BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.29

PRODUCTION PROCESS STANDARD

Installation of Blind Nuts

Issue 12
- This standard supersedes PPS 2.29, Issue 11.
- 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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Table of Contents

Sections **Page**

1 Scope . . . 3
2 Hazardous Materials . . . 3
3 References . . . 3
4 Materials and Equipment . . . 3
4.1 Materials . . . 3
4.2 Equipment . . . 4
5 Procedure . . . 6
5.1 General . . . 6
5.2 Preparation of Parts . . . 6
5.3 Use of Go/No-Go Gauges . . . 7
5.4 Fastener Selection . . . 8
5.5 Selection and Set Up of Installation Tooling . . . 10
5.6 Installation of Blind Nuts Using BG2500 Power Tool . . . 12
5.7 Installation of Blind Nuts Using Hand Tools . . . 13
5.8 Removal of Blind Nuts . . . 14
6 Requirements . . . 14
7 Safety Precautions . . . 16
8 Personnel Requirements . . . 16
9 Recommended Maintenance of Equipment . . . 16

Tables

Table 1 - Hole Preparation Data . . . 6
Table 2 - Hole Size Verification Sample Requirement . . . 7
Table 3 - Blind Nut Sleeve Length . . . 8
Table 4 - Blind Nut BG2500 Power Tool Accessories . . . 10
Table 5 - Blind Nut Hand Tools and Accessories . . . 11

Figures

Figure 1 - General Description and Part Number Breakdown For Blind Nuts . . . 4
Figure 2 - Blind Nut Power Tool . . . 5
Figure 3 - Blind Nut Hand Tool . . . 5
Figure 4 - Use of Go/No-Go Gauges . . . 9
Figure 5 - Use of a Cherrymax Rivet Grip Gauge . . . 10
Figure 6 - Assembly of Installation Tooling to BG2500 Gun . . . 11
Figure 7 - Installation of Blind Nut using Power Tools . . . 12
Figure 8 - Installation of Blind Nut using Hand Tools (typ.) . . . 13
Figure 9 - Removal of Blind Nuts . . . 14
Figure 10 - Dimensional/Visual Examination of Installed Blind Nuts . . . 15

1 Scope

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

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 PPS 1.09 - Drilling and Reaming.

3.2 PPS 1.33 - Countersinking for Flush Head Fasteners.

3.3 PPS 13.26 - General Subcontractor Provisions.

3.4 PPS 14.01 - Torquing & Tightening.

3.5 PPS 34.05 - Application of Corrosion Preventive Jointing Compound.

4 Materials and Equipment

4.1 Materials

4.1.1 Blind nuts as specified on the engineering drawing (e.g., Bombardier B0203034, Hi-Shear BN360 or Hi-Shear BN1360). Refer to Figure 1 for a general description and part number breakdown.

