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

# PPS 2.05

**PRODUCTION PROCESS STANDARD**

## Installation of Rivnuts

Issue 10
- This standard supersedes PPS 2.05, Issue 9.
- 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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| | Production Process Standards (PPS) | |
| Approved By: | (L.K. John) | August 27 2013 |
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| | Quality | |

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 procedures and requirements for the installation of Rivnut 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. 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 1.01 - Dimpling Aluminum Alloys.

3.2 PPS 1.07 - Dimpling Ferrous, Nickel and Titanium Alloys.

3.3 PPS 1.09 - Drilling and Reaming.

3.4 PPS 1.33 - Countersinking for Flush Head Fasteners.

3.5 PPS 13.26 - General Subcontractor Provisions.

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

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

## 4 Materials and Equipment

### 4.1 Material

4.1.1 Rivnuts as specified on the engineering drawing. Refer to Figure 1 for a breakdown description of the NAS part number code. Refer to Figure 2 for a breakdown description of the Rivnut part number. Refer to Figure 3 for a general description drawing of the Rivnut fastener. Refer to Table 1 for a listing of fastener grip ranges and head identification markings, consisting of either radial or circumferential dashes equally spaced on the Rivnut head.

### 4.2 Equipment

4.2.1 Rivnut keyway cutting tools and accessories as listed in Table 6.

4.2.2 Rivnut speed header installation tools as listed in Table 8.

4.2.3 Rivnut wrench type header tools as listed in Table 7.

