BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.25

PRODUCTION PROCESS STANDARD

INSTALLATION OF LOCK SPINDLE RIVETS

Issue 8
- This standard supersedes PPS 2.25, Issue 7.
- 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.

Prepared By:	(Michael Wright)	September 23, 2011
	Production Process Standards (PPS)	
Approved By:	(L.K. John)	September 23, 2011
	Materials Technology	
	(B. DeVreede)	September 26, 2011
	Quality	

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

TABLE OF CONTENTS

Sections **Page**

Tables

Figures

TABLE OF CONTENTS

Figures **Page**

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for installing standard and bulbed lock spindle rivets.

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 of Titanium 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 2.01 - Installation of Solid Rivets.

3.6 PPS 13.26 - General Subcontractor Provisions.

4 Materials and Equipment

4.1 Materials

4.2 Lock spindle rivets, standard and bulbed type, as specified on the engineering drawing. Refer so Figure 1 for a general description of lock spindle rivets. Refer to Figure 2 and Figure 3 for the NAS and Cherry Rivet part number breakdowns, respectively. Refer to Table I for cross reference of NAS and manufacturers part numbers.

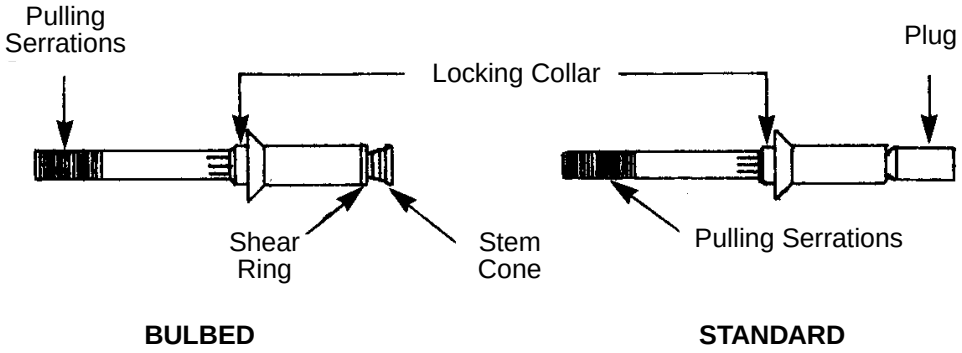


Figure 1 - General Description of Lock Spindle Rivets

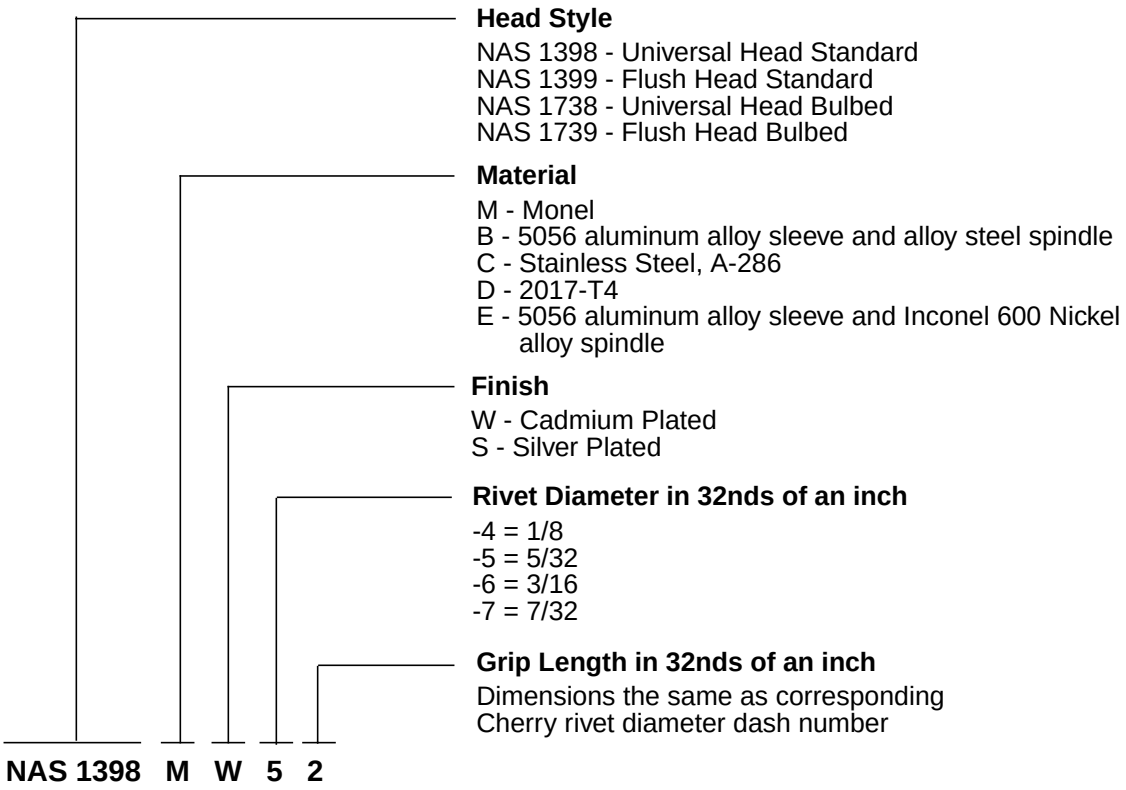
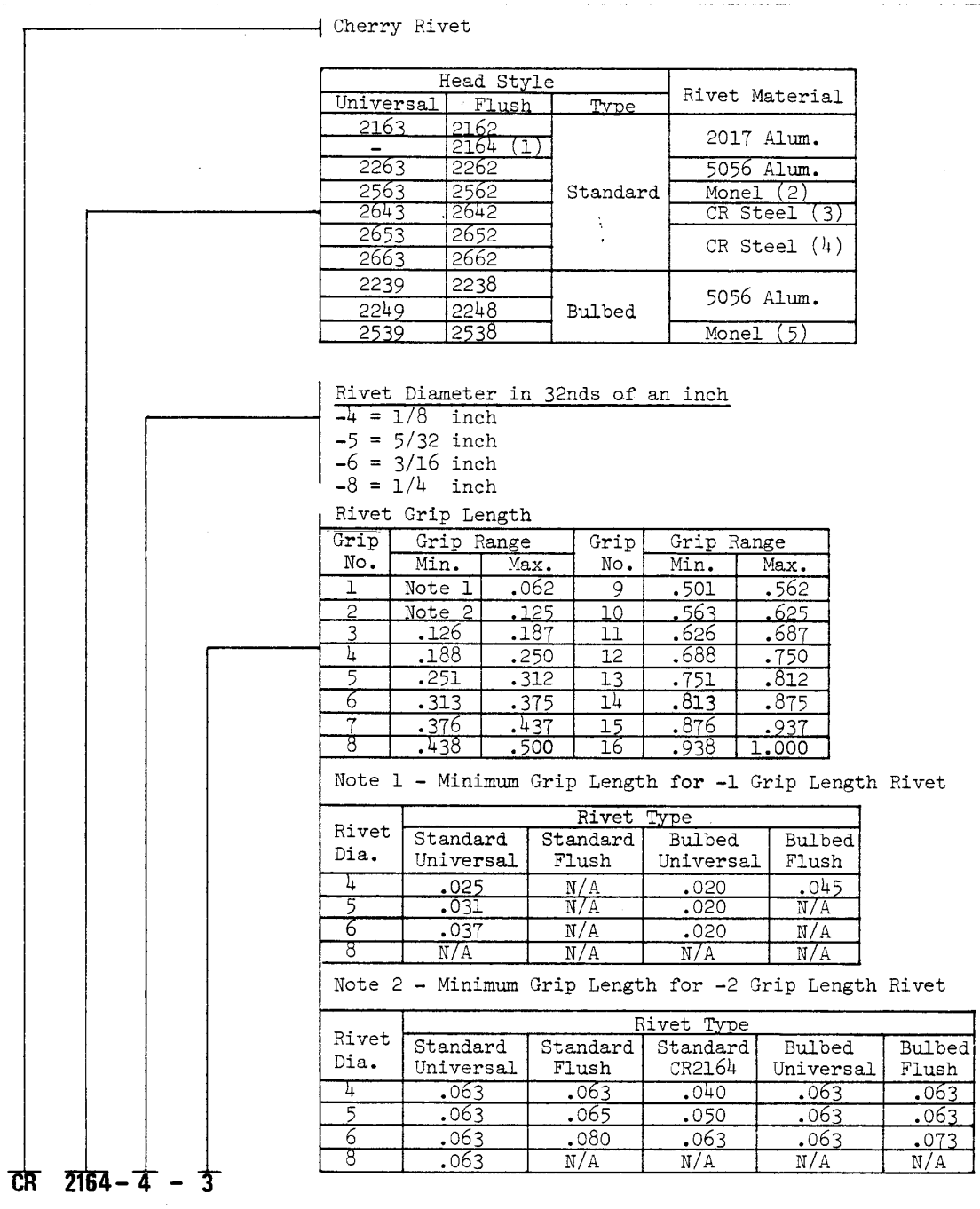


