BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.67

PRODUCTION PROCESS STANDARD

Installation of Hi-Lok/Hi-Tigue Fasteners

Issue 18
- This standard supersedes PPS 2.67, Issue 17.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS 2.67 related questions to michael.wright@aero.bombardier.com.
- This PPS is effective as of the distribution date.

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for installation of Hi-Lok/Hi-Tigue fasteners. As the effectiveness of the fastener is dependent on correct installation, strict adherence to the installation procedure specified herein is essential.

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 1.01 - 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 1.12 - Use of Rivet Squeezers.

3.5 PPS 1.14 - Use of Rivet Guns.

3.6 PPS 1.32 - Set-up and Operation of Spacematic Drillmotor Model 1600 and 6000.

3.7 PPS 1.33 - Countersinking for Flush Head Fasteners.

3.8 PPS 1.37 - Set-up and Operation of Spacematic and Q-Matic Drillmotors.

3.9 PPS 13.26 - General Subcontractor Provisions.

3.10 PPS 14.01 - Torquing & Tightening.

3.11 PPS 21.03 - Priming, Sealing & Repair of Integral Fuel Tanks.

3.12 PPS 27.05 - Manual Edge Finishing.

3.13 PPS 31.17 - Solvent Usage.

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

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

4 Materials and Equipment

4.1 Materials

4.1.1 Hi-Lok/Hi-Tigue pins, as specified on the engineering drawing. Refer to Figure 1 for a general description of the pins and a part number breakdown. Refer to Table 9 for a detailed listing of the fasteners.

4.1.2 Nuts or Hi-Lok/Hi-Tigue collars, as specified on the engineering drawing. Refer to Figure 2 for a general description of nuts and Hi-Lok/Hi-Tigue collars.

4.1.3 Washers, as specified on the engineering drawing.

4.1.4 Pin insertion lubricant: Boelube 70106, or BAMS 569-001 Class C or D. Use Boelube 70106 or BAMS 569-001 Class D lubricant for insertion of pins to be wet installed; BAMS 569-001 Class C lubricant is not suitable for pins to be wet installed.

4.2 Equipment

4.2.1 Installation tools including Allen keys, socket wrenches, box wrenches, air drivers from Hi-Shear Corporation, torque wrenches and adaptors.

4.2.2 Aluminum driving cap and support blocks (e.g., Bombardier Toronto (de Havilland) SD8853).

4.2.3 Modified rivet sets (e.g., Bombardier Toronto (de Havilland) TS.412.60.12 MK1).

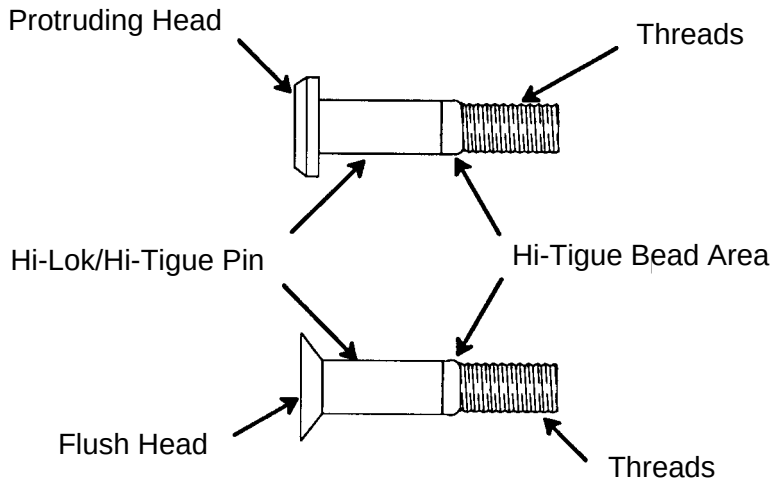
4.2.4 Impact Hi-Lok sets (e.g., straight set: Bombardier Toronto (de Havilland) TS.411.05.12 and offset set: Bombardier Toronto (de Havilland) TS.411.05.13).

4.2.5 Aluminum driving cap (e.g., Bombardier Toronto (de Havilland) TS.411.05.14).

4.2.6 Grip scales for Hi-Lok/Hi-Tigue pins, Hi-Shear #2-612.

4.2.7 Countersink gauge (e.g., Bombardier Toronto (de Havilland) TS.759.13.13).

4.2.8 Hole measuring gauges (e.g., Go/No-Go gauges, plug gauges, etc.).



The upper alpha-numeric code on the heads of pins is the part number of the pin, the lower alpha-numeric code is the manufacturers trademark and the first dash number (diameter). A “V”, if any, indicates titanium. “hs” or “H” are Hi Shear trademarks; VS is the Voi-Shan trademark; SPS is the Standard Pressed Steel trademark; etc.

BASIC HI-LOK/HI-TIGUE PIN PART NUMBER
HL325 - Shear type, MS20426 (AN426) flush head, steel alloy HL326 - Tension type, protruding head, steel alloy HL327 - Tension type, MS24694 (AN509) flush head, steel alloy HL328 - Shear type, protruding head, steel alloy HL329 - Shear type, flush head, steel alloy HL10V - Shear type, protruding head, titanium alloy HL11V - Shear type, flush head, titanium alloy HLT116 - Tension type, protruding head, steel alloy

PIN FINISH
- - Cadmium plate and cetyl alcohol lube - steel pins
AP - Aluminum coating and cetyl alcohol lube - titanium pins

DIAMETER CODE
- Nominal diameter in 1/32" increments
- Oversize pins retain the same dash number as standard size pins