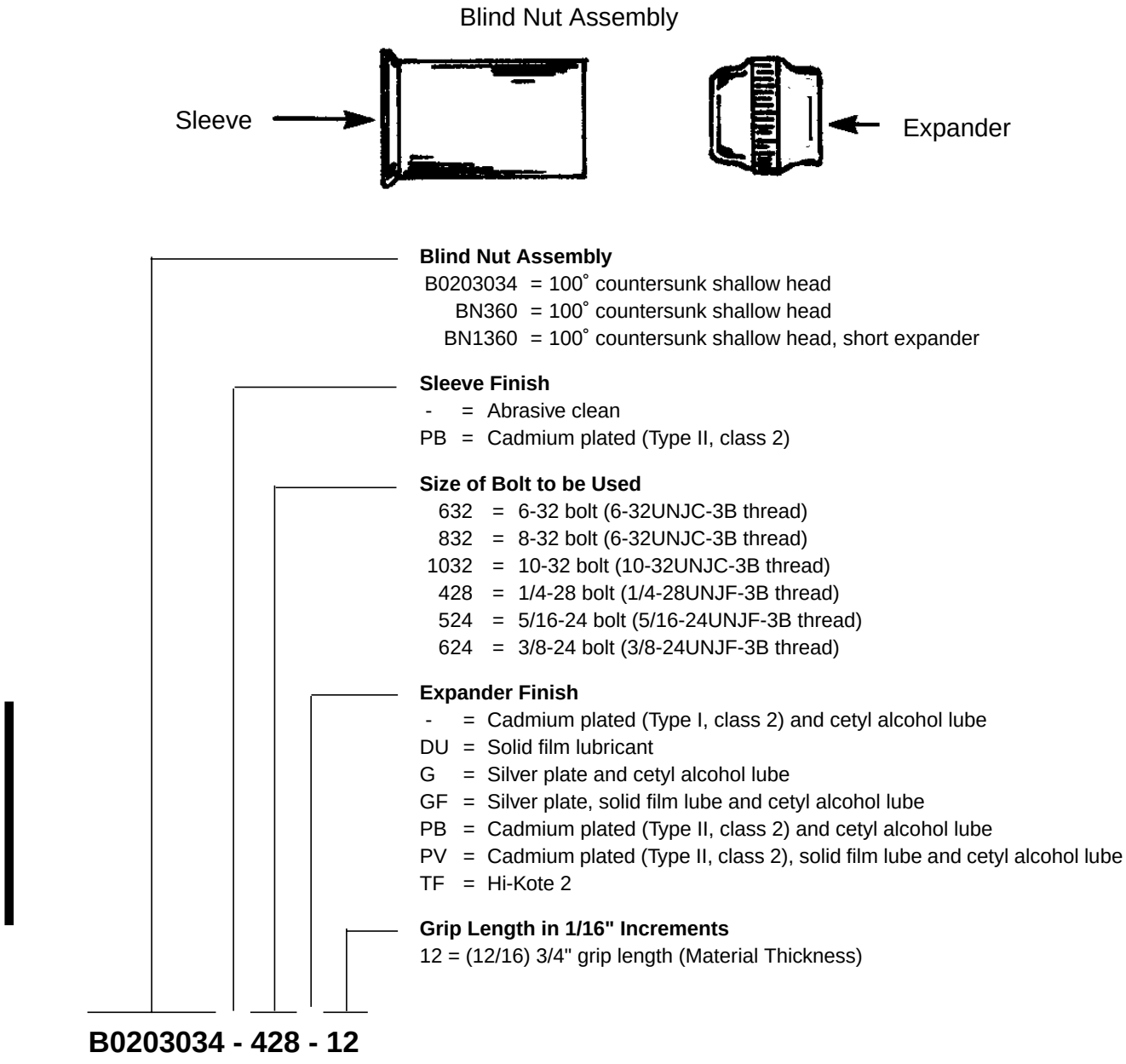


Figure 1 - General Description and Part Number Breakdown For Blind Nuts

4.2 Equipment

4.2.1 Blind nut power tool kit (e.g., a Hi-Shear BG2500 gun with a BP3000 or BP7000 air-hydraulic power unit and tooling accessories as listed in Table 4). The BP7000 power unit replaces the BP3000 unit, which is no longer available. Refer to Figure 2 for a general description of the power tool kit. It is acceptable to use alternative installation equipment provided that the final installation meets all the requirements specified in section 6.

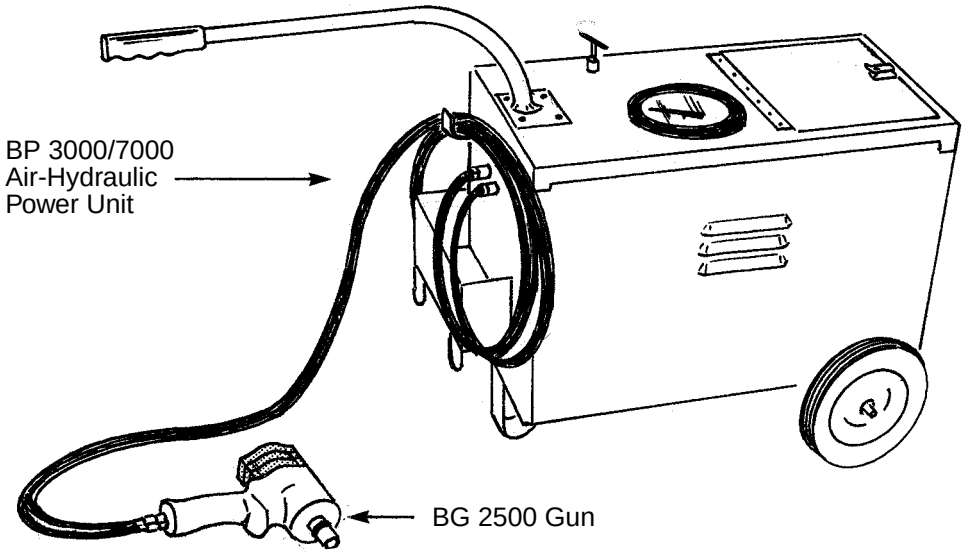


Figure 2 - Blind Nut Power Tool

4.2.2 Blind nut hand tools and accessories (e.g., as listed in Table 5). Refer to Figure 3 for a general description of the blind nut hand tools. It is acceptable to use alternative installation equipment provided that the final installation meets all the requirements specified in section 6.