Figure 2 - NAS Part Number Breakdown



Cherry Rivet

Head Style		Type	Rivet Material
Universal	Flush		
2163	2162	Standard	2017 Alum.
-	2164 (1)		
2263	2262		5056 Alum.
2563	2562		Monel (2)
2643	2642		CR Steel (3)
2653	2652		CR Steel (4)
2663	2662		
2239	2238	Bulbed	5056 Alum.
2249	2248		
2539	2538		Monel (5)

Rivet Diameter in 32nds of an inch
-4 = 1/8 inch
-5 = 5/32 inch
-6 = 3/16 inch
-8 = 1/4 inch

Rivet Grip Length

Grip No.	Grip Range Min.	Grip Range Max.	Grip No.	Grip Range Min.	Grip Range Max.
1	Note 1	.062	9	.501	.562
2	Note 2	.125	10	.563	.625
3	.126	.187	11	.626	.687
4	.188	.250	12	.688	.750
5	.251	.312	13	.751	.812
6	.313	.375	14	.813	.875
7	.376	.437	15	.876	.937
8	.438	.500	16	.938	1.000

Note 1 - Minimum Grip Length for -1 Grip Length Rivet

Rivet Dia.	Rivet Type: Standard Universal	Standard Flush	Bulbed Universal	Bulbed Flush
4	.025	N/A	.020	.045
5	.031	N/A	.020	N/A
6	.037	N/A	.020	N/A
8	N/A	N/A	N/A	N/A

Note 2 - Minimum Grip Length for -2 Grip Length Rivet

Rivet Dia.	Rivet Type: Standard Universal	Standard Flush	Standard CR2164	Bulbed Universal	Bulbed Flush
4	.063	.063	.040	.063	.063
5	.063	.065	.050	.063	.063
6	.063	.080	.063	.063	.073
8	.063	N/A	N/A	N/A	N/A

(1) CR2164 rivets have reduced flush heads.
(2) Standard monel rivets are silver plated when suffixed “S”, no suffix denotes cadmium plate, suffix “M” denotes no plating.
(3) Hard stem.
(4) Soft stem.
(5) Bulbed monel rivets are cadmium plated when suffixed “P”, no suffix denotes no plating.

Figure 3 - Cherry Rivet Part Number Breakdown

Table I - Cross Reference of NAS and Manufacturer's Part Numbers

NAS PART NUMBERS		MANUFACTURERS PART NUMBERS	
PROTRUDING	**COUNTERSUNK**	**PROTRUDING**	**COUNTERSUNK**
1398D	1399D	CR2163	CR2162
1398B	1399B	CR2263	CR2262
1398M	1399M	CR2563M	CR2562M
1398MW	1399MW	CR2563	CR2562
1398MS	1399MS	CR2563S	CR2562S
---	---	CR2643	CR2642
1398C	1399C	CR2663	CR2662
---	---	CR2653	CR2652
1738B	1739B	CR2249	CR2248
1738E	1739E	CR2239	CR2238
1738M	1739M	CR2539	CR2538
---	---	---	CR2164

4.2.1 Cherry Lock Spindle rivets are lubricated by the manufacturer. Satisfactory installation is not possible if the lubricant has been removed or contaminated. Protect fasteners at all times from dust, dirt, moisture and excessive heat. If possible, keep fasteners in their original containers; if this is not possible, use non-absorbent containers. Always use oldest stock first.

4.3 Equipment

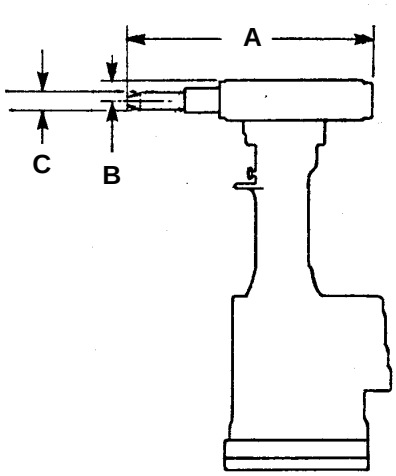
4.3.1 Cherry installation guns as listed in Table V. Also listed in Table V are the operating capacities for the maximum rivet length each gun is capable of pulling.

4.3.2 Pulling heads as listed in Table VI. A separate pulling head is required to install each diameter and head style lock spindle rivet, as shown in Table VI. Also listed in Table VI are the appropriate installation guns for the pulling head to be used. Refer to Figure 4 for a general reference of tool dimensions.

4.3.3 Cherry #226 adapter.

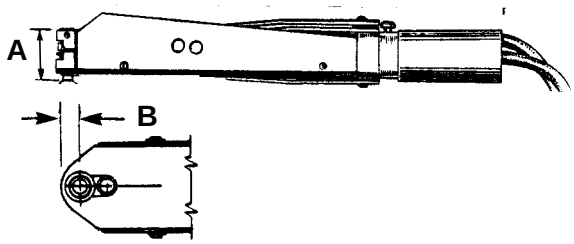
4.3.4 Vixen file (e.g., SD8066).