GRIP LENGTH CODE
- Refer to Table 7 for grip ranges for each dash number

HL325 - -6 -8

Figure 1 - Hi-Lok/Hi-Tigue Pins and Part Number Breakdown

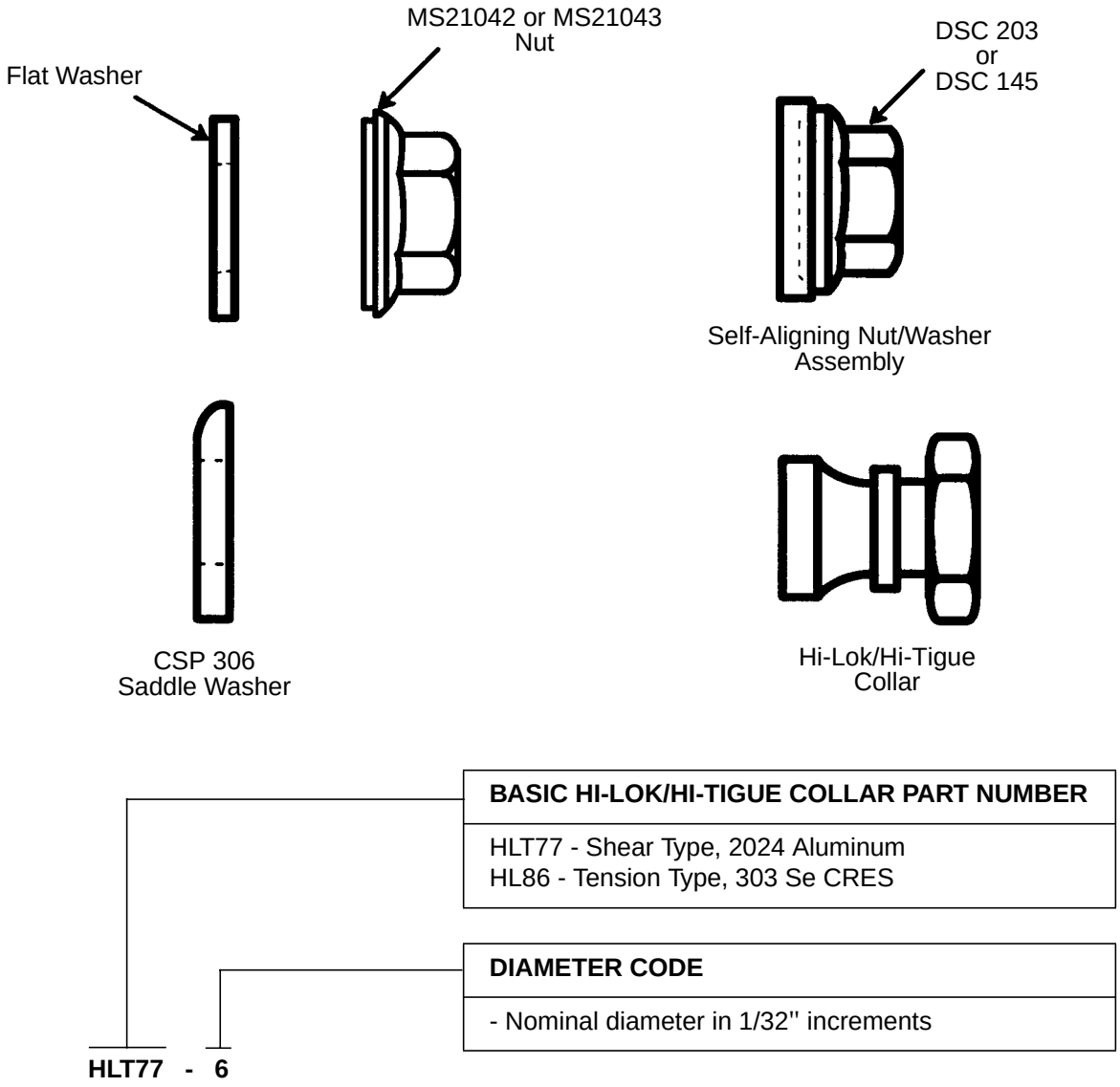


Figure 2 - Nuts, Hi-Lok/Hi-Tigue Collars and Washers

5 Procedure

5.1 General

5.1.1 The Hi-Lok/Hi-Tigue fastening system is designed for use in high strength structural joints. The Hi-Lok/Hi-Tigue fastener can be installed either in a transition fit or interference fit hole as specified by the engineering drawing.

5.1.2 As the Hi-Lok/Hi-Tigue pin is pressed into the hole, the Hi-Tigue bead plastically deforms the hole surface, thereby sizing, burnishing and cold working the hole. This cold working combined with the controlled interference fit and the pre-load provided by the threaded nut results in increased structural fatigue life. Although clamping action is achieved through the use of a threaded pin and a nut (as used on regular threaded bolts) or Hi-Lok/Hi-Tigue collar, these fasteners are used for permanent installation.

5.1.3 Hi-Lok/Hi-Tigue fasteners are also used in areas of restricted access if installation of other permanent high strength fasteners such as lockbolts or Hi-Shear rivets would be difficult. For example, Engineering may specify use of Hi-Lok/Hi-Tigue fasteners in areas where access is limited on the side of the structure from which the fastener pin is inserted, if such restricted access would prevent the insertion of the longer pull type lockbolt pin into the hole or would prevent the use of riveting tools on the heads of stump type lockbolts or Hi-Shear rivets. Engineering may also specify use of Hi-Lok/Hi-Tigue fasteners if access is limited on the collar side of the structure, if such restricted access would prevent the use of the installation tools for pull type or stump type lockbolts or Hi-Shear rivets.

5.1.4 Hi-Lok/Hi-Tigue pins are lubricated by the manufacturer. Fasteners shall be protected at all times from dust, dirt, moisture and excessive heat. Take care to handle the fastener only from the threaded portion of the shank. If possible, keep fasteners in their original containers. If this is not possible, keep fasteners in non-absorbent containers. Use oldest stock first.

5.2 Hole Preparation

5.2.1 If the hole locations for Hi-Lok/Hi-Tigue fasteners are determined by pre-drilled holes in one of the components in the assembly, prepare holes as follows:

Step 1. If the engineering drawing specifies a dimpled installation, pre-drill for dimpling as specified in Table 1 according to PPS 1.09.

Table 1 - Pre-Drill for Dimpling

NOMINAL FASTENER DIAMETER	HL325	HL327	HL329 or HL11V
-5 (5/32")	#30	#29	#27
-6 (3/16")	#20	#24	#17
-8 (1/4")	#1	#6	#1
-10 (5/16")	---	1/4	K
-12 (3/8")	---	---	---
-14 (7/16")	---	---	---

Step 2. If the engineering drawing specifies a dimpled installation, ram coin dimple according to PPS 1.01 or PPS 1.07

Step 3. Pre-drill for final drilling/reaming as specified in Table 2 according to PPS 1.09. Ensure that the hole is square to the surface against which the head will seat for correct head seating.

Table 2 - Pre-Drilling of Fastener Holes

NOMINAL FASTENER DIAMETER	PRE-DRILL SIZE
-5 (5/32”)	#27 (0.144")
-6 (3/16”)	#16 (0.177")
-8 (1/4”)	#1 (0.228")
-10 (5/16”)	L (0.290")
-12 (3/8”)	S (0.348")
-14 (7/16”)	13/32” (0.406")

Step 4. For flush head fasteners, if the engineering drawing specifies countersinking or does not specify dimpling, countersink using a micro-stop countersink according to PPS 1.33. Refer to Table 3 for the reference countersink diameter; adjust the countersink diameter as required to ensure that the head flushness requirements specified in paragraph 6.2 are met.