4.2.4 Cherrymax/Cherrylock rivet grip gauge No. 269C3.

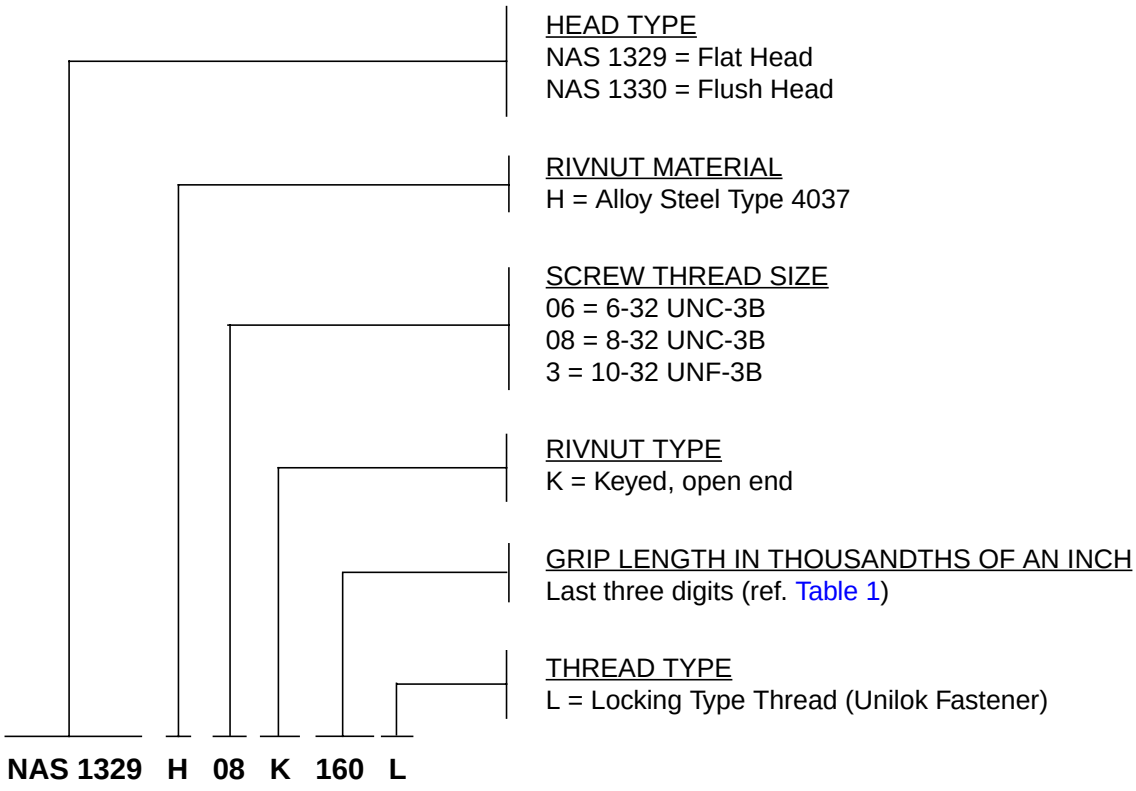



**Figure 1 - NAS Part Number Breakdown**

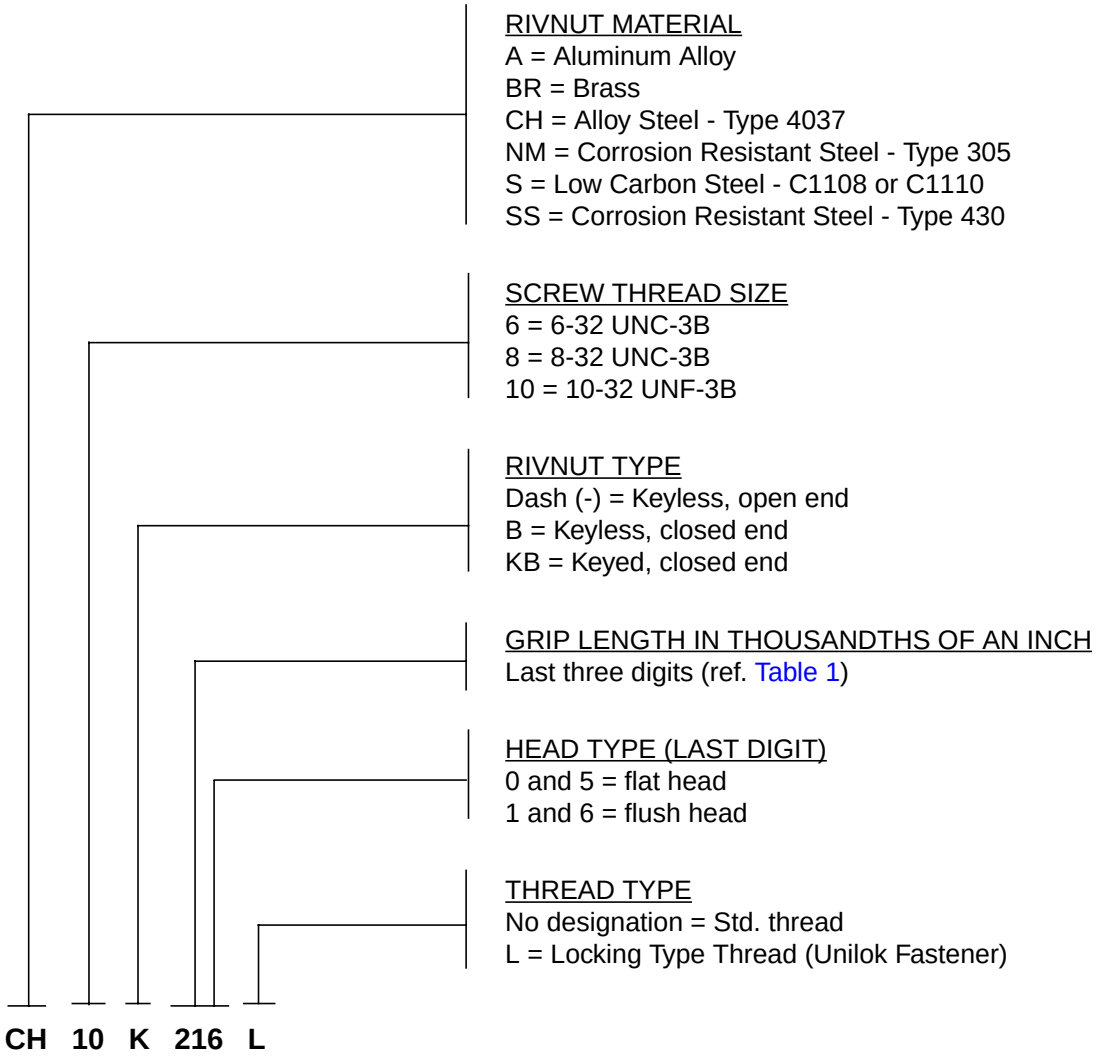



**Figure 2 - Rivnut Part Number Breakdown**

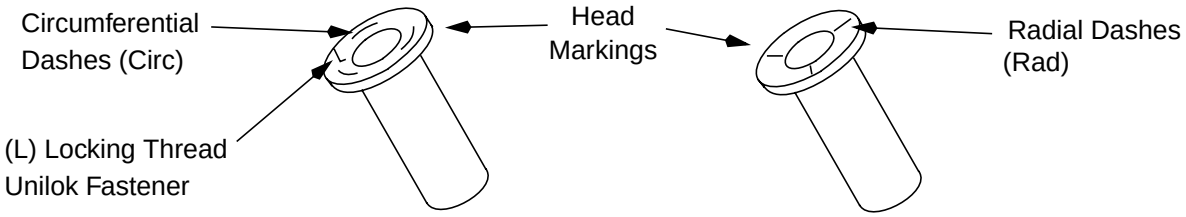



**Figure 3 - General Description of Rivnut Fastener**

**Table 1 - Grip Ranges and Head Identification Markings for Rivnuts**

| RIVNUT | FLAT HEAD | | | FLUSH HEAD | | |
|---|---|---|---|---|---|---|
| | GRIP LENGTH | GRIP RANGE | IDENT. MARK | GRIP LENGTH | GRIP RANGE | IDENT. MARK |
| 6-32 | -75 | 0.010" - 0.075" | 1-Rad | -106 | 0.063" - 0.106" | Blank |
| | -120 | 0.075" - 0.120" | 3-Rad | -161 | 0.106" - 0.161" | 2-Rad |
| | -160 | 0.120" - 0.160" | 5-Rad | -201 | 0.161" - 0.201" | 4-Rad |
| | -200 | 0.160" - 0.200" | 1-Circ | -241 | 0.201" - 0.241" | 1-Circ |
| | -240 | 0.200" - 0.240" | 2-Circ | -281 | 0.241" - 0.281" | 2-Circ |
| | -280 | 0.240" - 0.280" | 3-Circ | -321 | 0.281" - 0.321" | 3-Circ |
| 8-32 | -75 | 0.010" - 0.075" | 1-Rad | -106 | 0.063" - 0.106" | Blank |
| | -120 | 0.075" - 0.120" | 3-Rad | -161 | 0.106" - 0.161" | 2-Rad |
| | -160 | 0.120" - 0.160" | 5-Rad | -201 | 0.161" - 0.201" | 4-Rad |
| | -200 | 0.160" - 0.200" | 1-Circ | -241 | 0.201" - 0.241" | 1-Circ |
| | -240 | 0.200" - 0.240" | 2-Circ | -281 | 0.241" - 0.281" | 2-Circ |
| | -280 | 0.240" - 0.280" | 3-Circ | -321 | 0.281" - 0.321" | 3-Circ |
| 10-32 | -80 | 0.010" - 0.080" | Blank | -116 | 0.065" - 0.116" | Blank |
| | -130 | 0.080" - 0.130" | 1-Rad | -166 | 0.116" - 0.166" | 1-Rad |
| | -180 | 0.130" - 0.180" | 2-Rad | -216 | 0.166" - 0.216" | 2-Rad |
| | -230 | 0.180" - 0.230" | 3-Rad | -266 | 0.216" - 0.266" | 3-Rad |
| | -280 | 0.230" - 0.280" | 4-Rad | -316 | 0.266" - 0.316" | 4-Rad |