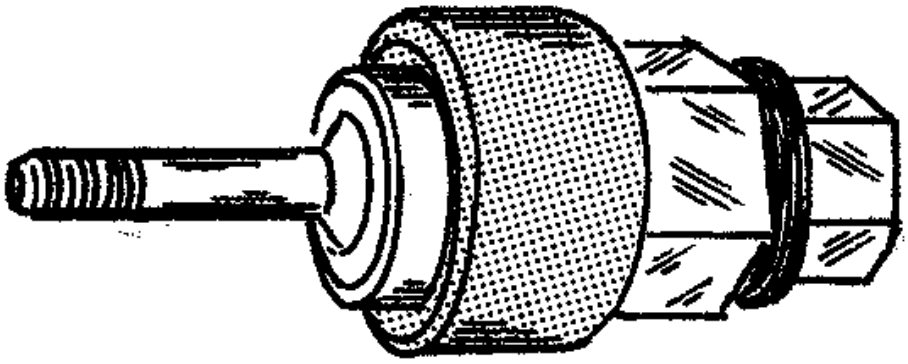


Figure 3 - Blind Nut Hand Tool

4.2.3 Box end wrenches for use with blind nut hand tools (e.g., 9/16" and 3/4").

4.2.4 Torque wrench for use with blind nut hand tools, meeting requirements of PPS 14.01.

4.2.5 Cherrymax rivet grip scale, No. 269C3.

5 Procedure

5.1 General

5.1.1 Blind nuts are high strength blind type fasteners which are generally used instead of nutplates on closed or blind side assemblies. The blind nut is basically a 2 piece assembly consisting of a ductile sleeve and a threaded expander or nut element.

5.1.2 Installation of the blind nut consists of assembling the sleeve and expander onto a threaded mandrel pulling tool, inserting the fastener into the prepared hole and setting in place by pulling the expander into the sleeve until a specific pulling load is reached, and then un-threading the mandrel from the installed fastener. As the expander is pulled into the sleeve, the sleeve is flared out to form a blind head to secure the fastener in the part and at the same time provide a positive retention of the expander inside the sleeve.

5.2 Preparation of Parts

5.2.1 Prepare parts for installation of blind nuts as follows:

Step 1. Pre-drill holes as specified in Table 1 according to PPS 1.09.

Step 2. Countersink the pre-drilled holes according to PPS 1.33 to the diameter specified in Table 1.

Step 3. Drill the countersunk holes to the final size specified in Table 1 according to PPS 1.09.

Table 1 - Hole Preparation Data

SIZE OF BOLT TO BE USED	RECOMMENDED PRE-DRILL DIAMETER	COUNTERSINK DIAMETER	FINAL DRILL	
			RECOMMENDED DRILL SIZE	HOLE SIZE
632	#30	0.278" - 0.288"	#2	0.219" - 0.222"
832	#20	0.317" - 0.327"	G	0.258" - 0.264"
1032	F	0.372" - 0.382"	O	0.313" - 0.319"
428	O	0.450" - 0.460"	25/64"	0.391" - 0.397"
524	25/64"	0.528" - 0.538"	15/32"	0.469" - 0.477"
624	25/64"	0.590" - 0.600"	17/32"	0.531" - 0.539"

Note 1. In place of the drills specified in this table, it is acceptable to use locally equivalent drills provided that the specified hole tolerance requirements are met when verified using gauges or equipment calibrated in inches.

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.

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.

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
91 - 150	11
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 1 using the applicable go/no-go gauge as follows (see Figure 1):

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.

5.4 Fastener Selection

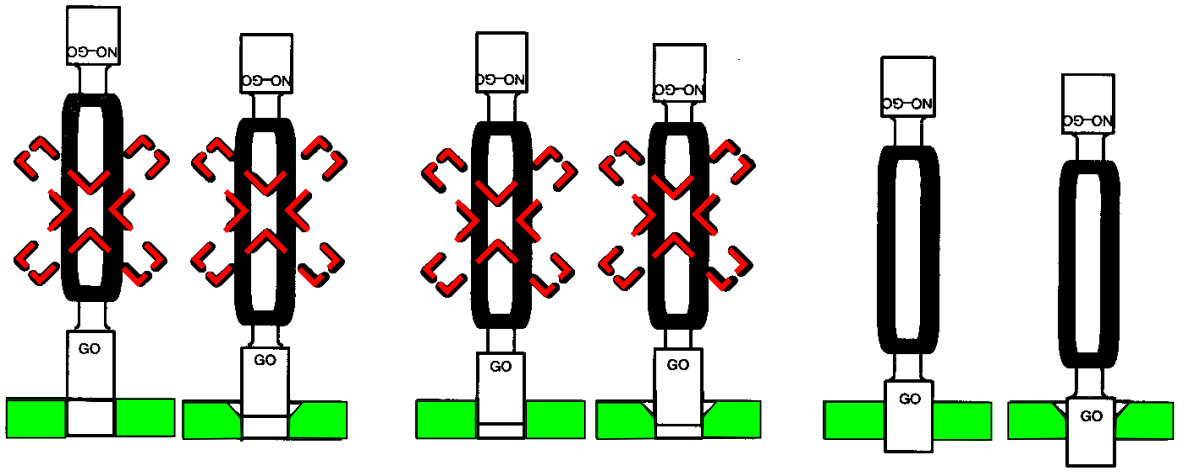
5.4.1 In order to verify that the actual blind nut sleeves selected for the installation are the correct grip lengths, measure the overall length of one sleeve and check against the length specified in Table 3 for the particular blind nut size and grip length.