Table 3 - Reference Countersink Diameter

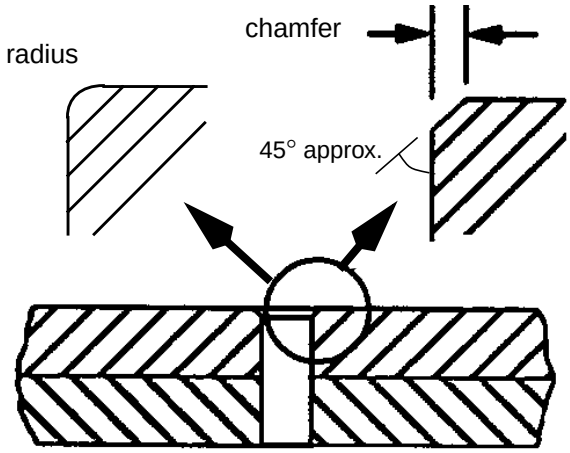
NOMINAL FASTENER DIAMETER	COUNTERSINK PILOT	HL325 100° COUNTERSINK DIAMETER	HL327 100° COUNTERSINK DIAMETER	HL329 OR HL11V 100° COUNTERSINK DIAMETER
-5 (5/32")	0.144"	0.280" - 0.294"	0.318" - 0.330"	0.252" - 0.264"
-6 (3/16")	0.177"	0.345" - 0.357"	0.374" - 0.386"	0.292" - 0.306"
-8 (1/4")	0.228"	0.468" - 0.479"	0.495" - 0.506"	0.386" - 0.398"
-10 (5/16")	0.290"	0.556" - 0.566"	0.622" - 0.632"	0.465" - 0.477"
-12 (3/8")	0.348"	0.686" - 0.695"	0.750" - 0.759"	0.554" - 0.563"
-14 (7/16")	0.406"	0.652" - 0.662"	0.871" - 0.881"	n/a

Step 5. Open the hole to the final size specified in Table 4 according to PPS 1.09.

Table 4 - Final Hole Size Requirements

FASTENER NOMINAL DIAMETER	INTERFERENCE FIT		TRANSITION FIT	
	RECOMMENDED CUTTER SIZE	HOLE LIMITS	RECOMMENDED CUTTER SIZE	HOLE LIMITS
-5 Ti (5/32")	0.1615"	0.1610" - 0.1625"	---	---
-5 (5/32")	0.1615"	0.1615" - 0.1635"	0.1650"	0.1645" - 0.1665"
-6 (3/16")	0.1865"	0.1860" - 0.1880"	0.1895"	0.1890" - 0.1910"
-8 (1/4")	0.2465"	0.2460" - 0.2480"	0.2495"	0.2490" - 0.2510"
-10 (5/16")	0.3090"	0.3085" - 0.3105"	0.3120"	0.3115" - 0.3135"
-12 (3/8")	0.3710"	0.3705" - 0.3725"	0.3745"	0.3740" - 0.3760"
-14 (7/16")	0.4335"	0.4330" - 0.4350"	0.4370"	0.4365" - 0.4385"

Step 6. For protruding head fasteners, manually break the edge of the hole to create a slight chamfer or radius as shown in Figure 3 according to PPS 27.05.



NOMINAL FASTENER DIAMETER	CHAMFER OR RADIUS
-5 (5/32")	0.015" - 0.025"
-6 (3/16")	
-8 (1/4")	
-10 (5/16")	0.020" - 0.030"
-12 (3/8")	
-14 (7/16")	

Figure 3 - Edge Break

5.2.2 If the hole locations are determined by Spacematic drill templates, prepare holes using Spacematic or Q-Matic drills as follows:

Step 1. Set-up, adjust and operate Spacematic or Q-Matic drillmotors according to PPS 1.32 or PPS 1.37, as applicable. Drill mating parts simultaneously to ensure alignment of holes.

Step 2. After placing the drill template in position, prepare the **starting hole** manually according to paragraph 5.2.1, except for countersinking, if required.

Step 3. Check the starting hole for conformance to the hole limits requirements of Table 4 using a Go/No-Go gauge, a plug gauge or other hole measuring gauge.

Step 4. Insert the collet of the drillmotor into the starting hole and the template boss into the next hole in the template.

Step 5. Drill all holes to the sizes specified in Table 4.

Step 6. Remove the drill template.

Step 7. For flush head fasteners, countersink the starting hole (and other holes, if necessary) using a micro-stop countersink according to PPS 1.33. For protruding head fasteners, manually break the edge of the hole on which the fastener head will seat as shown in Figure 3 according to PPS 27.05.

Step 8. If possible, disassemble mating parts and remove all chips and metal cuttings from faying surfaces.

5.2.3 If the engineering drawing specifies the use of CSP306 saddle washers, drill out the hole in the washer as follows:

Step 1. Determine the location of the hole in the washers by placing the washer in position, ensuring that the radius of the washer nests in the fillet radius of the component, and marking the hole location on the washer.

Step 2. Drill out the pre-drilled or un-drilled saddle washers using the drill size specified in Table 5.

Table 5 - Drilling of Saddle Washers

NOMINAL FASTENER DIAMETER	DRILL SIZE FOR SADDLE WASHERS
-5 (5/32")	#17 (0.173")
-6 (3/16")	#8 (0.199")
-8 (1/4")	F (0.257")
-10 (5/16")	P (0.323")
-12 (3/8")	W (0.386")
-14 (7/16")	29/64" (0.453")

5.2.4 On a sample basis, check at random (across the entire pattern) the number of holes specified in Table 6 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.

5.2.4.1 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 6 - Hole Size Verification Sample Requirements

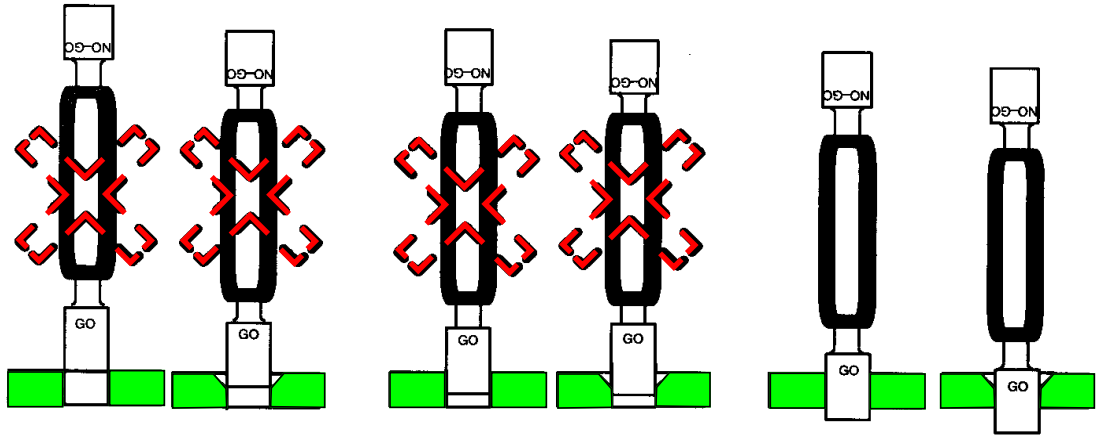
NUMBER OF HOLES IN PATTERN	REQUIRED SAMPLE SIZE
5 or less	all
6 - 50	5
51 - 90	7
91 - 150	11
151 - 280	13
281 - 500	16
more than 500	19