4.3.5 Cherry rivet grip gauge, #269C3.



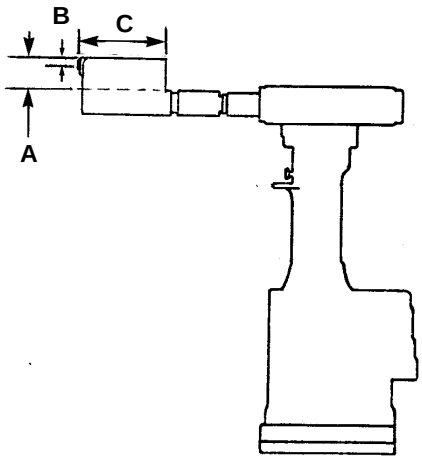
GUN AND HEAD	A	B	C
G15 Gun & H615 Head	9 1/8"	27/32"	21/32"
G40 Gun & H640 Head	12 1/4"	1 1/16"	
G684, G700 or G784 Gun with H680, H680A or H681 Head	8 3/8"	13/16"	

Installation Gun With Straight Pulling Head



GUN AND HEAD	A	B
G695 Gun & H690 Head	2 3/8"	3/8"

Right Angle Installation Gun With Pulling Head



HEAD	A	B	C
H642	9 1/8"	27/32"	21/32"
H644	12 1/4"	1 1/16"	
Pulling head widths are 1			

Installation gun with Offset Pulling Head

Figure 4 - Installation Gun and Pulling Head Dimensions

5 Procedure

5.1 General

5.1.1 Cherry lock spindle rivets are high strength, blind rivets which are set and locked by means of a single action pulling tool which pulls the mandrel stem to form the blind head, inserts the locking collar into place and simultaneously breaks off the mandrel stem.

5.1.2 Drill fastener holes according to PPS 1.09.

5.2 Preparation of Fastener Holes

5.2.1 Prepare fastener holes as follows:

Step 1. Pre-drill the fastener hole to the size specified in Table II.

Table II - Pre-Drill Data

FASTENER SIZE	PRE-DRILL
-4 (1/8")	#40
-5 (5/32")	#30
-6 (3/16")	#20
-8 (1/4")	#1

Step 2. For flush head fasteners, if dimpling is specified on the engineering drawing, ram coin dimple according to PPS 1.01 or 1.07, as applicable. If countersinking is specified on the engineering drawing, countersink according to PPS 1.33 to the countersink diameter specified in Table III.

Table III - Countersinking Data

FASTENER SIZE	COUNTERSINK PILOT DIAMETER	REFERENCE COUNTERSINK DIAMETER	
		ALL RIVETS EXCEPT CR2164	CR2164 RIVETS
-4 (1/8")	0.098"	0.211" - 0.221"	0.185" - 0.190"
-5 (5/32")	0.128"	0.272" - 0.282"	0.236" - 0.241"
-6 (3/16")	0.159"	0.339" - 0.349"	0.292" - 0.297"
-8 (1/4")	0.228"	0.462" - 0.472"	0.385" - 0.390"
Note 1. The countersink diameters specified herein are for reference only; prepare countersinks so that the head protrusion of flush head fasteners will meet the requirements of Figure 16.			

Step 3. Final drill to the final hole size specified in Table IV.

Table IV - Final Hole Data

FASTENER SIZE	FINAL DRILL			
	STANDARD		BULBED	
	RECOMMENDED DRILL SIZE	HOLE LIMIT	RECOMMENDED DRILL SIZE	HOLE LIMIT
-4 (1/8")	#30	0.129" - 0.132"	#27	0.143" - 0.146"
-5 (5/32")	#20	0.160" - 0.164"	#15	0.176" - 0.180"
-6 (3/16")	#10	0.192" - 0.196"	#5	0.205" - 0.209"
-8 (1/4")	F	0.256" - 0.261"	---	---

5.3 Fastener Selection

5.3.1 Use only the type and diameter of fastener specified on the Engineering Drawing. In order to verify that the grip length specified is correct, after final drilling measure the combined material thickness using a grip gauge as shown in Figure 5. Always read to the next higher number (i.e., if the reading is past the **end** of the -2 marking then use a -3 fastener). As the fastener grip length specified on the engineering drawing or Product Specification or Shop Order is only a REFERENCE LENGTH, if the grip length determined by measurement does not agree with the specified grip length, use the measured length.

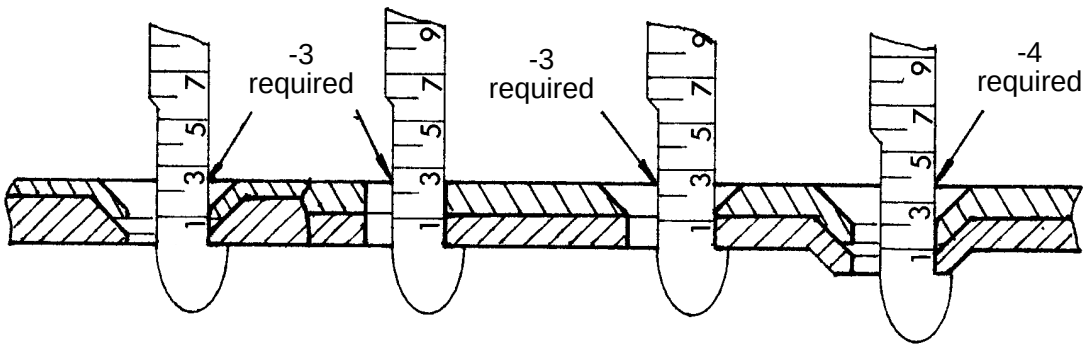


Figure 5 - Use of Cherry Rivet Grip Gauge

5.4 Selecting Installation Tools

5.4.1 Select the appropriate installation gun from Table V.

5.4.2 Select the appropriate pulling head from Table VI for the installation gun selected and the diameter and head style of rivet to be installed. Use offset and right angle pulling heads only in limited access situations.