## 5 Procedure

### 5.1 General

5.1.1 A Rivnut fastener is a tubular rivet with internal threads which, can be installed from one side of the work using simple hand operated tools. Rivnuts are generally used in blind applications such as tubular or closed sections instead of a nutplate.

5.1.2 Installation is accomplished by threading the Rivnut onto the installation tool pulling stud, inserting the Rivnut into the prepared hole, pulling up the threaded stud to expand the Rivnut shank against the material and then un-threading the pull stud from the installed fastener.

### 5.2 Preparation of Work

5.2.1 Perform all pre-drill and final drilling of holes for Rivnuts according to PPS 1.09.

5.2.2 Prepare holes for Rivnuts as follows:

Step 1. Pre-drill through the pilot holes (where provided) using the pre-drill specified in Table 2.

**Table 2 - Pre-Drill Hole Preparation Data**

| RIVNUT SIZE | INSTALLATION CONFIGURATION | PRE DRILL DIAMETER |
|---|---|---|
| 6-32 | Flat Head (Protruding) | #21 |
| 8-32 | | |
| 10-32 | | |
| 6-32 | Flush Head (Dimpled) | #19 |
| 8-32 | | #8 |
| 10-32 | | #1 |
| 6-32 | Flush Head (Countersunk) | #21 |
| 8-32 | | |
| 10-32 | | |

Step 2. If dimpling is specified on the engineering drawing, dimple holes according to PPS 1.01 or PPS 1.07, as applicable. If countersinking is specified, countersink holes according to PPS 1.33 to the diameter specified in Table 3.

**Table 3 - Countersink Hole Preparation Data**

| RIVNUT SIZE | PILOT DIAMETER | REFERENCE COUNTERSINK DIAMETER |
|---|---|---|
| 6-32 | 5/32" | 0.323" - 0.333" |
| 8-32 | | 0.355" - 0.365" |
| 10-32 | | 0.390" - 0.400" |

Note 1. Countersink angle = 100°.
Note 2. The countersink diameters specified herein are for reference only; prepare countersinks so that the head protrusion of flush head Rivnuts will meet the requirements of Figure 12.

Step 3. Drill holes to the final size specified in Table 4.

**Table 4 - Final Drill Hole Preparation Data**

| RIVNUT SIZE | FINAL DRILL | |
|---|---|---|
| | RECOMMENDED DRILL SIZE | HOLE SIZE |
| 6-32 | #12 | 0.189" - 0.193" |
| 8-32 | #2 | 0.221" - 0.226" |
| 10-32 | 1/4" | 0.250" - 0.256" |

Step 4. Except when installing aluminum alloy Rivnuts in aluminum structure, prime countersinks with F1 zinc chromate primer according to PPS 34.02 or F19 Type 2 epoxy-polyamide primer according to PPS 34.08.

5.2.3 On a sample basis, check at random (across the entire pattern) the number of holes specified in Table 5 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.

5.2.3.1 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.

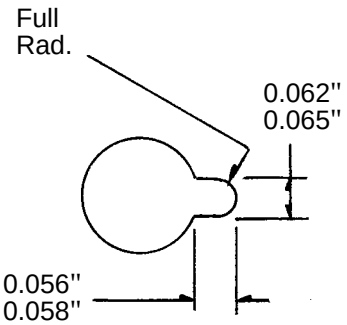
**Table 5 - Hole Size Verification Sample Requirement**

| NUMBER OF HOLES IN PATTERN | REQUIRED SAMPLE SIZE |
|---|---|
| 5 or less | all |
| 6 - 50 | 5 |
| 51 - 90 | 7 |
| 91 - 150 | 11 |
| 151 - 280 | 13 |
| 281 - 500 | 16 |
| more than 500 | 19 |

5.2.4 If the engineering drawing specifies the use of keyed type Rivnuts, after drilling to final size cut a keyway in the hole using the keyway cutting tool specified in Table 6 (see Figure 4) as follows:

Step 1. Select the correct keyway cutting tool from Table 6 for the particular type and size of Rivnut to be installed.