5.3 Use of GO/NO-GO Gauges

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

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

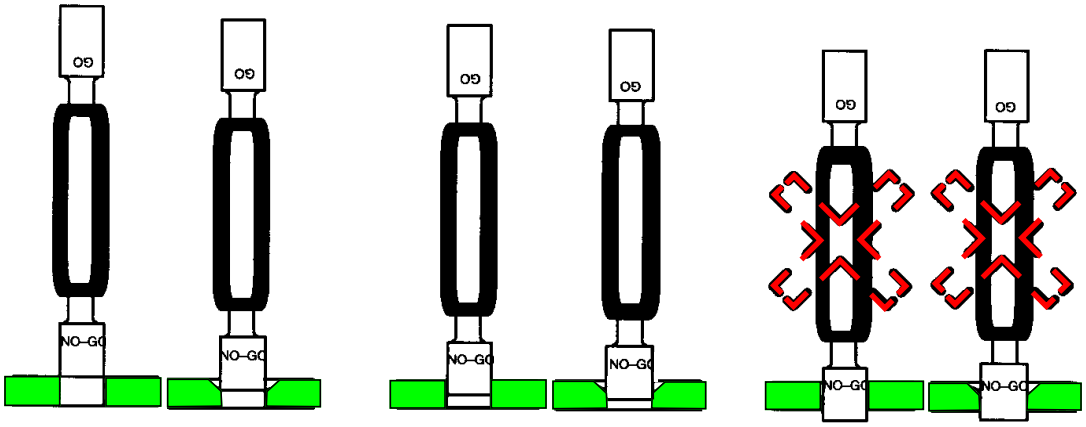


Does not go in.
UNDERSIZE HOLE

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 4 - Use of Go/No-Go Gauges

5.4 Fastener Length 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 Hi-Lok/Hi-Tigue grip scale (include all the components to be joined, such as CSP 306 saddle washers).

5.4.2 Except for 5/32" diameter Hi-Lok/Hi-Tigue fasteners, install a fastener of the measured length. For 5/32" diameter Hi-Lok/Hi-Tigue fasteners, install a fastener one grip length longer than the measured grip length.

5.4.3 The hole depth number shown on the grip scale corresponds to the Hi-Lok/Hi-Tigue pin grip length dash number. Always read to the next higher number as shown in Figure 5 (i.e., if the reading is past the **end** of the -3 marking, then use a -4 fastener). If a tapered sheet condition exists, use the grip length indicated for the thickest section. If the fastener assembly specifies an MS21042 or MS21043 nut or Hi-Lok/Hi-Tigue collar, use a pin with a dash number as read on the grip scale. If the fastener assembly specifies a DSC 203 or DSC 145 self-aligning nut/washer assembly, use a pin with the next longer dash number than that read on the grip scale. For example, if the scale reads a -7 pin length, use a -8 pin length.

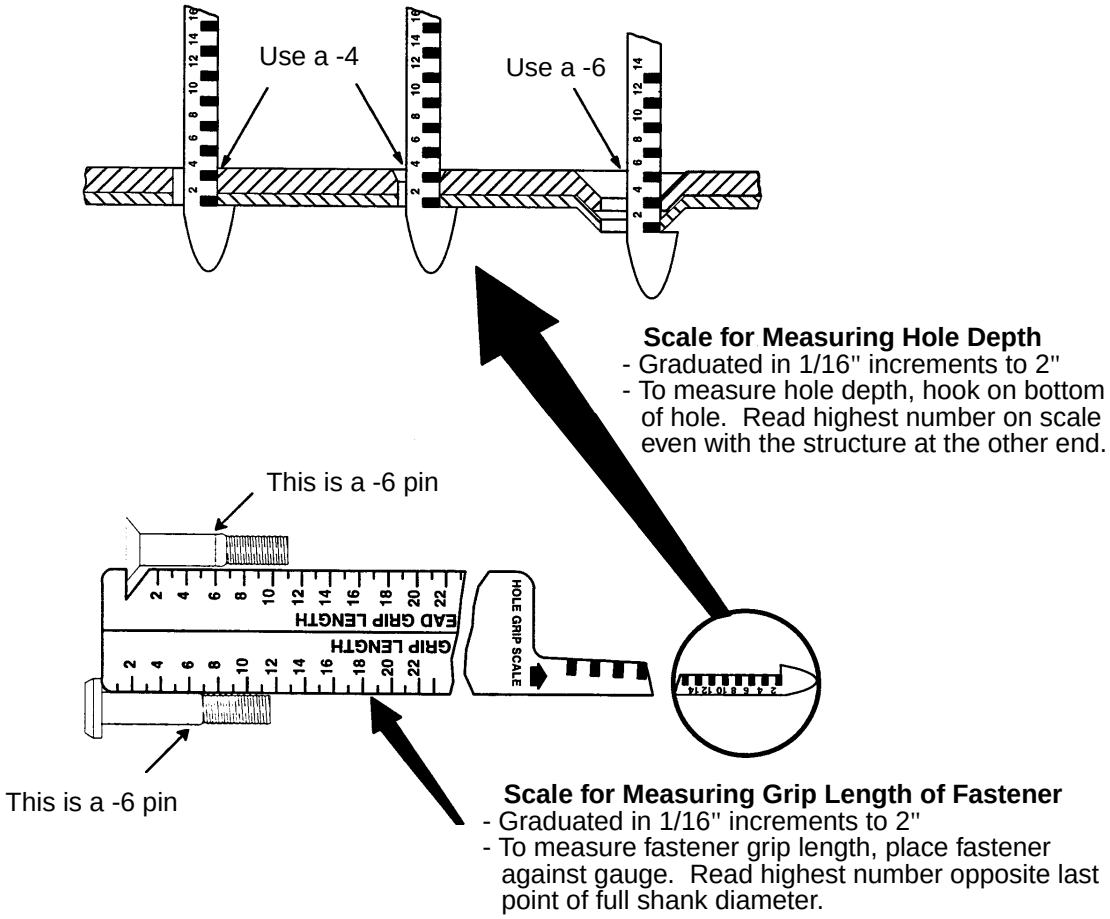


Figure 5 - Grip Scale (Hi-Shear #2-612)

5.4.4 If the head markings of pins do not show the grip dash number, check the grip length of Hi-Lok/Hi-Tigue pins using the grip scale as shown in Figure 5. Refer to Table 7 for a listing of the grip length ranges for each grip dash number.

5.4.5 If Hi-Lok/Hi-Tigue pins of the correct length are not available, it is acceptable to use the next longer pin length provided that the requirements of Figure 8 are met. Also, if authorized in writing by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB, Hi-Lok/Hi-Tigue pins may be shimmed to the correct length using washers.