Table V - Installation Guns and Capacities

GUN NO.	MINIMUM AIR PRESSURE AT GUN	RIVET DIA.	MAXIMUM GRIP NUMBER WHICH CAN BE PULLED									
			STANDARD RIVET						BULBED RIVET			
			ALUMINUM		MONEL		CRES		ALUMINUM		MONEL	
			2163 2263	2162 2262 2164	2563	2562	2643 2653 2663	2642 2652 2662	2239 2248	2238	2539	2538
G11	Hand	1/8"	12	13	12	13	12	13	All	All	---	---
		5/32"	12	13	12	13	---	---	---	---	---	---
		3/16"	12	13	---	---	---	---	---	---	---	---
		1/4"	---	---	---	---	---	---	---	---	---	---
G36	Hand	1/8"	All	All	All	All	All	All	All	All	---	---
		5/32"	All	All	All	All	---	---	---	---	---	---
		3/16"	12	13	---	---	---	---	---	---	---	---
		1/4"	---	---	---	---	---	---	---	---	---	---
G15DC	90	1/8"	All	All	All	All	All	All	---	---	---	---
		5/32"	8	9	---	---	---	---	---	---	---	---
		3/16"	8	9	---	---	---	---	---	---	---	---
		1/4"	---	---	---	---	---	---	---	---	---	---
G40C	90	1/8"	8	9	8	9	8	9	All	All	All	All
		5/32"	8	9	8	9	8	9	All	All	All	All
		3/16"	8	9	8	9	---	---	---	---	---	---
		1/4"	8	9	---	---	---	---	---	---	---	---
G40E G684	90	1/8"	8	9	8	9	8	9	All	All	All	All
		5/32"	8	9	8	9	8	9	All	All	All	All
		3/16"	8	9	8	9	8	9	All	All	All	All
		1/4"	8	9	8	9	---	---	---	---	---	---
G695	90	1/8"	4	4	4	4	4	4	All	All	All	All
		5/32"	4	4	4	4	4	4	All	All	All	All
		3/16"	4	4	4	4	---	---	---	---	---	---
		1/4"	4	4	---	---	---	---	---	---	---	---
G700	90	1/8"	8	9	8	9	8	9	All	All	All	All
		5/32"	8	9	8	9	8 (1)	9 (1)	---	---	---	---
		3/16"	8	9	---	---	---	---	---	---	---	---
		1/4"	---	---	---	---	---	---	---	---	---	---
G784	90	1/8"	All	All	All	All	All	All	All	All	All	All
		5/32"	8	9	8	9	8	9	All	All	All	All
		3/16"	8	9	8	9	8	9	All	All	All (1)	All (1)
		1/4"	8	9	8	9	---	---	---	---	---	---

Note 1. Air pressure of 95 psi at the gun may be required.

Table VI - Pulling Head Types and Application

PULLING HEAD SERIES	RIVET DIAMETER	RIVET HEAD STYLE	PULLING HEAD NUMBER	GUN NUMBER
H615A or H615B	1/8"	Universal	H615A or B-4U	G11 G15DC G36
		Countersunk	H615A or B-4C	
	5/32"	Universal	H615A or B-5U	
		Countersunk	H615A or B-5C	
	3/16"	Universal	H615A or B-6U	
		Countersunk	H615A or B-6C	
H640A or H640B	1/8"	Universal	H640A or B-4U	G40C G40E
		Countersunk	H640A or B-4C	
	5/32"	Universal	H640A or B-5U	
		Countersunk	H640A or B-5C	
	3/16"	Universal	H640A or B-6U	
		Countersunk	H640A or B-6C	
	1/4"	Universal	H640A or B-8U	
		Countersunk	H640A or B-8C	
Offset Heads H642 or H644	1/8"	Universal	H642/H644-4U15	G11 G15DC G36
		Countersunk	H642/H644-4C15	
	5/32"	Universal	H642/H644-5U15	
		Countersunk	H642/H644-5C15	
	3/16"	Universal	H642/H644-6U15	
		Countersunk	H642/H644-6C15	
	1/8"	Universal	H642/H644-4U40	G40C G40E
		Countersunk	H642/H644-4C40	
	5/32"	Universal	H642/H644-5U40	
		Countersunk	H642/H644-5C40	
	3/16"	Universal	H642/H644-6U40	
		Countersunk	H642/H644-6C40	
H680 /H680A H681	1/8"	Universal	H680/680A/681-4U	G684 G700 G784
		Countersunk	H680/680A/681-4C	
	5/32"	Universal	H680/680A/681-5U	
		Countersunk	H680/680A/681-5C	
	3/16"	Universal	H680/680A/681-6U	
		Countersunk	H680/680A/681-6C	
	1/4"	Universal	H680/680A/681-8U	
		Countersunk	H680/680A/681-8C	
Right Angle Head H690	1/8"	Universal	H690-4U	G695
		Countersunk	H690-4C	
	5/32"	Universal	H690-5U	
		Countersunk	H690-5C	
	3/16"	Universal	H690-6U	
		Countersunk	H690-6C	
	1/4"	Universal	H690-8U	
		Countersunk	H690-8C	

5.5 Assembling of Pulling Heads to Guns

5.5.1 Assemble H615, H642, H644 series pulling heads to installation guns as follows:

Step 1. Screw the pulling head sleeve cap all the way onto the drawbolt and head cap of the applicable gun (see Figure 6).

Step 2. When the pulling head is threaded all the way on, tighten the jam nut to secure the pulling head.

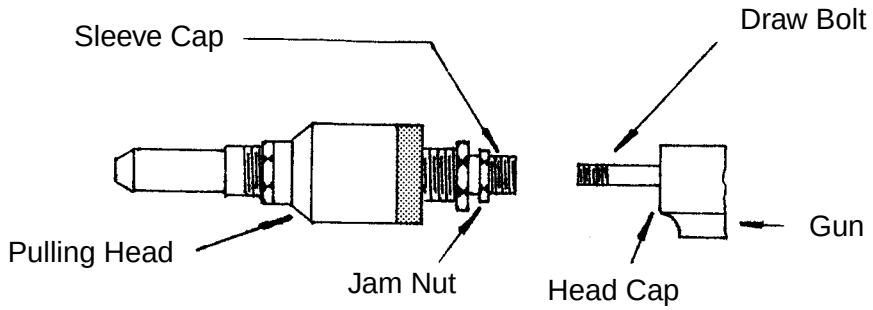


Figure 6 - Installing H615 Pulling Head to Gun

5.5.2 Assemble H640 pulling heads to installation guns as follows (see Figure 7):

Step 1. Thread the pulling head sleeve cap all the way onto the drawbolt of the gun.

Step 2. Align one or more of the holes in the sleeve cap of the pulling head with those in the sleeve adapter of the gun.

Step 3. Tighten the lock screw to secure the pulling head.

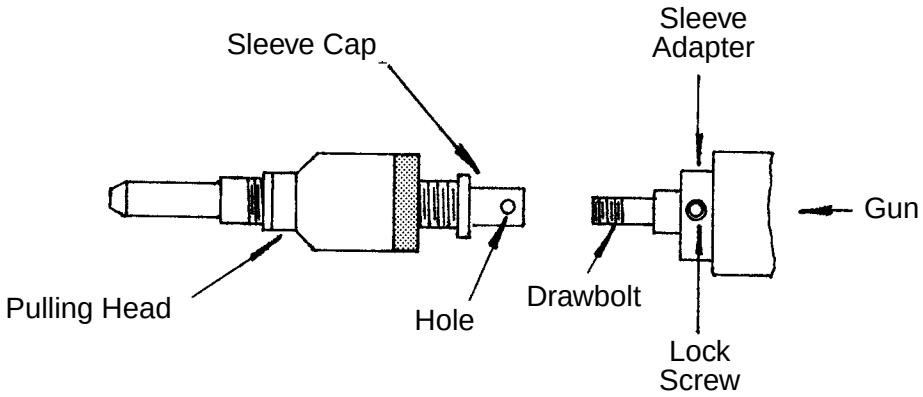


Figure 7 - Installing H640 Pulling Head to Gun

5.5.3 Assemble H680/H680A/H681 pulling heads to installation guns as follows (see Figure 8):

Step 1. Remove knurled cap and spring from the front of the gun head.