**Table 6 - Keyway Cutting Tools**

| RIVNUT | | KEYWAY CUTTING TOOL | | | KEYWAY DIMENSIONS |
|---|---|---|---|---|---|
| SIZE | TYPE | TOOL NO. | DIE ASSY. | CUTTER BLADE | |
| 6-32 | Flat Head | C-3576 or C-3600 (Note 1) | K-2-6 | K-14 |  |
| 8-32 | | | K-2-8 | | |
| 10-32 | | | K-2-10 | | |
| 6-32 | Flush Head | C-3576 or C-3600 (Note 1) | K-16-6 | K-14 | |
| 8-32 | | | K-16-8 | | |
| 10-32 | | | K-16-10 | | |



Note 1. C-3576 tool has been replaced by new tool number C-3600.

Step 2. With the squeeze handle in the open position, insert the tool into the hole so that the pilot is fully seated in the hole.

Step 3. Hold the tool square to the surface of the work and squeeze the handle against the tool body to retract the cutter blade and cut the keyway.

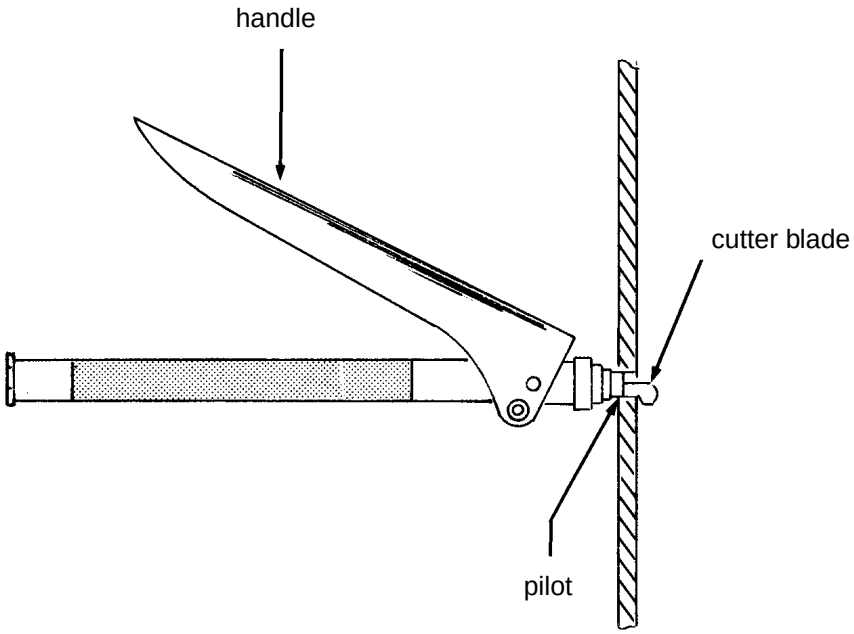


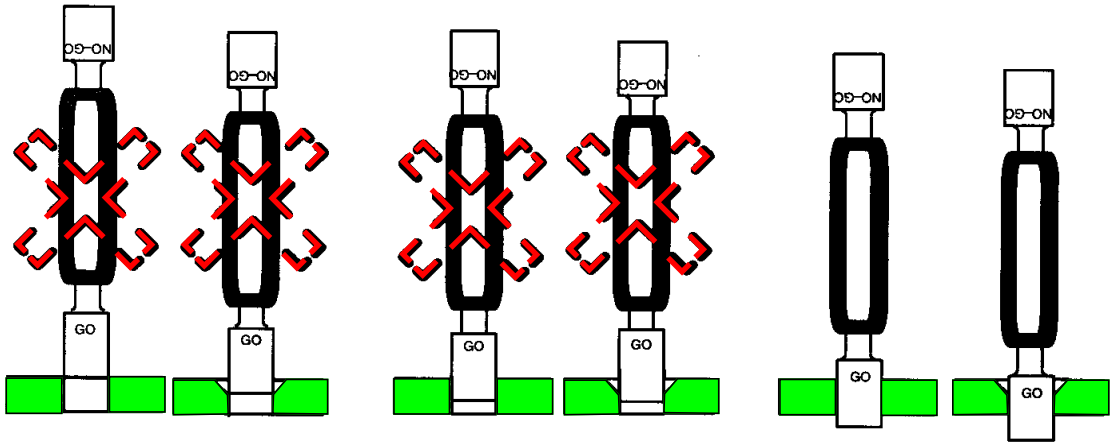

**Figure 4 - Keyway Cutting Tool**

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

5.3.1 Check selected fastener holes for conformance to the requirements of Table 4 using the applicable go/no-go gauge as follows (see Figure 5):

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 4.

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.