Table 7 - Hi-Lok/Hi-Tigue Pin Grip Ranges

SECOND DASH # (GRIP #)	GRIP LENGTH
2	0.063" - 0.125"
3	0.126" - 0.188"
4	0.189" - 0.250"
5	0.251" - 0.312"
6	0.313" - 0.375"
7	0.376" - 0.438"
8	0.439" - 0.500"
9	0.501" - 0.562"
10	0.563" - 0.625"
11	0.626" - 0.688"

SECOND DASH # (GRIP #)	GRIP LENGTH
12	0.689" - 0.750"
13	0.751" - 0.812"
14	0.813" - 0.875"
15	0.876" - 0.938"
16	0.939" - 1.000"
17	1.001" - 1.062"
18	1.063" - 1.125"
19	1.126" - 1.188"
20	1.189" - 1.250"
21	1.251" - 1.312"

SECOND DASH # (GRIP #)	GRIP LENGTH
22	1.313" - 1.375"
23	1.376" - 1.438"
24	1.439" - 1.500"
25	1.501" - 1.562"
26	1.563" - 1.625"
27	1.626" - 1.688"
28	1.689" - 1.750"
39	1.751" - 1.812"
30	1.813" - 1.875"
31	1.876" - 1.938"

5.5 Pin Insertion

5.5.1 Unless the fastener is to be wet installed, prime all countersinks for flush head Hi-Lok/Hi-Tigue pins with F1 zinc chromate primer according to PPS 34.02 or F19 Type 2 epoxy-polyamide primer according to PPS 34.08. If the engineering drawing specifies wet installation of flush head pins, priming is not required.

5.5.2 Insert the pin fully into the prepared hole so that the head is seated against the structure. Insertion of the pin may be aided by applying a light coating of liquid lubricant (see Materials section, paragraph paragraph 4.1.4) to the **shank** of the pin. Do not allow lubricant to contact the pulling grooves of the pin.

5.5.3 If possible, seat the pin using a squeeze gun according to PPS 1.12. Fit a flush rivet set on the fixed jaw (for both flush head and protruding head pins) and a modified rivet set on the moving jaw.

5.5.4 If squeeze riveting is not possible, seat the pin using a light rivet gun according to PPS 1.14. Fit the rivet gun with a special flush rivet set or a standard rivet set with an aluminum snap cap to prevent damaging the pin head, for both flush head and protruding head pins. If the driving force required to seat the pin is high (i.e., maximum interference or thick material gauge), support the reverse side of the structure using SD8853-3 or -5 aluminum faced support blocks to prevent damage to the structure (this is particularly important when inserting pins into bonded composite structure as delamination may occur if the reverse side is not supported properly - see Figure 6).

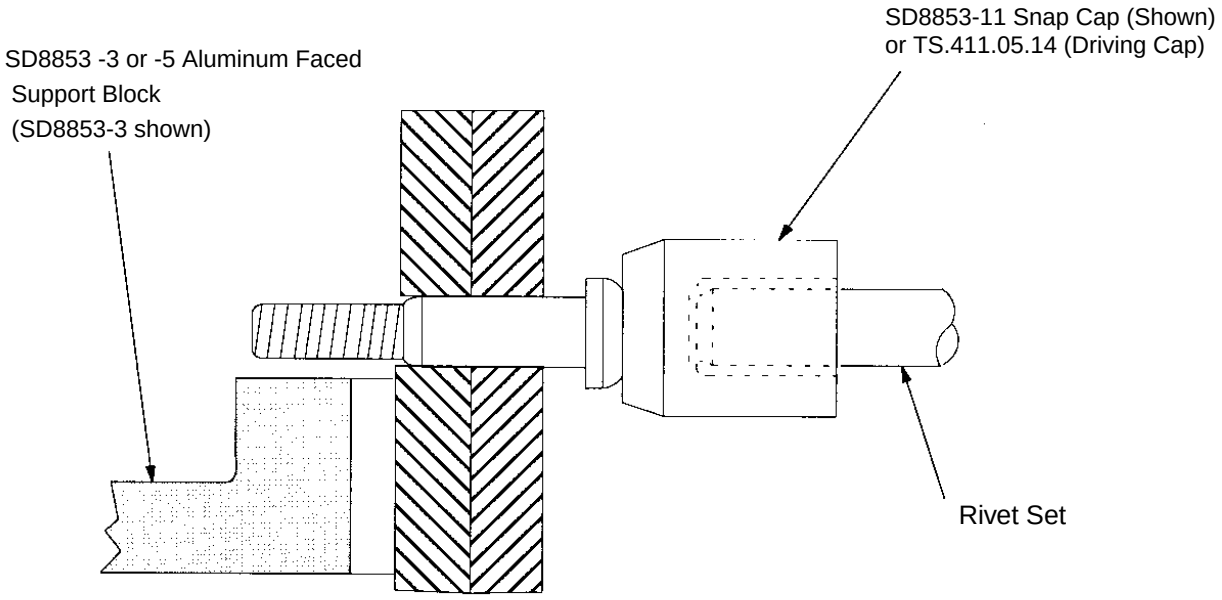


Figure 6 - Seating of Pin using a Rivet Gun

5.5.5 If pin insertion using a squeeze gun or a rivet gun is not possible, seat the pin using an SD8948 installation tool (see Figure 7).

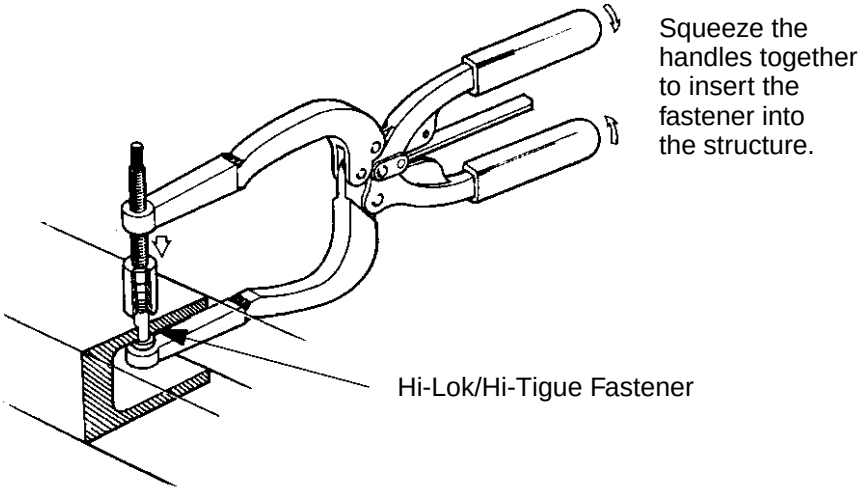


Figure 7 - Use of SD8948 Insertion Tool

5.6 Grip Length Verification

5.6.1 After the Hi-Lok/Hi-Tigue pin has been fully seated, ensure that threads are located correctly as shown in Figure 8. Threads in bearing are acceptable only against CSP306 saddle washers and in non-structural packers and brackets such as attachment clips for electrical wiring and plumbing.

5.6.2 If the pin length is too short, remove the pin according to section 5.10, re-check the material thickness using a grip scale according to section 5.4, and check the pin length using the grip scale.

5.6.3 If installing a pin/collar combination, the grip length of a fully seated pin may be verified by checking the pin protrusion using a #2-1522 Hi-Lok protrusion gauge.

