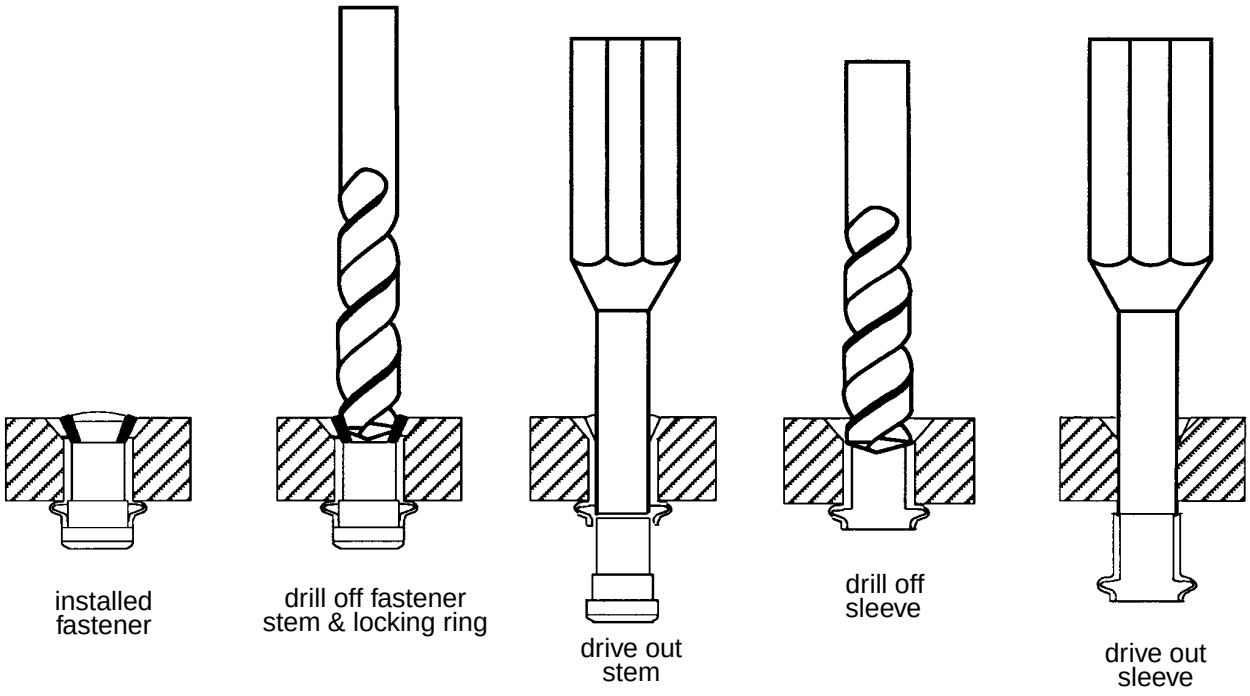



**Figure 7 - Removal of Installed Blind Bolts**

Step 2. Place a pin punch slightly smaller in diameter than the bolt stem diameter on the fastener and drive out the stem.

Step 3. Using a drill the same size as the bolt shank diameter, drill out the sleeve to a depth equal to the height of the fastener head.

Step 4. Drive out the sleeve using a pin punch of the same diameter as the bolt shank diameter.

Step 5. Break-off the remaining head of the blind bolt using a suitable pin punch.

## 5.8 Installation of Oversize Blind Bolts

5.8.1 If authorized in writing by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB, install oversize blind bolts for salvage of slightly oversize holes as follows:

Step 1. Select the appropriate oversize blind bolt from Table 5 for the corresponding standard size blind bolt. Use the same grip number as would be used for the standard size blind bolt.

Step 2. Open up the fastener hole to the dimension specified in Table 5. The countersink diameter limits for oversize blind bolts are the same as those specified for the corresponding standard size blind bolt.