Step 2. Place the jaw assembly inside collet and insert the spring end of jaw assembly into hole in gun piston rod. Apply pressure to engage collet threads and turn until collet bottoms on shoulder of piston rod. Hand tighten only.

Step 3. Back off the collet very slightly to align the slot in the piston rod with the notch in the collet of the H680 head or with the leaf spring on the collet of the H680A/H681 head.

Step 4. Place sleeve assembly over collet, slip the knurled cap and spring over the sleeve assembly and thread onto end of gun head, hand tight.

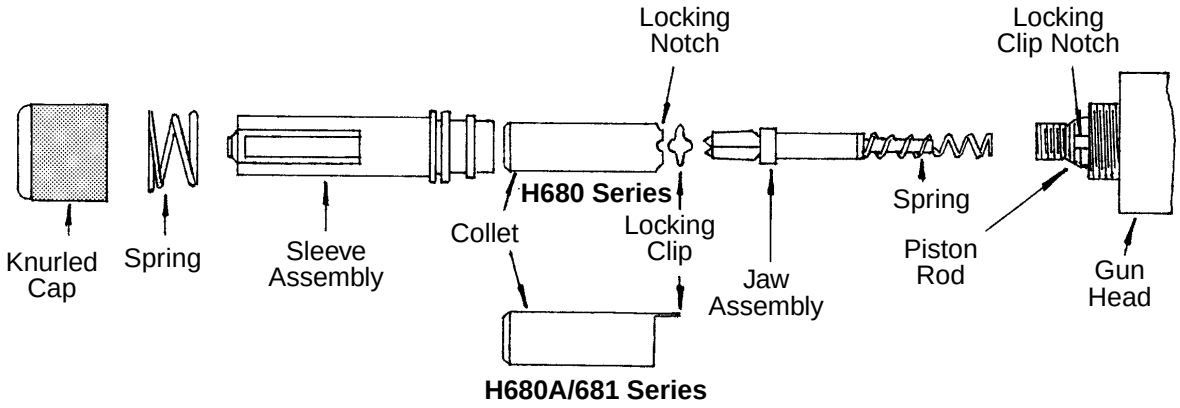


Figure 8 - Installing H680/681 Pulling Head to Gun

5.5.4 Assemble H690 series pulling heads to installation guns as follows (see Figure 9):

Step 1. Place the lock ring anvil into the nose piece and pry the bottom leaf spring of a G695 gun open far enough to insert the anvil and nose assembly. Release the leaf spring to hold the assembly in place. If an extension nose piece (9/16", 15/16", or 1 1/2") is being used, insert the proper spacer on top of the lock ring anvil before installing the nose assembly into the gun. When installing the longer nose extensions, it may be necessary to loosen the set screws holding the leaf spring, rather than prying it open.

Step 2. Remove the set screw and thread the jaw holder assembly into the upper frame until only about 1/16" protrudes.

Step 3. Place soft plug in the screw hole and replace the set screw. Do not tighten the set screw until the pulling head has been adjusted according to section 5.6 of this standard.

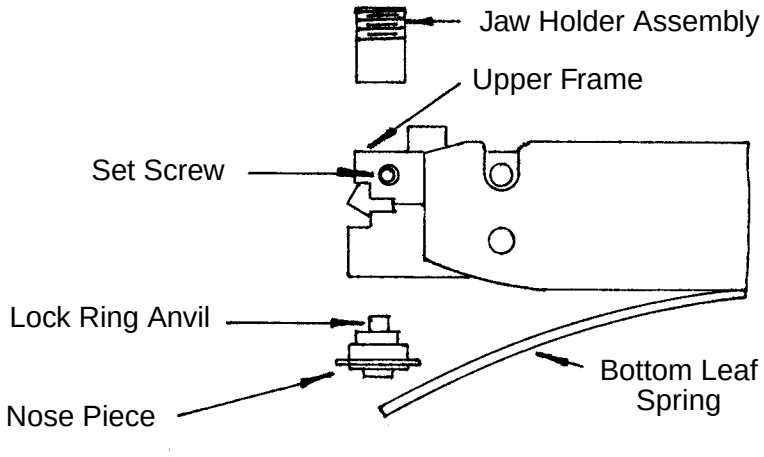


Figure 9 - Installing H690 Pulling Head to Gun

5.5.5 Use of Adapter #226

5.5.5.1 Adapter #226 may be used with H615, H642-XX15 series and H644-XX15 series pulling heads for adapting to fit the G40 gun (see Figure 10).

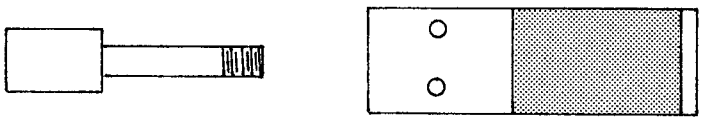


Figure 10 - #226 Adapter

5.6 Adjustments to Pulling Heads

5.6.1 The pulling heads are factory adjusted to seat universal head and countersunk head lock spindle rivets up to the maximum grip lengths specified. The pulling head should fracture the rivet stem between 0.020" above flush and 0.015" below flush of the rivet head. If necessary, the shift point may be adjusted slightly in order to break the rivet stem higher or lower as required; make minor shift point adjustments to the pulling heads or gun as specified in paragraph 5.6.1.1, paragraph 5.6.1.2, paragraph 5.6.1.3, paragraph 5.6.1.4 or paragraph 5.6.1.5, as applicable:

5.6.1.1 For H615 and H640 series pulling heads, adjust the shift point as follows (see Figure 11):

Step 1. Slacken off the three locking ring set screws.

Step 2. Hold the pulling head sleeve and turn the locking ring clockwise to reduce the stem protrusion or counter-clockwise to increase the stem protrusion. One quarter turn of the locking pin will provide approximately 0.010" adjustment. If the correct stem break-off cannot be obtained by turning the locking ring one-half turn in either direction, thoroughly check over and rectify any problems with the pulling head according to the manufacturer's maintenance instructions.

Step 3. When the correct shift point has been obtained tighten the three set screws.

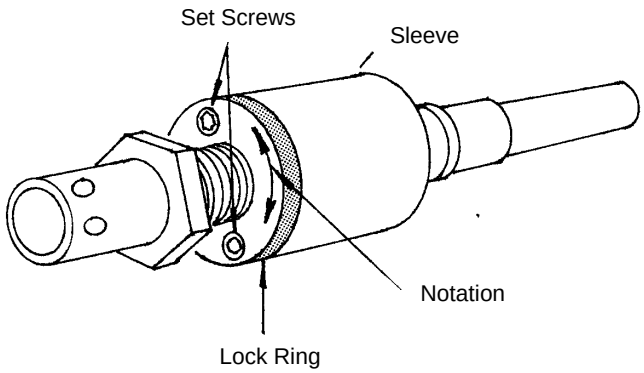


Figure 11 - Shift Point Adjustment to H615 and H640 Pulling Heads

5.6.1.2 For H642 and H644 series pulling heads, adjust the shift point as follows (see Figure 12):

Step 1. Loosen set screw.