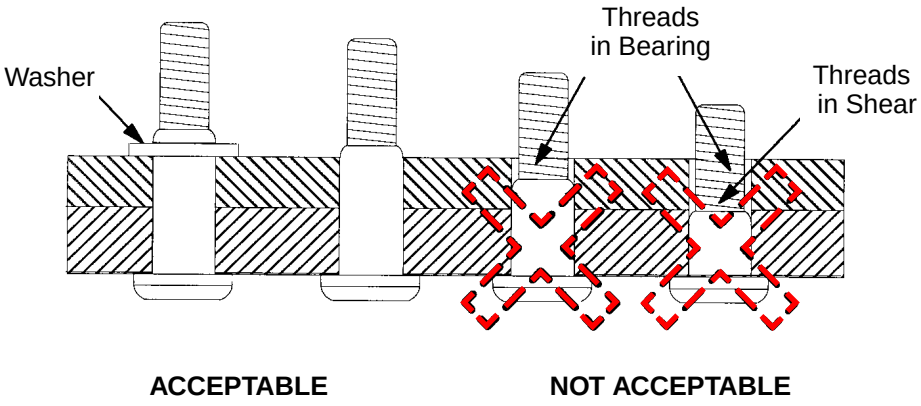


Figure 8 - Grip Length Verification

5.7 Installation of Nuts/Collars

5.7.1 Install Hi-Lok/Hi-Tigue nuts/collars as follows:

Step 1. If CSP306 saddle washers are specified on the engineering drawing, position the washer, drilled according to paragraph 5.2.3, over the pin so that the radius of the washer nests in the fillet radius of the component.

Step 2. Place the specified flat washer, if any, over the pin.

Step 3. Install the specified nut or collar. The threads of the nut or collar should allow the engagement of the threads of the pin by hand, but only up to the self-locking device. If the nut or collar cannot be threaded on by hand, check for imperfect or damaged threads on the pin, nut or collar and replace as necessary. Discard nuts or collars which permit the pin to pass through the self-locking portion by hand tightening. Ensure that there is no sealant or pin insertion lubricant on the threaded end of the pin before installing the nut or collar; if necessary, solvent clean according to PPS 31.17.

Step 4. If the **pin/nut** combination is to be used, torque the nut according to PPS 14.01 to the value specified in Table 8. For Hi-Lok/Hi-Tigue installation, torqued fastener identification is not required. If the **pin/collar** combination is to be used, tighten the collar using a suitable socket wrench or box wrench until the hex end of the collar has been torqued off. If the pin has been installed with its proper interference fit, free rotation of the pin during tightening should not occur. If slight rotation of the pin does occur, use an Allen or hex key (see Table 8) in the hex cavity in the end of the pin to keep it from rotating.

Table 8 - Torque Values

NOMINAL DIAMETER	TORQUE (inch-pounds)		ALLEN KEY
	SHEAR TYPE (Note 1)	TENSION TYPE (Note 2)	
-5 (5/32")	25 - 30	30 - 35	5/64"
-6 (3/16")	30 - 40	40 - 50	5/64"
-8 (1/4")	70 - 90	120 - 140	3/32"
-10 (5/16")	160 - 180	220 - 240	1/8"
-12 (3/8")	260 - 280	400 - 420	5/32"
-14 (7/16")	as specified by the engineering drawing		3/16"

Note 1. Shear type Hi-Lok/Hi-Tigue fasteners: HL10, HL11, HL325, HL328, HL329, HLT425, HLT428, HLT625, HLT628, HLT629.
Note 2. Tension type Hi-Lok/Hi-Tigue fasteners: HL326, HLT426, HLT626, HL327, HLT427, HLT627.

Step 5. Except as noted below, for **pin/collar** combinations where the hex end of an aluminum collar has been torqued off, touch-up the exposed bare metal of the collar in the break-off area with F19 Type 2 epoxy primer according to PPS 34.08.

- In fuel tank areas **only**, touch-up of the exposed bare metal of aluminum collars in the break-off area with F21 Type II epoxy primer according to PPS 21.03 is preferred.
- If dome sealing of the collar is specified, it is not necessary to touch-up the exposed bare metal of the collar in the break-off area.
- It is not necessary to touch-up the exposed bare metal of titanium or stainless steel collars in the break-off area.

5.8 Installation of Oversize Hi-Lok/Hi-Tigue Pins

5.8.1 Oversize Hi-Lok/Hi-Tigue pins may be installed to salvage oversize holes only if authorized in writing by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB.

5.8.2 Refer to Table 9 for the oversize pin part numbers for the corresponding original standard size pin. Install 1/32" oversize pins only if the hole damage exceeds the hole diameter specified for 1/64" oversize pins. Use the grip number of the standard size pin. Refer to the written Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB repair authorization for the type of nut or collar to be used.

Table 9 - Selection of Oversize Hi-Lok/Hi-Tigue Pins

STANDARD SIZE PIN	1/64" OVERSIZE PIN	1/32" OVERSIZE PIN
HL325	HLT425	HLT625
HL326	HLT426	HLT626
HL327	HLT427	HLT627
HL328	HLT428	HLT628
HL329	HLT429 or HLT1001 (Note 1)	HLT629
HL10V	HL110V	HL410V
HL11V	HL111V	HL411V
HLT116	Oversize pins not available.	

Note 1. HLT429 1/64" oversize pins are superseded by HLT1001 1/64" oversize pins according to EO 7336. Existing stock of HLT429 pins may be used to depletion but thereafter HLT1001 pins should be used.

5.8.3 Except for HLT629 oversize pins, the head size of oversize pins is the same as for standard size pins and therefore the required countersink diameter is the same. For HLT629 oversize pins (i.e., 1/32" oversize 100° flush head shear pins), the head of the pin is larger than the HL329 standard size pin and the HLT429 and HLT1001 1/64" oversize pin. When installing HLT629 pins, increase the countersink diameter (before opening the hole to final size) to that specified in Table 10 using a micro-stop countersink fitted with a pilot that is approximately 0.002" smaller in diameter than the hole.

Table 10 - Reference Countersinking Data for HLT629, 1/32" Oversize Pins

ORIGINAL FASTENER NOMINAL DIAMETER	OVERSIZE FASTENER NOMINAL DIAMETER	REFERENCE COUNTERSINK DIAMETER (100° ANGLE)
-6 (3/16")	7/32"	0.321" - 0.335"
-8 (1/4")	9/32"	0.417" - 0.429"
-10 (5/16")	11/32"	0.497" - 0.508"
-12 (3/8")	13/32"	0.585" - 0.595"

Note. The countersink pilot should be approximately 0.002" smaller in diameter than the existing hole.