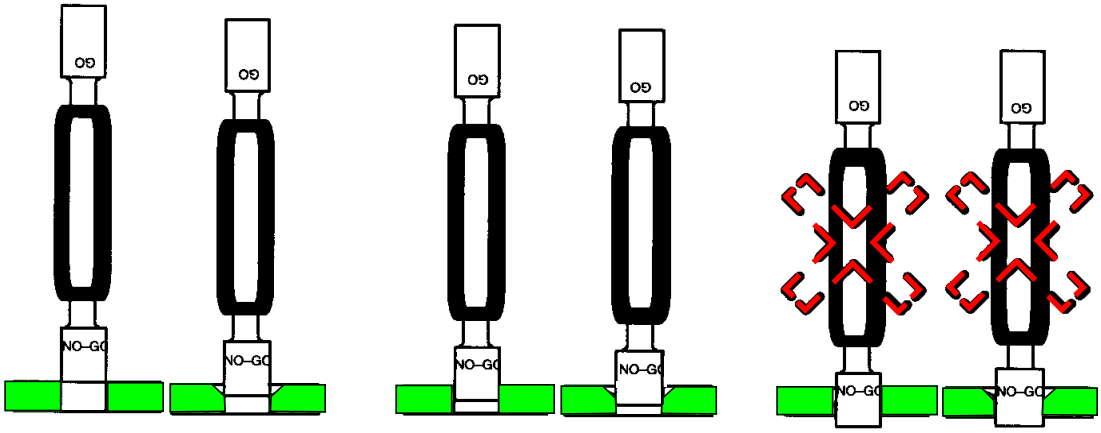



Does not go in.
UNDERSIZE HOLE

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

## 5.4 Fastener Selection

5.4.1 Install only Rivnuts of the type and diameter specified on the engineering drawing.

5.4.2 Rivnuts are extremely grip length sensitive and it is imperative that the correct grip length be selected and used in order to ensure satisfactory performance of the fastener in service. In order to verify that the grip length specified is correct, measure the combined material thickness after final drilling using a CherryMax/Cherrylock rivet grip gauge No. 269C3 as shown in Figure 6. The fastener grip length specified is only a REFERENCE LENGTH, and if the grip length determined by measurement does not agree with the specified grip length, install a Rivnut with the measured grip length.

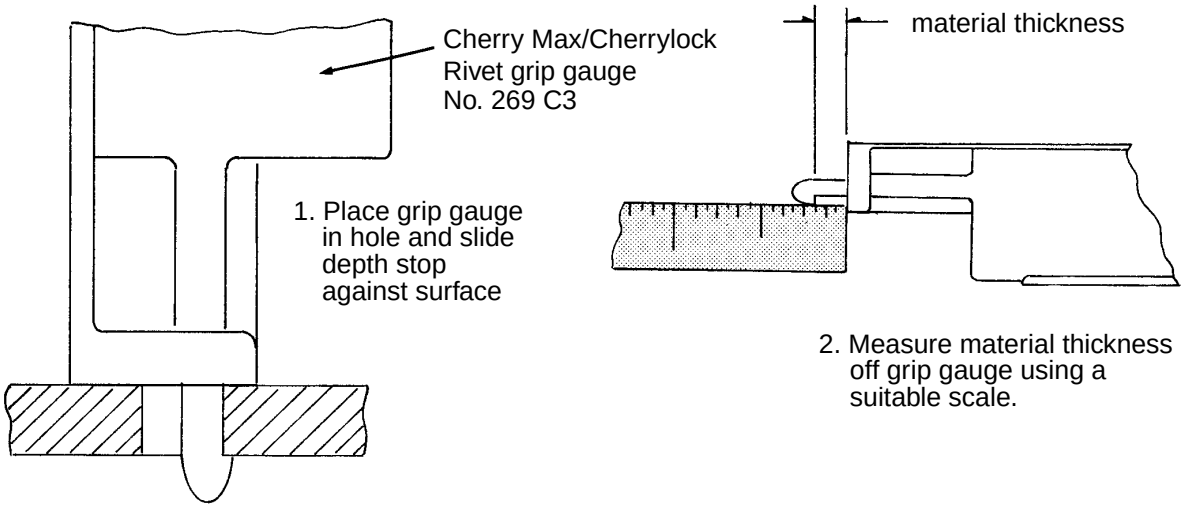



**Figure 6 - Use of a Rivet Grip Gauge to Check Material Thickness**

## 5.5 Selection of Installation Tooling

5.5.1 Installation tooling for Rivnuts consists of either the wrench operated hand tools (GTC 722 or C-845) as listed in Table 7 or the hand operated speed header (C-5000 or C-6000) and accessories as listed in Table 8. In general, it is preferred that the speed header tool be used for production work, with the wrench operated tools only being used for rework or repair if limited access prevents using the speed header.

**Table 7 - Rivnut Wrench Type Header**

| RIVNUT SIZE | OLD TOOL NO. | NEW TOOL NO. |
|---|---|---|
| 6-32 | GTC-722-6-32 | C-845-6-32 |
| 8-32 | GTC-722-8-32 | C-845-8-32 |
| 10-32 | GTC-722-10-32 | C-845-10-32 |

**Table 8 - Rivnut Speed Header Installation Tooling**

| RIVNUT | | TOOL NO. (Note 1) | REPLACEMENT PARTS | | |
|---|---|---|---|---|---|
| SIZE | TYPE | | COLLAR | PULL-UP STUD | ANVIL |
| 6-32 | standard screw thread | C-5000-6 | C-15-6 | C-16-6 | C-41-6 |
| 8-32 | | C-5000-8 | C-15-8 | C-16-8 | C-41-8 |
| 10-32 | | C-5000-10 | C-15-10 | C-16-10 | C-41-10 |
| 6-32 | locking screw thread (Note 2) | C-6000-6L | C-15-6 | C-16-6L | C-41-6 |
| 8-32 | | C-6000-8L | C-15-8 | C-16-8L | C-41-8 |
| 10-32 | | C-6000-10L | C-15-10 | C-16-10L | C-41-10 |

Note 1. The C-5000 tool has been replaced by the C-6000 tool.
Note 2. Locking screw thread Rivnuts require the use of a reduced diameter pull-up stud (identified by the suffix "L") to allow easy engagement of the Rivnut threads. Tools with reduced dia. pull studs may be used to install std. thread Rivnuts but not vice-versa.