Step 2. Turn adjusting screw clockwise to fracture the stem higher and counter-clockwise to fracture the stem lower. If the correct stem break-off cannot be obtained by turning the locking ring one-half turn in either direction, thoroughly check over and rectify any problems with the pulling head according to the manufacturer's maintenance instructions.

Step 3. Tighten set screw.

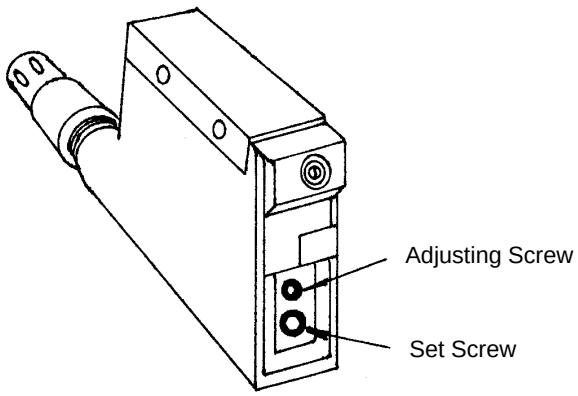


Figure 12 - Shift Point Adjustment to H642 and H644 Pulling Head

5.6.1.3 H680 series pulling heads are not adjustable; however, the head of the G684 gun on which the H680 pulling heads are used is adjustable by turning the shift point adjustment clockwise to fracture the stem lower or counter-clockwise to fracture the stem higher (see Figure 13). If the correct break-off cannot be obtained within the shift point adjustment limits, thoroughly check over and rectify any problems with the pulling head or gun according to the manufacturer's maintenance instructions.

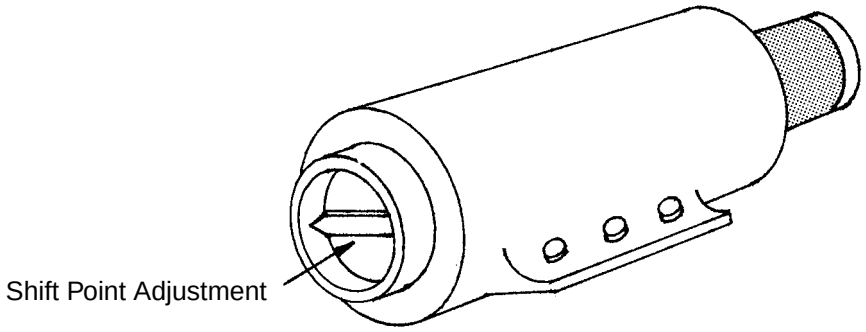


Figure 13 - Shift Point Adjustment to G684 Gun Head

5.6.1.4 For H690 series pulling heads, adjust the shift point as follows (see Figure 8):

Step 1. Loosen the set screw.

Step 2. Turn the jaw assembly holder (one-quarter of a turn at a time) clockwise to break the stem lower or counter-clockwise to break the stem higher. If adjusting the jaw assembly holder does not affect break-off within the specified limits, thoroughly check over and rectify any problems with the pulling head or gun according to the manufacturer's maintenance instructions.

Step 3. Tighten the set screw.

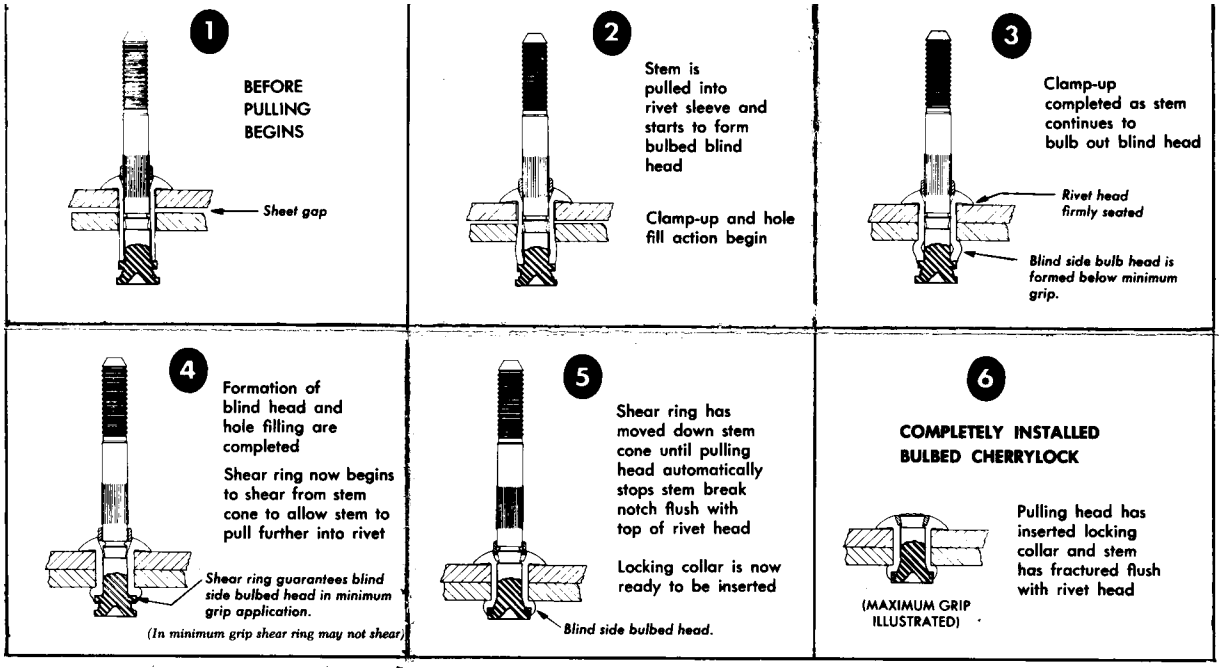
5.6.1.5 Whenever the pulling head is changed in a G695 gun, set-up the gun and pulling head according to the manufacturer's maintenance instructions.