5.4.2 Blind nuts 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. Verify that the grip length specified is correct by measuring the combined material thickness, after final drilling, using a Cherrymax/Cherrylock rivet gauge No. 269C3 as shown in Figure 5. 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, use the measured length. The minimum total material thickness for installation of blind nuts is 0.080"; if the total material thickness is less than 0.080" refer to Liaison Engineering.

5.4.3 If the engineering drawing specifies use of a BN360 blind nut, it is acceptable to install the equivalent type and diameter BN1360 blind nut instead.

Table 3 - Blind Nut Sleeve Length

GRIP LENGTH	BLIND NUT SIZE/SLEEVE LENGTH					
	-632	-832	-1032	-428	-524	-624
1	0.343"	0.378"	0.443"	0.513"	0.563"	0.613"
2	0.405"	0.440"	0.505"	0.575"	0.625"	0.675"
3	0.468"	0.503"	0.568"	0.638"	0.688"	0.738"
4	0.530"	0.565"	0.630"	0.700"	0.750"	0.800"
5	0.593"	0.628"	0.693"	0.763"	0.813"	0.863"
6	0.655"	0.690"	0.755"	0.825"	0.875"	0.925"
7	0.718"	0.753"	0.818"	0.888"	0.938"	0.988"
8	0.780"	0.815"	0.880"	0.950"	1.000"	1.050"
9	0.843"	0.878"	0.943"	1.013"	1.063"	1.113"
10	0.905"	0.940"	1.005"	1.075"	1.125"	1.175"
11	0.968"	1.003"	1.068"	1.138"	1.188"	1.238"
12	1.030"	1.065"	1.130"	1.200"	1.250"	1.300"