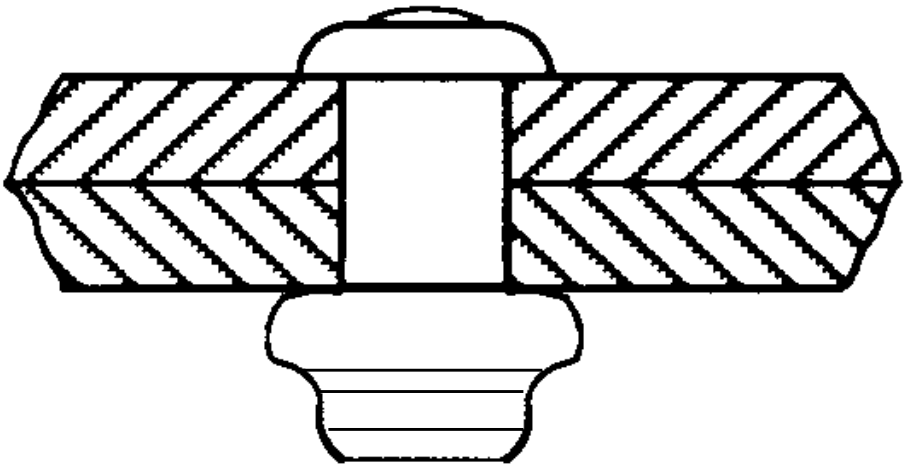
Step 3. Install the oversize blind bolt in the same manner and using the same tools as used for the corresponding standard size blind bolts.

**Table 5 - Hole Preparation Data for Oversize Blind Bolts**

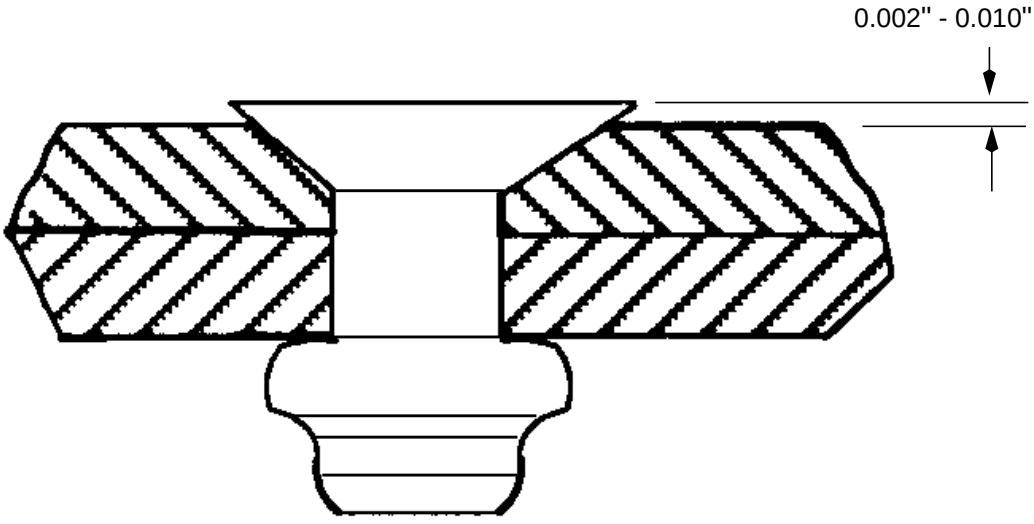
| STANDARD SIZE BLIND BOLT | HUCK OVERSIZE BLIND BOLT | | FINAL HOLE DATA | | |
|---|---|---|---|---|---|
| | | | RECOMMENDED DOUBLE MARGIN DRILL | | HOLE LIMITS |
| | PROTRUDING HEAD | FLUSH HEAD | DRILL SIZE | TS.561.11.16 | |
| -05 | OBP-T05 | OB100-T05 | 0.181" | MK 43 | 0.180" - 0.183" |
| U05 | OSBP-T05 | OSB100-T05 | | | |
| -06 | OBP-T06 | OB100-T06 | 0.216" | MK 44 | 0.215" - 0.218" |
| U06 | OSBP-T06 | OSB100-T06 | | | |
| -08 | OBP-T08 | OB100-T08 | 0.277" | MK 45 | 0.276" - 0.279" |
| U08 | | | | | |