## 5.6 Pull-Up Stud Adjustments

5.6.1 Adjust the pull-up stud of the installation tool for each Rivnut grip length so that the stud engages all threads in the Rivnut. Adjust the pull-up stud for open end Rivnuts so that the chamfer on the end of the stud extends just beyond the end of the Rivnut shank. Adjust the pull-up stud for closed end Rivnuts so that it is within a distance approximately equal to the Rivnut diameter (see Figure 7).

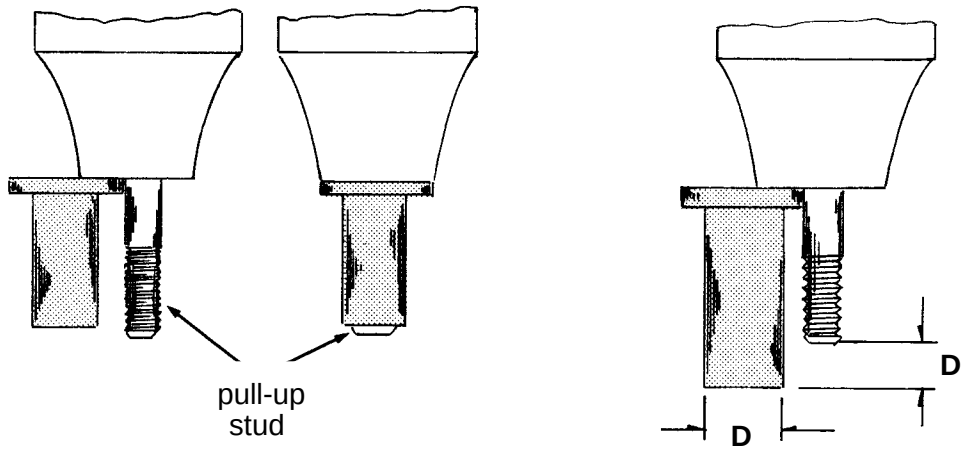



**Figure 7 - Pull-Up Stud Adjustment**

5.6.2 Adjust the stud length on the C-5000 speed header as follows (see Figure 8):

Step 1. Loosen the 3 collar set screws through the access hole on the front of the tool and unscrew the slide mechanism securing nut on the back of tool.

Step 2. Remove the slide mechanism assembly from the tool, taking care not to lose any of the 6 steel balls from the mechanism. Take care to avoid contaminating the slide mechanism with dirt or shop swarf while disassembled.

Step 3. Loosen the 2 set screws at the threaded coupling.

Step 4. Adjust the stud length as required.

Step 5. Re-tighten the set screws.

Step 6. Re-assemble the slide mechanism assembly to the tool.

Step 7. With tool handle in the open position, tighten the 3 collar set screws.

Step 8. Operate slide mechanism several times to verify smooth operation of the tool.