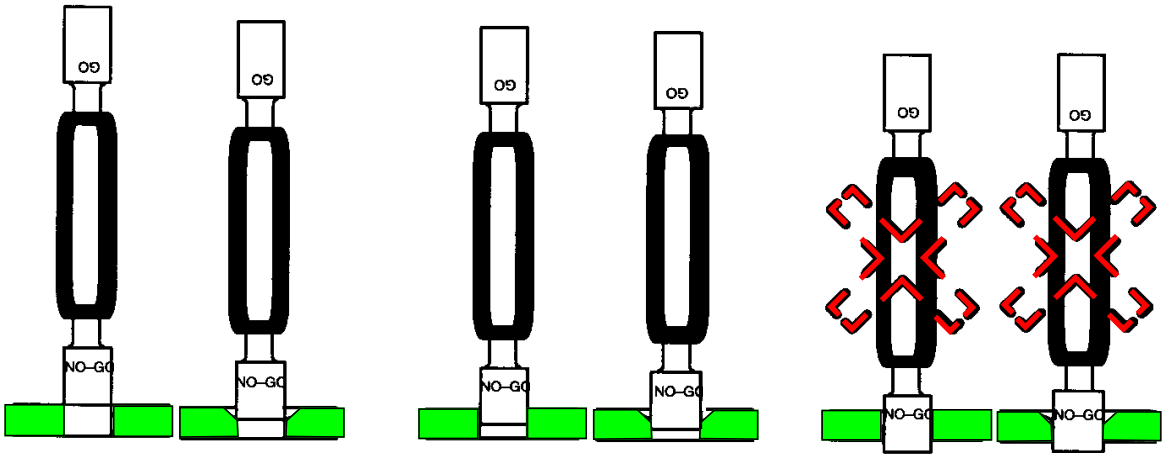


Does not go in.
UNDERSIZE HOLE

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

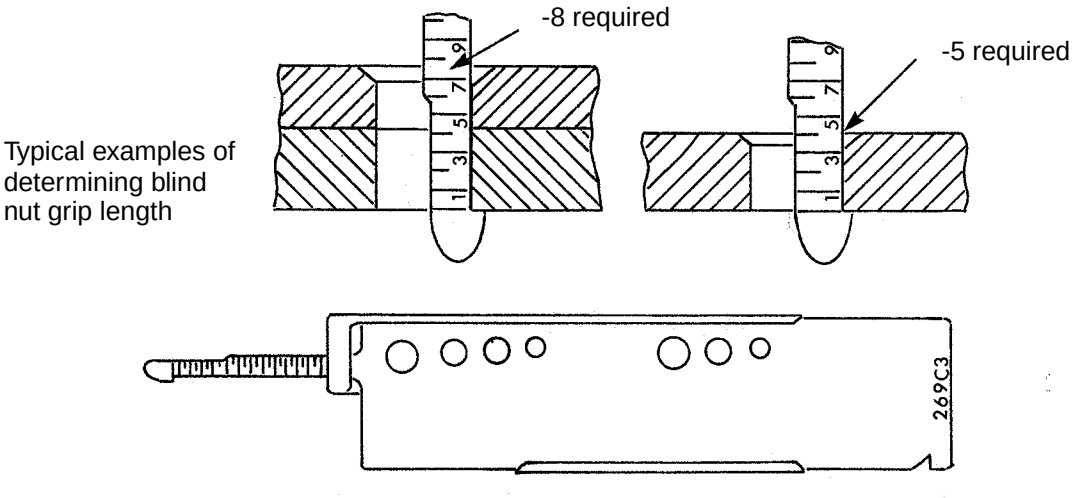


Figure 5 - Use of a Cherrymax Rivet Grip Gauge

5.5 Selection and Set Up of Installation Tooling

5.5.1 Installation tooling consists of either a power driven pistol type tool (BG2500) and accessories as listed in Table 4, or a wrench operated hand tool (BH Series) and accessories as listed in Table 5.

Table 4 - Blind Nut BG2500 Power Tool Accessories

BLIND NUT		MANDREL	ANVIL	CHUCK	DRIVING PRESSURE
BOLT SIZE TO BE USED	GRIP LENGTH				
632	0.080" - 0.5"	M01-632	A27-632	C2-632	400 lbs
	0.5" - 1.0"	M1-632			
832	0.080" - 0.5"	M01-8	A27-832	C2-8	650 lbs
	0.5" - 1.0"	M1-8			
1032	0.080" - 0.5"	M01-1032	A27-1032	C2-1032	950 lbs
	0.5" - 1.0"	M1-1032			
428	0.080" - 0.5"	M01-12	A27-428	C2-12	1450 lbs
	0.5" - 1.0"	M1-12			
524	0.080" - 0.5"	M01-14	A27-524	C2-14	1900 lbs
	0.5" - 1.0"	M1-14			
624	0.080" - 0.5"	M01-16	A27-624	C2-16	2250 lbs
	0.5" - 1.00"	M1-16			

Table 5 - Blind Nut Hand Tools and Accessories

BOLT SIZE TO BE USED (Note 1)	TOOL NUMBER	MANDREL	CROWS FOOT ADAPTER	TORQUE VALUES (Note 2)
632	BH120-632-M2	M2-632	AN8506-8	75 - 85 inch lbs
832	BH120-832-M2	M2-8		140 - 175 inch lbs
1032	BH120-1032-M2	M2-1032		200 - 225 inch lbs
428	BH220-428-M2	M2-12	AN8506-10	425 - 450 inch lbs

Note 1. 428 is the largest which can be installed using a hand tool.

Note 2. Torque according to PPS 14.01. The torque value specified herein has been corrected to include use of the crows foot adapter, so a torque correction calculation is not required.

5.5.2 Set up the BG2500 power tool as follows:

Step 1. Assemble the appropriate mandrel, chuck and anvil, selected from Table 4 for the size of blind nut to be installed, onto the BG2500 gun as shown in Figure 6.

Step 2. Thread the anvil fully onto the gun, hand tight only.

Step 3. Using the control handle, set the power unit pressure to the driving pressure specified in Table 4 for the size of blind nut to be installed.

Step 4. Assemble the blind nut sleeve and expander onto the mandrel and press the ON control button to screw the mandrel into the expander. Ensure that the expander is assembled onto the mandrel tapered end first (i.e., tapered end towards gun).

Step 5. Adjust the anvil to the correct sleeve length by screwing the anvil against the sleeve head and hand tighten the locknut against the anvil.

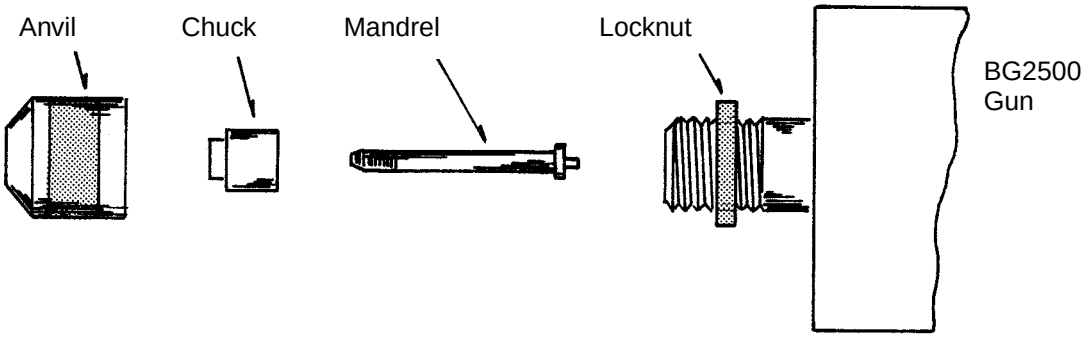


Figure 6 - Assembly of Installation Tooling to BG2500 Gun

5.5.3 Set-up hand tools as follows:

Step 1. Select the appropriate hand tool from Table 5 for the size of blind nut to be installed.