## 6 Requirements

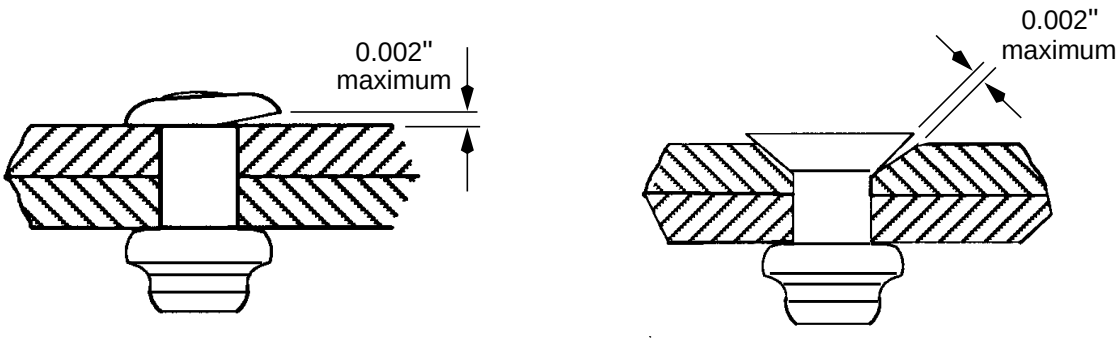
6.1 Ensure that the sheets are drawn up tight and there are no cracks in the bolt head as shown below:



6.1.1 Ensure that the head of flush type blind bolts is 0.002" - 0.010" above flush, as shown below. If the head is less than 0.002" or more than 0.010" above surface, remove the blind bolt and check the countersink diameter before replacing the blind bolt.



6.2 Ensure that any gap under one side of head does not exceed 0.002" and does not extend to the fastener shank, as shown below. If the gap exceeds 0.002" or extends to the fastener shank, remove the blind bolt and, for flush head blind blots, check the countersink diameter before replacing the blind bolt.




6.3 Ensure that the bolt stem fracture protrusion meets the requirements specified in Table 6, as shown below. If the bolt stem fracture is too much above flush, or below flush, remove and replace the blind bolt. For safety or aerodynamic purposes, a stem fracture up to the maximum allowable above flush may be shaved or filed flush with the fastener head; however, any evidence that the fastener head has been marked is not acceptable and would necessitate removal and replacement of the blind bolt.