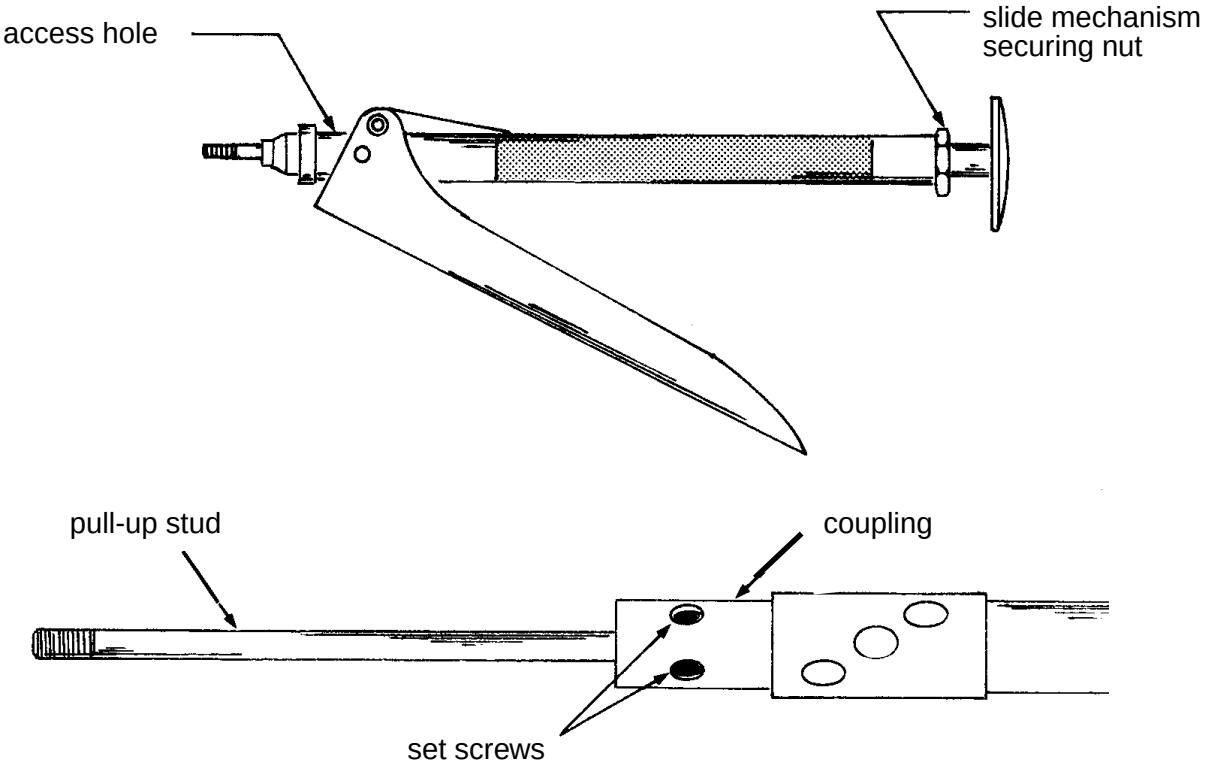



**Figure 8 - Adjusting C-5000 Speed Header**

5.6.3 Adjust the pull-up stud length on the C-6000 speed header by adjusting the pull-up stud anvil as follows (see Figure 9):

Step 1. Loosen the anvil adjustment set screw at the front of tool.

Step 2. Adjust the anvil by threading it into or out of the anvil sleeve, as required, to obtain the correct stud pull-up stud length.

Step 3. Re-tighten the set screw.

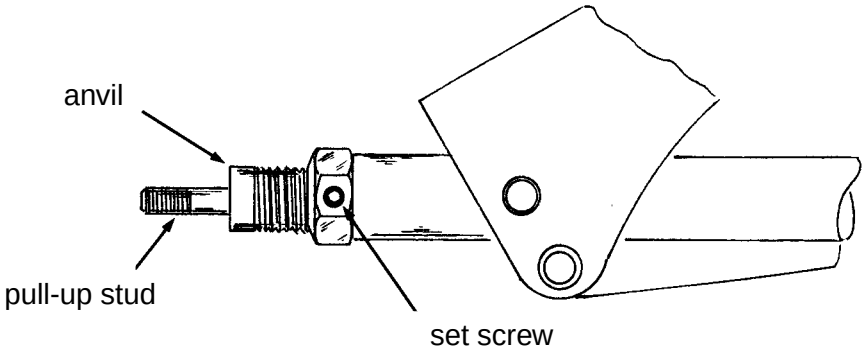



**Figure 9 - Adjusting C-6000 Speed Header**

5.6.4 Adjust wrench type header tools by holding the nut on the header body and threading the body in or out, as required, to obtain the correct pull-up stud length (see Figure 10)

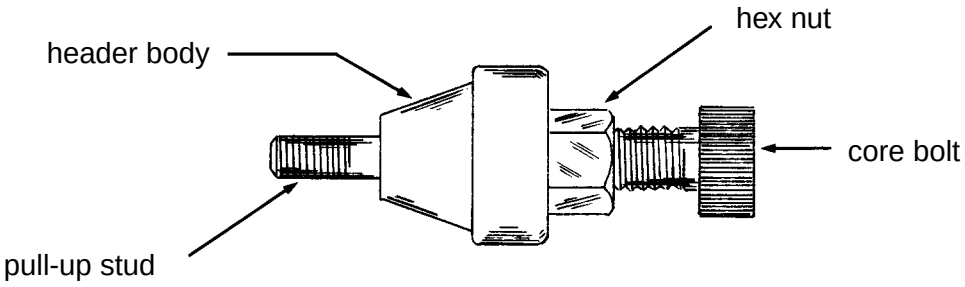



**Figure 10 - Adjusting Wrench Type Header**

**5.7 Installation of Rivnuts** (See Figure 11)

5.7.1 Install Rivnuts using speed header tools as follows:

Step 1. Select the correct speed header tool from Table 8 for the type and size of Rivnut to be installed.

Step 2. Check and adjust the pull-up stud length according to section 5.6.

Step 3. Pull the slide mechanism knob all the way out, engage the Rivnut on the first one or two threads of the pull-up stud and, while holding the Rivnut to prevent it rotating, push the knob firmly in to thread the stud into the rivnut. The Rivnut should be fully threaded onto the pull-up stud so that, with the tool handle in the open position, the Rivnut head is in contact with the pull-up stud anvil.

Step 4. Insert the Rivnut into the prepared hole. For keyed Rivnuts, ensure that the key is fully engaged in the keyway.

Step 5. Hold the header tool square to the surface of the work and, while maintaining a slight inward pressure, squeeze the handle against the tool body until a solid resistance is felt. It is not necessary to close the handle fully against the tool body; excessive pressure may destroy the fastener thread.

Step 6. Release the squeeze handle and pull the knob all the way out to unscrew the stud from the installed Rivnut.

5.7.2 Install Rivnuts using a wrench type header tool as follows:

Step 1. Select the correct header tool from Table 7 for the size of Rivnut to be installed.

Step 2. Adjust pull-up stud length according to section 5.6.

Step 3. While holding the bolt and hex nut of the tool so that they will not rotate, thread the Rivnut fully onto the pull-up stud so that it contacts the anvil.

Step 4. Insert the Rivnut into the prepared hole. For keyed Rivnuts, ensure that the key is fully engaged in the keyway.

Step 5. Hold the header tool square to the surface of the work and, while maintaining a firm inward pressure, turn the hex nut counter clockwise (using a suitable wrench) while using the Allen key supplied with the tool to prevent the core bolt from turning. Turn the nut only until a solid resistance is felt; do not over-tighten as this will break the tool or strip the threads in the Rivnut.