Step 2. Turn the chuck bolt on the hand tool counter clockwise to fully engage it in the body.

Step 3. Assemble the sleeve onto the mandrel and screw on the expander finger tight. Turn the chuck bolt clockwise to seat the sleeve firmly against the anvil. Ensure that the expander is assembled onto the mandrel tapered end first (i.e., tapered end towards tool).

5.6 Installation of Blind Nuts Using BG2500 Power Tool

5.6.1 Install blind nuts using a BG2500 power tool as follows (see Figure 7):

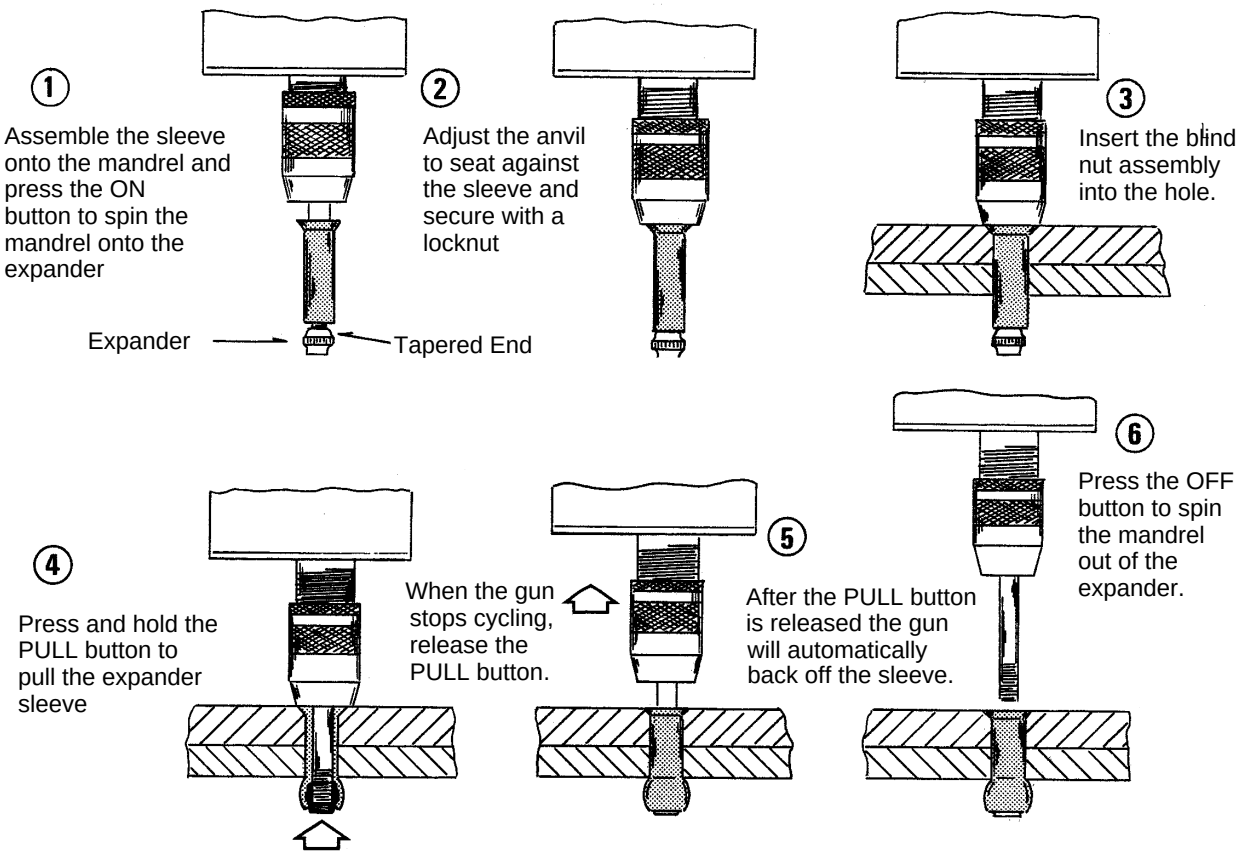


Figure 7 - Installation of Blind Nut using Power Tools

Step 1. Apply a thin brush coat of corrosion preventive jointing compound to the fastener hole according to PPS 34.05.

Step 2. Insert the mandrel and blind nut into the installation hole.

Step 3. Holding the gun square to the surface of the work, press and hold the PULL control button to pull the expander into the sleeve.

Step 4. When the power unit stops cycling (i.e., full pull up pressure is reached) release the PULL control button. The gun will then automatically back-off the sleeve head and installation is completed.