5.7 Riveting Operation

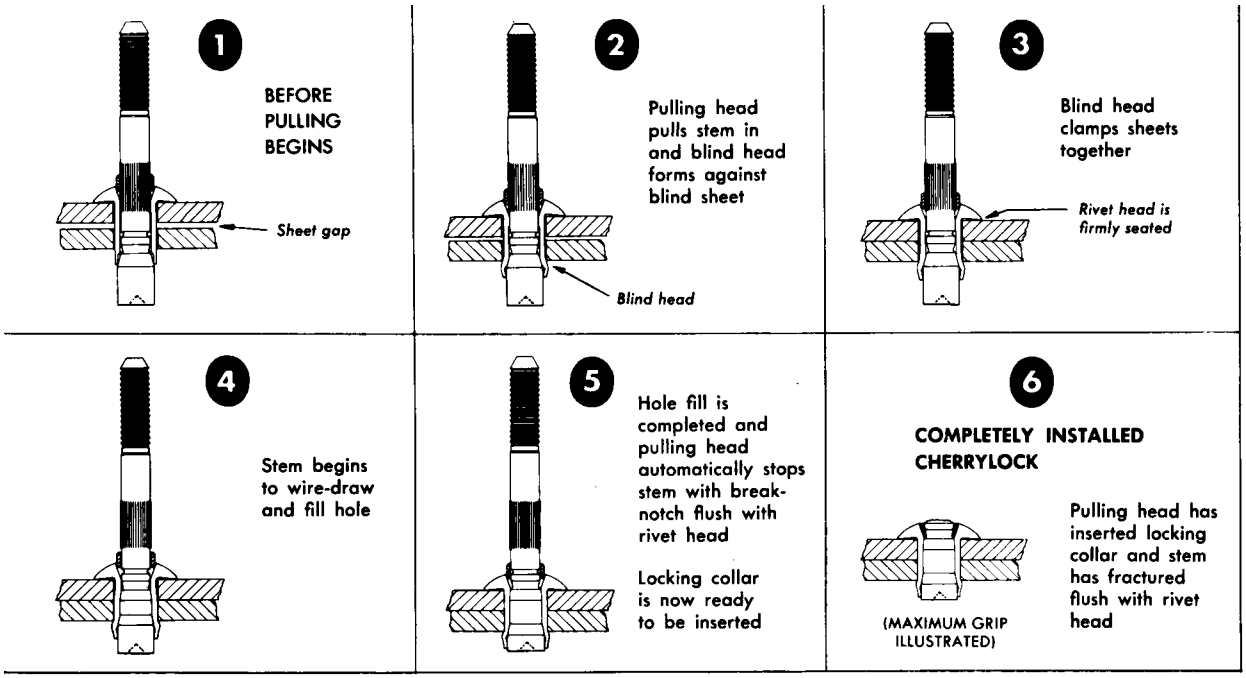
5.7.1 Perform riveting operations as follows (see Figure 14).

Step 1. Check at least one hole from each pattern of drilled holes to ensure conformance to the requirements of Table IV before installing rivets.

Step 2. Clamp parts to be riveted tightly using cleco or similar temporary fasteners in every 4^{th} to 6^{th} rivet hole. Ensure all holes are in alignment with dimples nested properly and no excessive gaps between sheets.



Bulbed Lock Spindle Rivets



Standard Lock Spindle Rivets

Figure 14 - Lock Spindle Rivet Installation Sequence

Step 3. Insert the rivet shank into the prepared hole.

Step 4. Place the pulling head onto the rivet so that the stem of the river contacts the stem step in the pulling head. On the short grip rivets the pulling head will not contact the rivet head. On the long grip rivets the pulling head will contact the rivet head. Do not apply excessive pressure on the rivet as, when a short grip rivet is installed, this will tend to disassemble the rivet.

Step 5. Holding the gun lightly and flexibly and square to the surface of the work, squeeze the trigger to set the rivet, form the lock and fracture the stem. Do not press down with force as this will not allow self alignment of the gun and rivet.

Step 6. Release the trigger to eject the broken-off portion of the stem.

5.8 Enlarged Holes and Countersinks

5.8.1 If rivet holes exceed the maximum limits specified in Table IV, refer to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

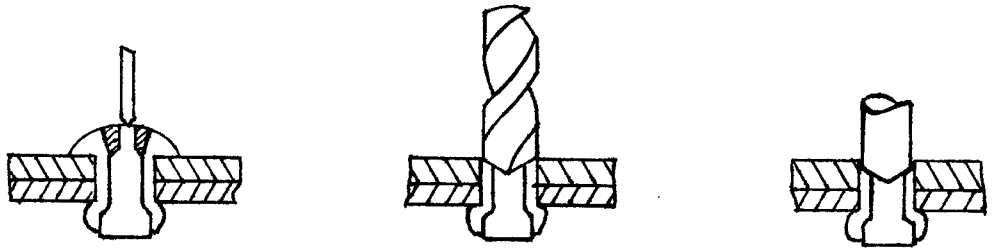
5.9 Removal of Installed Rivets

5.9.1 Remove installed rivets, if necessary, as follows (see Figure 15):

Step 1. Using a centre punch, mark the centre of the rivet stem.

Step 2. Drill completely through the head of the rivet, using the final drill size specified in Table IV for the applicable rivet diameter, so as to break off the head.

Step 3. Drive out the rivet shank using a suitable drift punch. In order to prevent damage to thin gauge material, it may be necessary to support the structure from the reverse side with a suitable support block while driving out the rivet shank.



Mark centre of stem with a centre punch

Drill off head using Final Drill size from Table IV

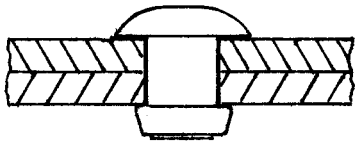
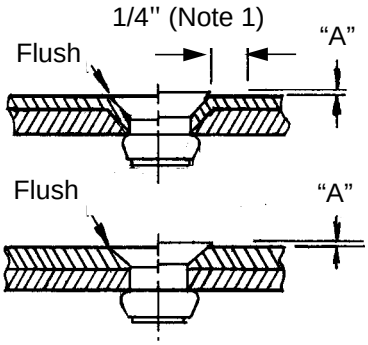
Drive out the rivet shank using a drift punch

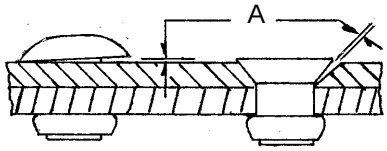
Figure 15 - Removal of Installed Rivets

6 Requirements

6.1 Visually check installed lock rivets according to Figure 16.

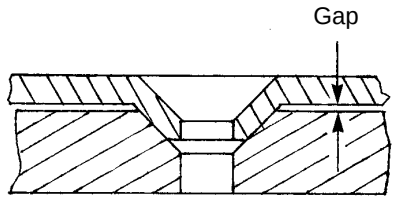
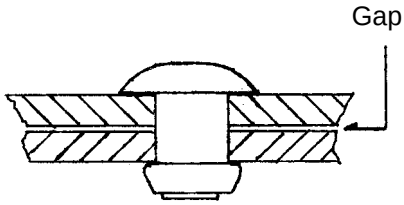
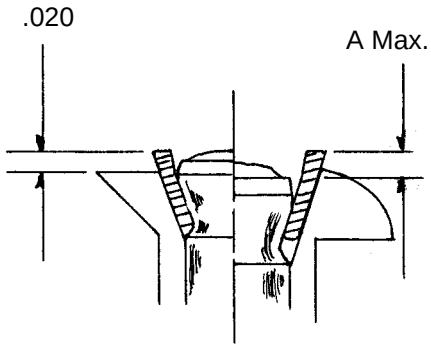
Figure 16 - Visual Examination Requirements