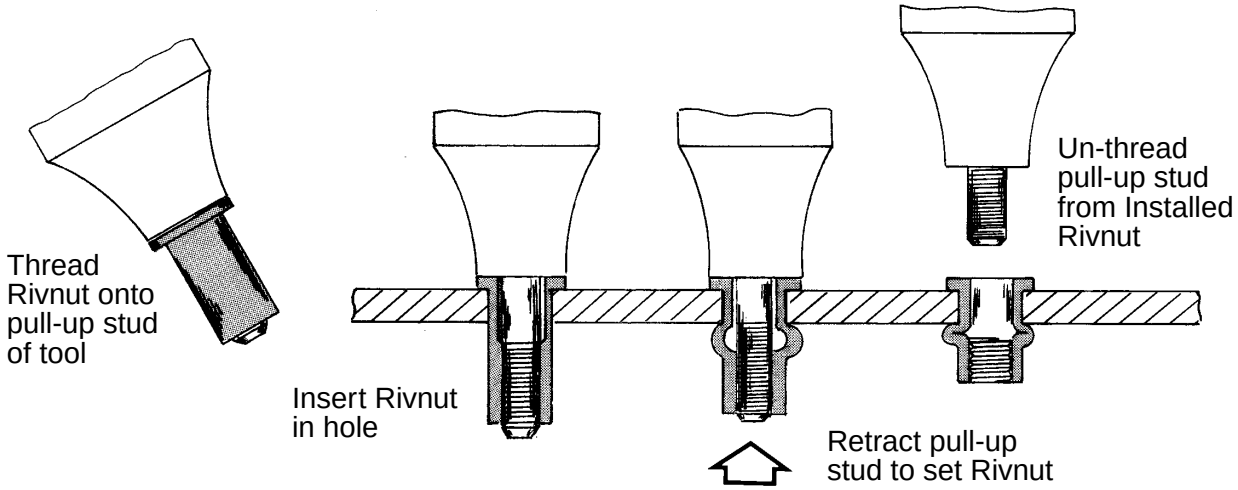



**Figure 11 - Installation of Rivnuts**

### 5.8 Removal of Rivnuts

5.8.1 If necessary, Rivnuts may be removed by drilling through the head of the Rivnut using the final size drill as specified in Table 4 to break loose the fastener head and then driving out the shank using a suitable punch.

5.8.2 After removal of Rivnuts, check that holes do not exceed the maximum hole size limits specified in Table 4. Refer oversize holes to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

## 6 Requirements

6.1 Ensure that all installed Rivnut fasteners meet the dimensional and visual requirements specified in Figure 12.

## 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 Rivnuts must have a good working knowledge of the procedure and requirements as specified herein and must have exhibited their competency to their supervisor.

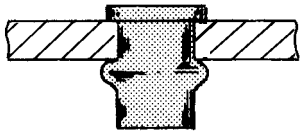
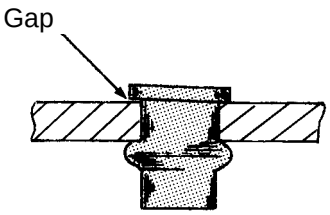
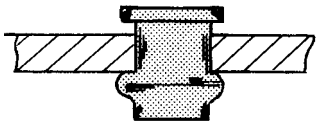
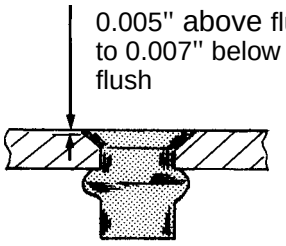
| VISUAL/DIMENSIONAL APPEARANCE | DESCRIPTION | CORRECTIVE ACTION |
|---|---|---|
|  | **Acceptable**<br>- Good installation.<br>- No gap under head of Rivnut<br>- Rivnut key (where applicable) fully engaged in keyway. | None Required |
|  | **Acceptable**<br>- Any gap under the head is less than 120° around the circumference, does not extend to the fastener shank and is less than 0.002" (i.e., the edge of a 0.002" feeler gauge will not fit into the gap). | None Required |
| | **Unacceptable**<br>- Gap extends more than 120° around the circumference, extends to the fastener shank or the edge of a 0.002" feeler gauge will fit into the gap. | Replace Rivnut |
|  | **Unacceptable**<br>- Loose Rivnut.<br>- Concentric gap under head.<br>- Rivnut key not engaged in keyway. | Replace Rivnut |
|  | **Acceptable**<br>- Head of flush type Rivnut 0.005" above flush to 0.007" below flush. | None Required |
| | **Unacceptable**<br>- Rivnut head more than 0.005" above flush. | Remove Rivnut and check countersink diameter. |
| | **Unacceptable**<br>- Rivnut head more than 0.007" below flush. | |
| Note 1. An annular groove around the head of the Rivnut is acceptable. | | |

**Figure 12 - Dimensional and Visual Requirements for Installed Rivnuts**

## 9 Recommended Maintenance of Equipment

9.1 Keep a close check on the condition of keyway cutting tools and speed header tools, paying particular attention to the key cutter blade and the cross shaft in the speed header squeeze handle. Repair or replace worn or damaged tools. Unauthorized modification of tooling is prohibited.