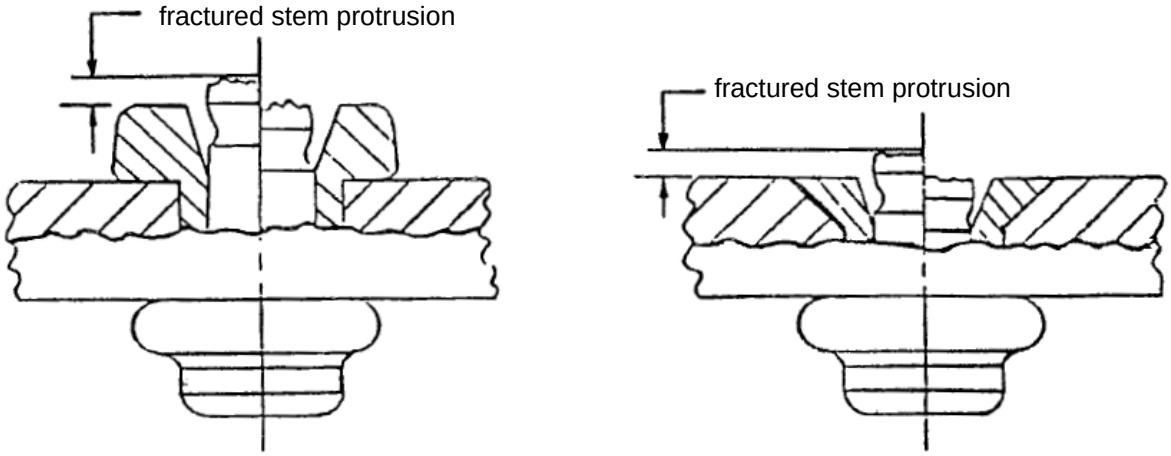


**Table 6 - Acceptable Fractured Stem Protrusion**

| NOMINAL BLIND BOLT DIAMETER | ACCEPTABLE FRACTURED STEM PROTRUSION |
|---|---|
| 5/32" | flush to 0.020" above flush |
| 3/16" | flush to 0.024" above flush |
| 1/4" | flush to 0.030" above flush |
| Note 1. It is not acceptable for the stem fracture to be below flush with the fastener head. | |

6.4 Ensure that the end of the lock collar is within the acceptable limits (above or below flush with the fastener head) as specified in Table 7, as shown below. If the position of the end of the lock collar is unacceptable, remove and replace the blind bolt. If the end of the lock collar protrudes less than the maximum allowed, the lock collar may be shaved or filed flush with the fastener head for safety or aerodynamic purposes; however, any evidence that the fastener head has been marked is not acceptable and would necessitate removal and replacement of the blind bolt.

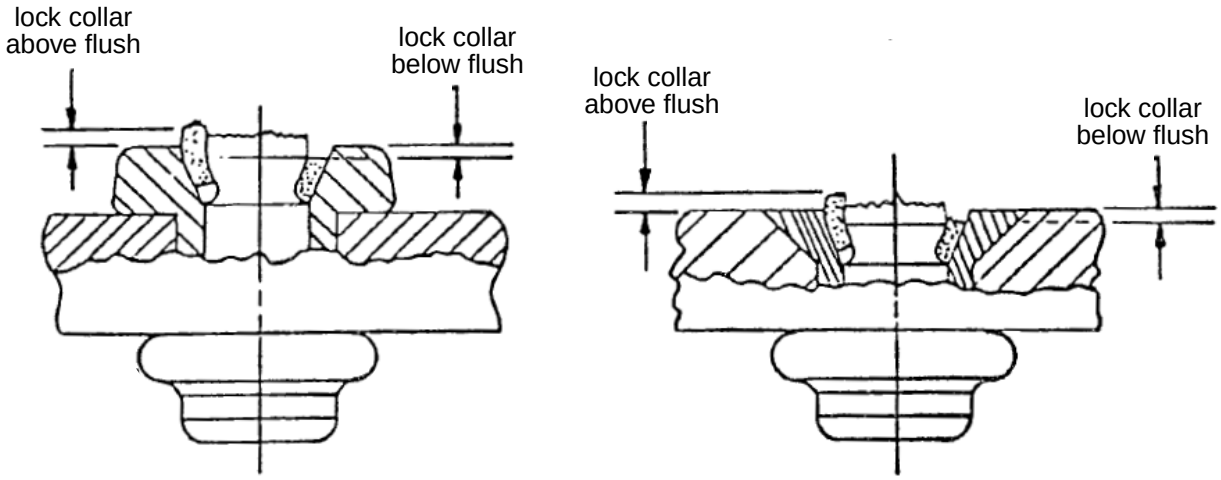



**Table 7 - Lock Collar Position**

| NOMINAL BLIND BOLT DIAMETER | LOCK COLLAR POSITION |
|---|---|
| 5/32" | ± 0.017" |
| 3/16" | ± 0.022" |
| 1/4" | ± 0.029" |
| Note 1. Measure the position of the end of the lock collar relative to the top of the fastener head. | |

## 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 installation of blind bolts 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 Within Bombardier Toronto (de Havilland), the following maintenance is recommended:

- Keep installation tools clean and dry.
- Lightly oil or grease moving parts regularly.
- Inject a few drops of light machine oil into the air inlet of pneumatic tools every day during which the tool may be used.
- Periodically check installation tools for wear. Replace damaged or badly worn parts immediately and independently from the periodic check-up.
- Obtain tool design approval before alterations to or rework of installation tools or accessories.
- Periodically check nose piece chuck jaws and ensure the jaw grooves are cleaned thoroughly.