5.8.4 Refer to Table 11 for the required final hole diameters for oversize pins.

Table 11 - Hole Preparation Data for Oversize Hi-Lok/Hi-Tigue Pins

ORIGINAL FASTENER NOMINAL DIAMETER	1/64" OVERSIZE FINAL HOLE		1/32" OVERSIZE FINAL HOLE	
	CUTTER SIZE	HOLE LIMITS	CUTTER SIZE	HOLE LIMITS
-6 (3/16")	0.2000"	0.1995" - 0.2015"	0.2155"	0.2150" - 0.2170"
-8 (1/4")	0.2620"	0.2615" - 0.2635"	0.2775"	0.2770" - 0.2790"
-10 (5/16")	0.3245"	0.3240" - 0.3260"	0.3400"	0.3395" - 0.3415"
-12 (3/8")	0.3865"	0.3860" - 0.3880"	0.4020"	0.4015" - 0.4035"
-14 (7/16")	0.4490"	0.4485" - 0.4505"	0.4645"	0.4640" - 0.4660"

5.8.5 If CSP306 saddle washers are specified on the engineering drawing, drill out the washers using the drill size specified in Table 12. Determine the location of the hole in the washers by placing the washer in position, ensuring that the radius of the washer nests in the fillet radius of the component, and marking the hole location on the washer.

Table 12 - Drilling of Saddle Washers

ORIGINAL NOMINAL FASTENER DIAMETER	DRILL SIZE FOR SADDLE WASHERS	
	FOR 1/64" OVERSIZE FINAL HOLE	FOR 1/32" OVERSIZE FINAL HOLE
-6 (3/16")	#4 (0.209")	#1 (0.228")
-8 (1/4")	I (0.272")	L (0.290")
-10 (5/16")	Q (0.332")	S (0.348")
-12 (3/8")	X (0.397")	Z (0.413")
-14 (7/16")	15/32" (0.469")	31/64 (0.485")

5.8.6 Install oversize pins using the same procedure and tools as for standard size pins. Requirements for installed oversize pins are the same as for standard size pins (see section 6).

5.9 Post Installation Clean-Up

5.9.1 After complete installation of the fastener, remove excess F1 zinc chromate primer by solvent cleaning according to PPS 31.17.

5.10 Removal of Installed Fasteners (see Figure 9)

5.10.1 If necessary, remove installed Hi-Lok/Hi-Tigue fasteners as follows:

Step 1. Back off the nut or collar until flush with the end of the pin. If necessary, use an Allen or hex key in the hex cavity in the end of the pin to prevent the pin from rotating.

Step 2. Support the opposite side of the structure using an SD8853 - 3 aluminum faced support block and lightly tap the end of the pin/nut with a hammer or a light rivet gun (e.g., CP-2X or RRH 04P) fitted with a flat snap to break the pin loose.

Step 3. Remove the nut and, using a flat punch with slightly rounded corners to prevent damage to the walls of the fastener hole, drive the pin out completely.

5.10.2 Pins and nuts may be reused provided that the finish has not been damaged and the threads and hex cavity are in good condition. Hi-Lok/Hi-Tigue collars shall not be reused.

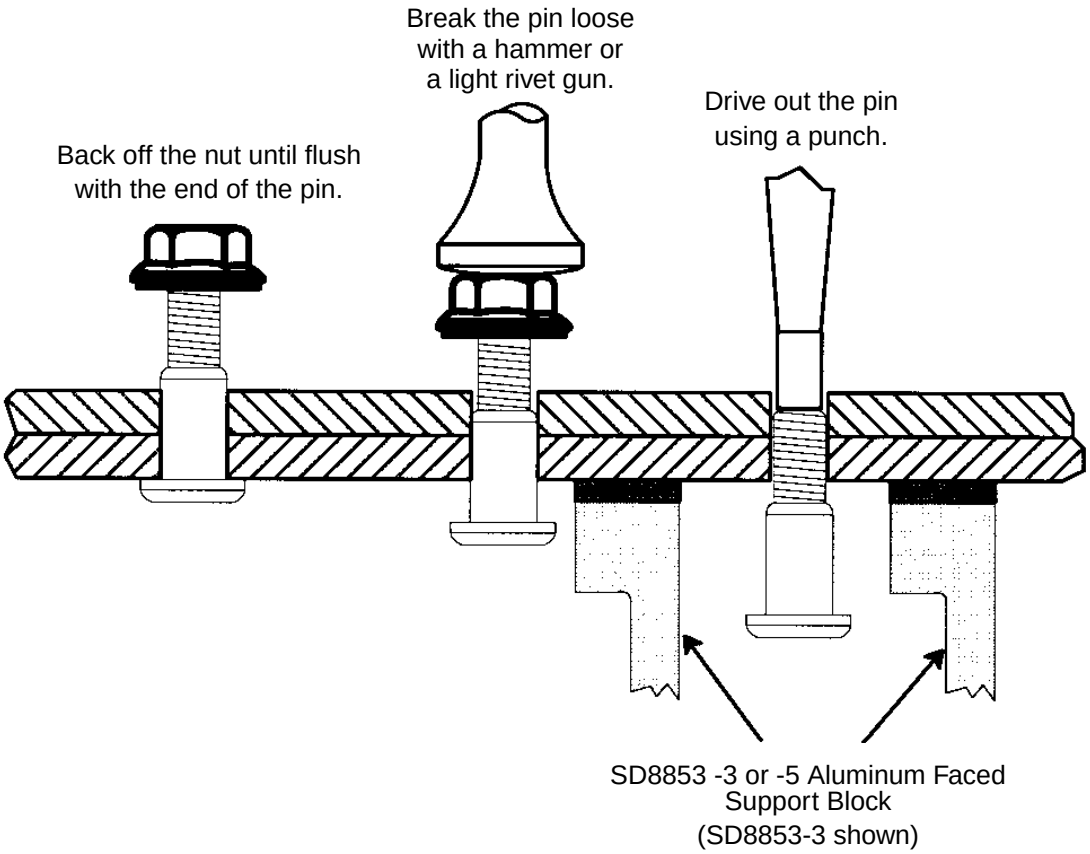
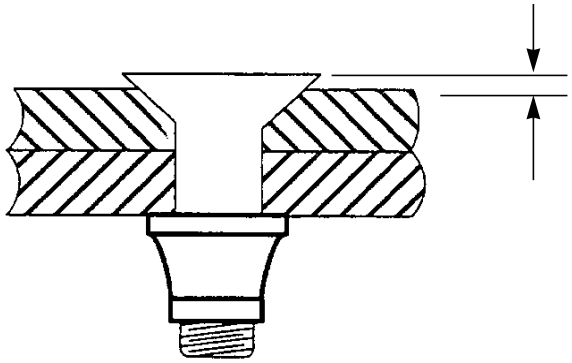


Figure 9 - Removal of Installed Fastener

6 Requirements

6.1 Edge distance requirements shall be as specified on the engineering drawing.

6.2 For flush head fasteners, the head protrusion should be 0.000" (i.e., flush) to 0.005" above flush as shown below.



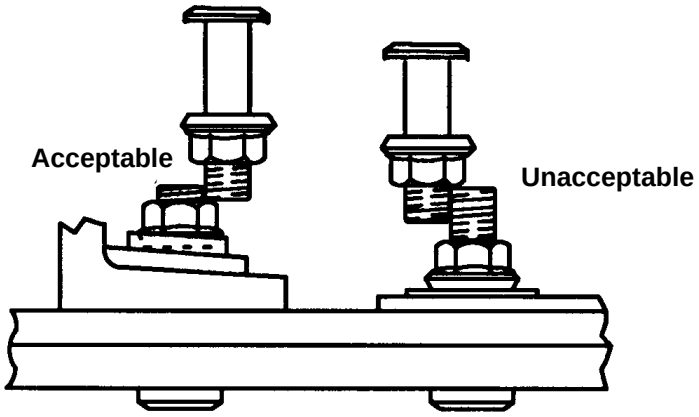
Head Protrusion Limits:
-0.000" to +0.005"