Step 5. Press the OFF control button to unscrew the mandrel from the blind nut. Assemble the sleeve onto mandrel and actuate the ON button to spin mandrel into the expander.

5.7 Installation of Blind Nuts Using Hand Tools

5.7.1 Install blind nuts using hand tools as follows (see Figure 8):

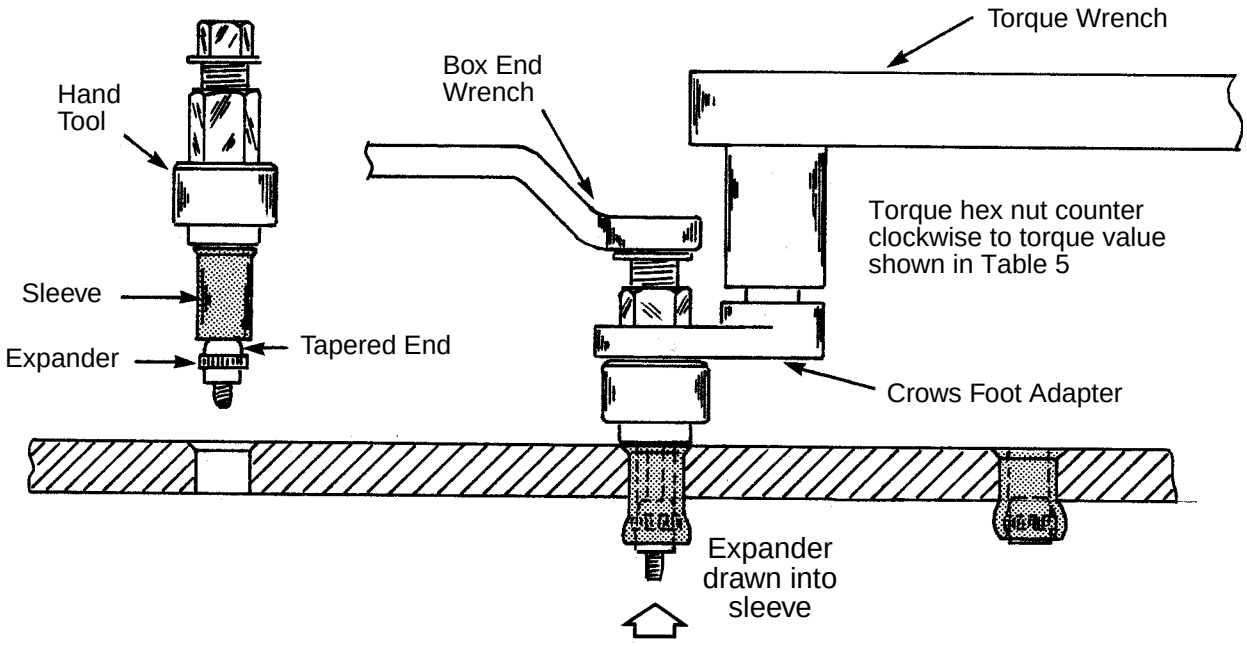


Figure 8 - Installation of Blind Nut using Hand Tools (typ.)

Step 1. Apply a thin brush coat of corrosion preventive jointing compound to the fastener hole according to PPS 34.05.

Step 2. Insert the assembled blind nut into the installation hole.

Step 3. Use a box end wrench to hold the chuck bolt firmly to prevent it rotating.

Step 4. Use a torque wrench fitted with the crows foot adapter to turn the hex nut on the tool body in a counter clockwise direction. When the expander first contacts the sleeve, the torque will increase sharply (possibly even above the torque specified in Table 5) but will then drop as the expander is drawn into the sleeve and will then increase a second time as the expander is seated. After pulling the expander past first contact with the sleeve, tighten the hex nut to the torque specified in Table 5 to seat the expander. Apply torque according to PPS 14.01.

Step 5. To remove the tool, turn the hex nut clockwise approximately 1/2 turn to loosen and unscrew the chuck bolt from the expander threads.

5.8 Removal of Blind Nuts

5.8.1 If necessary, installed blind nuts may be removed as follows (see Figure 9):

Step 1. Using the final size drill listed in Table 1, drill out the countersunk head of the sleeve to a depth approximately equal to the head thickness and break out the head.

Step 2. Drive out the sleeve and expander using a suitable drift punch.