<table>
<tr><th>VISUAL APPEARANCE</th><th>DESCRIPTION</th><th>CORRECTIVE ACTION</th></tr>
<tr><td>  </td><td>Acceptable
- good installation
- sheets drawn up tight
- stem trimmed flush
- no cracks in shop head</td><td>None Required</td></tr>
<tr><td rowspan="2"> 

<table>
<tr><td>RIVET TYPE</td><td>all rivets except CR2164</td><td>CR2164</td></tr>
<tr><td>“A” MAX</td><td>0.010"</td><td>0.005"</td></tr>
</table></td><td>Accept
- head of flush type rivet is flush to dimension “A” above flush.</td><td>None Required</td></tr>
<tr><td>Unacceptable
- head of flush type rivet is below flush or more than dimension “A” above flush.</td><td>Remove Rivet
- check countersink diameter</td></tr>
<tr><td rowspan="2"> 

<table>
<tr><td>RIVET TYPE</td><td>1/8"</td><td>5/32"</td><td>3/16"</td><td>1/4"</td></tr>
<tr><td>A MAX</td><td>0.002"</td><td>0.002"</td><td>0.003"</td><td>0.004"</td></tr>
</table></td><td>Accept
- gap under one side of head does not exceed dimension A (i.e. applicable feeler gauge does not touch rivet shank)</td><td>None Required</td></tr>
<tr><td>Unacceptable
- gap exceeds dimension A (i.e. applicable feeler gauge touches shank)</td><td>Remove Rivet
- refer to Liaison Engineering</td></tr>
<tr><td colspan="3">Note 1. For dimpled applications only, measure protrusion 1/4" from rivet head.</td></tr>
</table>

Figure 16 - Visual Examination Requirements

<table>
<tr><th>VISUAL APPEARANCE</th><th>DESCRIPTION</th><th>CORRECTIVE ACTION</th></tr>
<tr><td> 
</td><td>Accept
- A small gap or sheet separation of from 0.001" - 0.010" between sheets where a dimpled sheet nests into another dimple or countersink.</td><td>None Required</td></tr>
<tr><td> 
</td><td>Unacceptable
- sheets not drawn up tight</td><td>Remove Rivet
- check for chips and burrs between sheets</td></tr>
<tr><td rowspan="2"> 

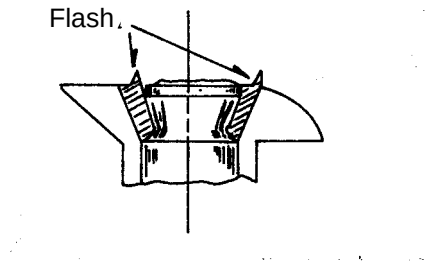
<table>
<tr><td>RIVET DIA.</td><td>1/8</td><td>5/32</td><td>3/16</td><td>1/4</td></tr>
<tr><td>A MAX</td><td>.015"</td><td>.020"</td><td>.025"</td><td>.030"</td></tr>
</table></td><td>Accept
- If the stem is above-flush with rivet head and the locking ring is not more than 0.020" above flush. If the stem is flush or below flush and the locking ring is not be more than dimension A above the stem.</td><td>None Required</td></tr>
<tr><td>Unacceptable
- If stem is above flush with rivet head and the locking ring is more than 0.020" above flush. If the stem is flush or below flush and the locking ring is more than dimension A above stem.</td><td>Replace Rivet</td></tr>
<tr><td> 
</td><td>Unacceptable
- locking ring flash</td><td>- shave or file locking ring flush with rivet head</td></tr>
</table>

Figure 16 - Visual Examination Requirements

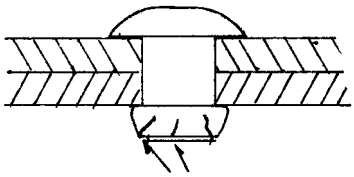
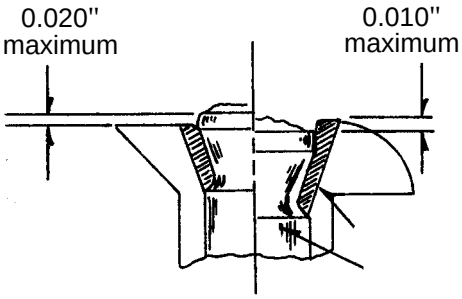
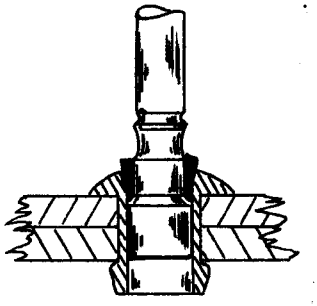
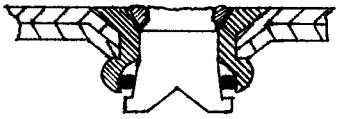
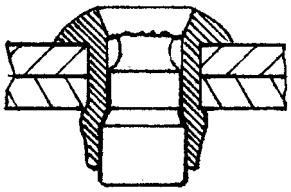
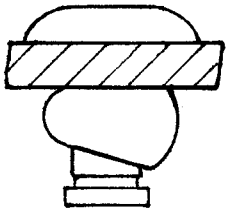
VISUAL APPEARANCE	DESCRIPTION	CORRECTIVE ACTION
 Cracks	**Unacceptable** - cracks in shop head	**Replace Rivet**
 0.020" maximum 0.010" maximum	**Accept** - rivet stem fracture is between 0.020" above flush and 0.010" below flush of the rivet head.	None Required
	Unacceptable - rivet stem fracture is more than 0.020" above flush or more than 0.010" below flush.	**Replace Rivet** If Above Flush - check hole diameter and depth - check for late pulling head shift If below Flush - check hole depth and rivet grip length - check for early pulling head shift
	**Unacceptable** - stem pulls through rivet	**Remove Rivet** - check hole diameter - check hole depth and rivet grip length
	**Unacceptable** - locking ring loose	**Remove Rivet** - check tool adjustment - check for defective rivets

Figure 16 - Visual Examination Requirements

VISUAL APPEARANCE	DESCRIPTION	CORRECTIVE ACTION
	**Unacceptable** - locking ring missing or premature stem break	**Remove Rivet** - check for undersize, slanted or misaligned hole condition - pulling head crooked or not down far enough on spindle - check for defective rivets
	**Accept** - irregular bulb formation	**None Required**

7 Safety Precautions

7.1 The procedures outlined herein present no specific safety hazards when performed according to accepted plant safety regulations.

8 Personnel Requirements

8.1 Personnel responsible for installation of standard and bulbed lock spindle rivets must have a good working knowledge of the procedure and requirements as specified herein and must have exhibited their familiarity to their supervisor.

9 Maintenance of Equipment

9.1 Keep riveting tools clean and moving parts oiled or greased. It is recommended that a few drops of light machine oil be injected daily into the air inlet of all air tools in use.

9.2 Periodically check riveting tools and accessories. Replace damaged or badly worn parts.

9.3 Obtain proper authorization before any rework or alteration of riveting tools.