6.3 If a nut has been used with the Hi-Lok/Hi-Tigue pin or if -5 (5/32") fasteners have been installed with a collar, check the pin protrusion as follows:

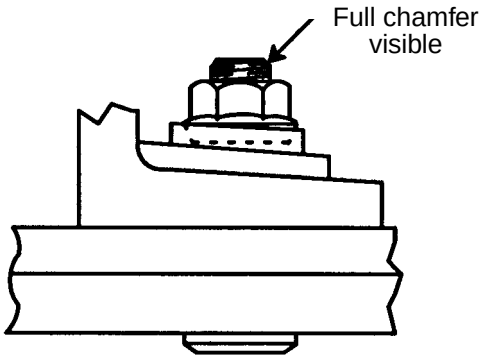
Step 1. Take a nut and Hi-Lok/Hi-Tigue pin of the same diameter as the pin/nut combination to be checked. The head style and grip length of the pin is optional (i.e., they do not need to be the same as the installed pin). This is the verification set.

Step 2. Run down the nut on the pin by hand until it bottoms, then back off 1/2 turn (180°).

Step 3. Check the thread protrusion of the installed pin/nut as shown below. The maximum pin protrusion is acceptable if the thread protrusion of the installed pin/nut is less than that of the pin/nut verification set.



Step 4. The minimum acceptable pin protrusion is one full chamfer visible beyond the end of the nut as shown below:



6.4 Ensure that for pin/collar combinations where the hex end of an **aluminum** collar has been torqued off, the exposed bare metal of the collar in the break-off area has been touched-up with F19 Type 2 epoxy primer according to PPS 34.08, or, in fuel tank areas **only**, with F21 Type II epoxy primer according to PPS 21.03.

6.5 Except for -5 (5/32") fasteners, if a collar has been installed with the Hi-Lok/Hi-Tigue pin, measure the pin protrusion using a Hi-Lok protrusion gauge #2-1522 as shown below. For installed standard -5 (5/32") fasteners using the pin/collar combination, the maximum thread protrusion shall be same as that required for the pin/nut combination (see paragraph 6.3).

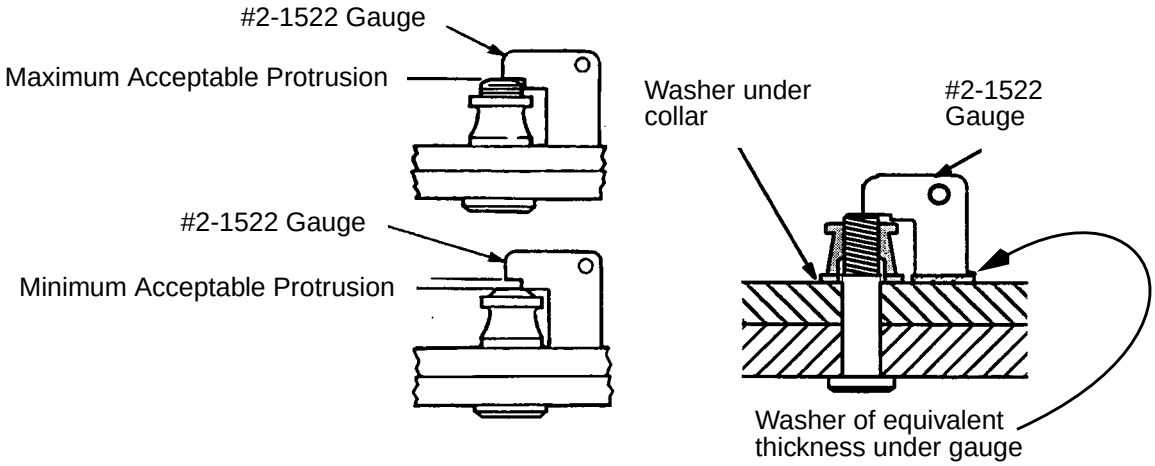
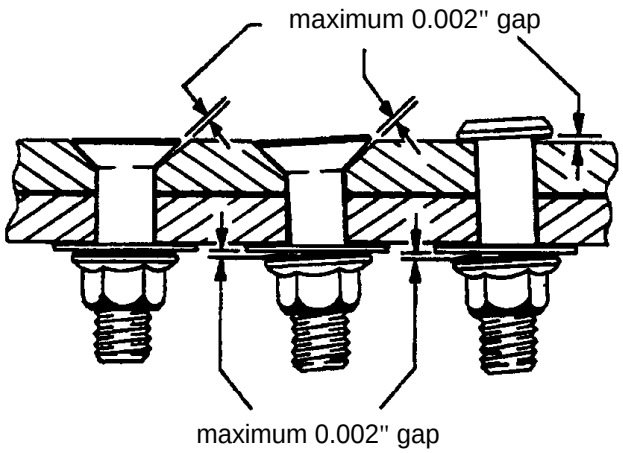


Figure 10 - Pin Protrusion Gauge

6.6 Ensure that any gap under the head of any installed Hi-Lok/Hi-Tigue fastener is on one side of the head only, is less than 0.002" (i.e., a 0.002" feeler gauge cannot fit into the gap), and does not extend to the shank of the fastener (see following example).



7 Safety Precautions

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

8 Personnel Requirements

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

9 Special Points to Note

9.1 Ensure that a small gap or sheet separation of 0.001" to 0.010" exists between sheets if a dimpled sheet nests into another dimple or into a countersink, as shown in Figure 11.

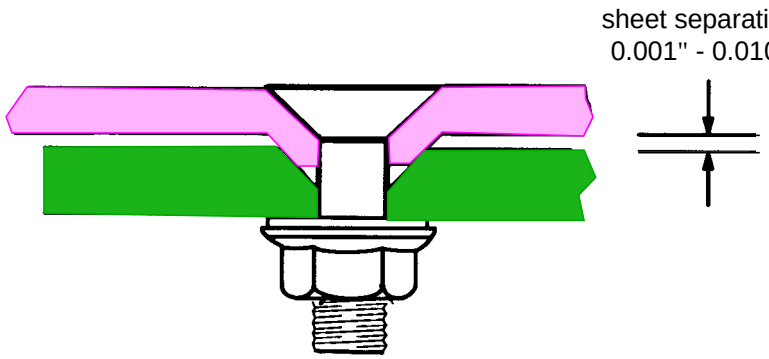


Figure 11 - Sheet Separation