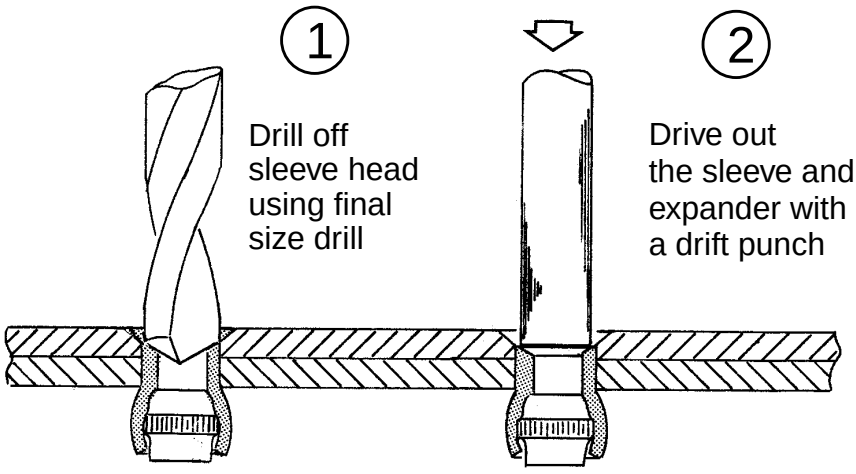


Figure 9 - Removal of Blind Nuts

6 Requirements

6.1 Visually examine installed blind nuts according to Figure 10.

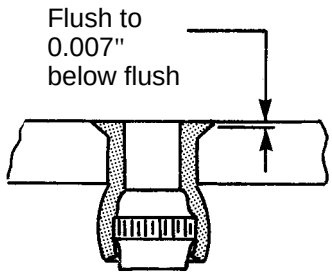
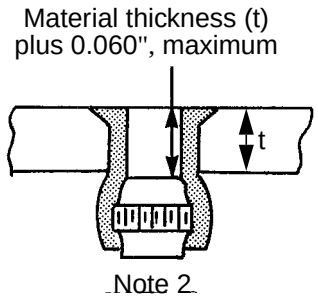
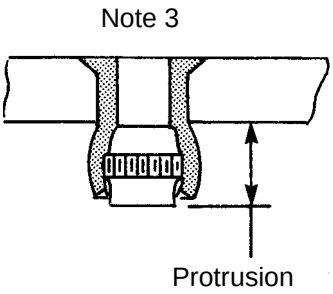
<table>
<tr><th>VISUAL/DIMENSIONAL APPEARANCE</th><th>DESCRIPTION</th><th>CORRECTIVE ACTION</th></tr>
<tr><td rowspan="2"> 
</td><td>ACCEPTABLE (Note 1)
- The sleeve head is flush to 0.007" maximum below flush with the surface.</td><td>None required.</td></tr>
<tr><td>UNACCEPTABLE
- The sleeve head is above flush or more than 0.007" below flush with the surface.</td><td>Remove the blind nut and check the countersink diameter.</td></tr>
<tr><td rowspan="2"> 
</td><td>ACCEPTABLE
- The maximum depth of the expander in the sleeve does not exceed the material thickness (t) by more than 0.060".</td><td>None required.</td></tr>
<tr><td>UNACCEPTABLE
- The depth of the expander in the sleeve exceeds the material thickness (t) by more than 0.060".</td><td>Re-pull the expander with the installation tool and re-check the depth.</td></tr>
<tr><td rowspan="2"> 
</td><td>ACCEPTABLE
- Maximum protrusion of fastener on blind side does not exceed the following limits
<table>
<tr><th>Bolt to be Used</th><th>B0203034 & BN360</th><th>BN1360</th></tr>
<tr><td>632</td><td>0.270"</td><td>0.220"</td></tr>
<tr><td>832</td><td>0.300"</td><td>0.260"</td></tr>
<tr><td>1032</td><td>0.360"</td><td>0.295"</td></tr>
<tr><td>428</td><td>0.430"</td><td>0.355"</td></tr>
<tr><td>524</td><td>0.480"</td><td>0.405"</td></tr>
<tr><td>624</td><td>0.540"</td><td>0.460"</td></tr>
</table></td><td>None required.</td></tr>
<tr><td>UNACCEPTABLE
- The protrusion on the blind side exceeds above limits</td><td>Re-pull the expander with the installation tool and re-check the protrusion</td></tr>
<tr><td colspan="3">NOTES - 1. An annular groove around the head of the sleeve is acceptable.
2. Use this check method if the blind nut is installed in a blind sided application.
3. Use this procedure as an alternate method of checking expander depth where the blind side of the assembly is accessible.</td></tr>
</table>

Figure 10 - Dimensional/Visual Examination of Installed Blind Nuts

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

9 Recommended Maintenance of Equipment

9.1 At suitable intervals service and/or adjust power tools and drive tool accessories exhibiting signs of wear.

9.2 It is recommended that before use in a particular shift, the accumulators in the air-hydraulic power unit be checked by connecting a shop air line to the power unit and then turning the pressure control handle fully counter clockwise. The pressure gauge should pause momentarily at the pressure of the low pressure accumulator (200 psi), then continue before pausing again at the pressure of the high pressure accumulator (900 psi). If the indicated accumulator pressures are less than the values specified, adjust or recharge the power unit, as necessary.