BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 2.68

PRODUCTION PROCESS STANDARD

Installation of Hi-Lite Fasteners

Issue 21
- This standard supersedes PPS 2.68, Issue 20.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS 2.68 related questions to michael.wright@aero.bombardier.com.
- This PPS is effective as of the distribution date.

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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 procedure and requirements for the installation of Hi-Lite fasteners. Refer to PPS 2.71 for the procedure and requirements for installation of Hi-Lite ST fasteners.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. **do not** supersede the procedure or requirements specified in this PPS.

2 Hazardous Materials

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto (de Havilland) Environment, Health and Safety Department.

3 References

3.1 PPS 1.09 - Drilling and Reaming.

3.2 PPS 1.12 - Use of Rivet Squeezers.

3.3 PPS 1.14 - Use of Rivet Guns.

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

3.5 PPS 1.33 - Countersinking for Flush Head Fasteners.

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

3.7 PPS 13.26 - General Subcontractor Provisions.

3.8 PPS 14.01 - Torquing - Method and Identification.

3.9 PPS 21.03 - Priming, Sealing and Repair of Integral Fuel Tanks.

3.10 PPS 27.05 - Manual Edge Finishing.

3.11 PPS 31.17 - Solvent Usage.

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

3.13 PPS 34.05 - Application of Corrosion Inhibiting Jointing Compound (F16).

3.14 PPS 34.08 - Application of Epoxy-Polyamide Primer.

4 Materials and Equipment

4.1 Materials

4.1.1 Hi-Lite pins and collars, as specified by the engineering drawing, Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB. Refer to Figure 1 and Figure 2 for a general description of the pins and collars. Refer to Figure 3 and Figure 4 for a part number breakdown of Hi-Lite pins and collars. K-Fast nuts, as specified on the engineering drawing or as substitutes for Hi-Lite collars as permitted by EO 7446.

4.1.1.1 In recent years, the Hi-Lite tension pin engineering drawings were changed slightly such that the pin thread length for -14 diameter pins was slightly increased (see Table 1). As a result, it may occur that older and newer Hi-Lite tension pins may be stocked together, as the part number is the same although the two pins may not be identical (older pins may be slightly shorter than the newer pins). It is acceptable to install either the older (shorter) or the newer (longer) pin. The only difference in the assembly process is that the pin protrusion limits for the older and newer -14 tension pins may not be the same; refer to Table 13 for the pin protrusion limits.

4.1.2 Shimming washers as specified in Table 7.

4.1.3 Boelube #70106, liquid lubricant.

Table 1 - Overall Pin Length Change for Standard Size -14 Diameter Tension Type Hi-Lite Pins

NOMINAL DIAMETER	STANDARD SIZE -14 DIAMETER TENSION PINS - OVERALL PIN LENGTH	
	OLDER (SHORTER) PIN	NEWER (LONGER) PIN
-14	maximum grip length + **0.485**" ± 0.010"	maximum grip length + **0.500**" ± 0.010"

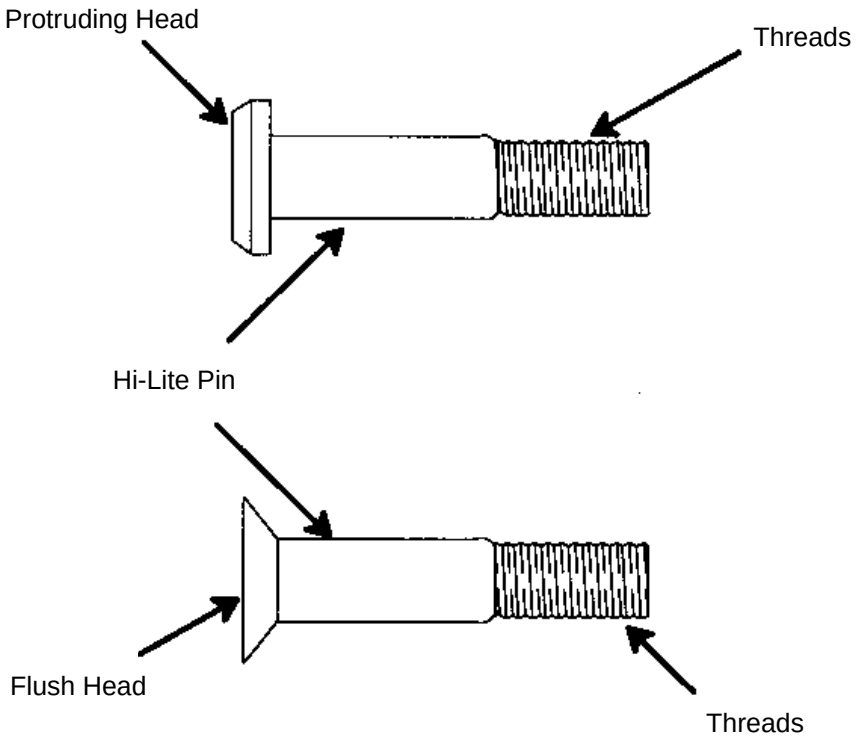


Figure 1 - General Description of Standard Hi-Lite Pins

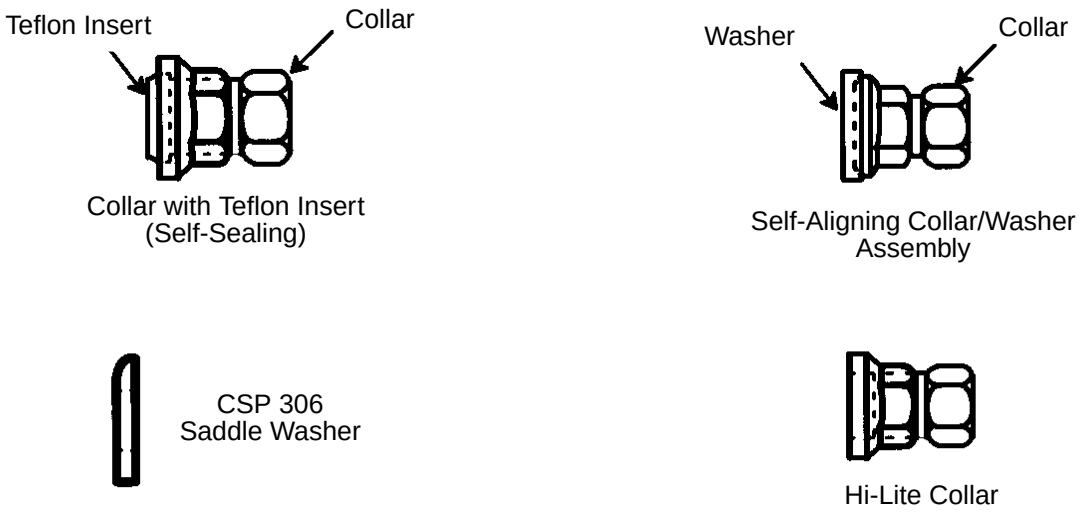
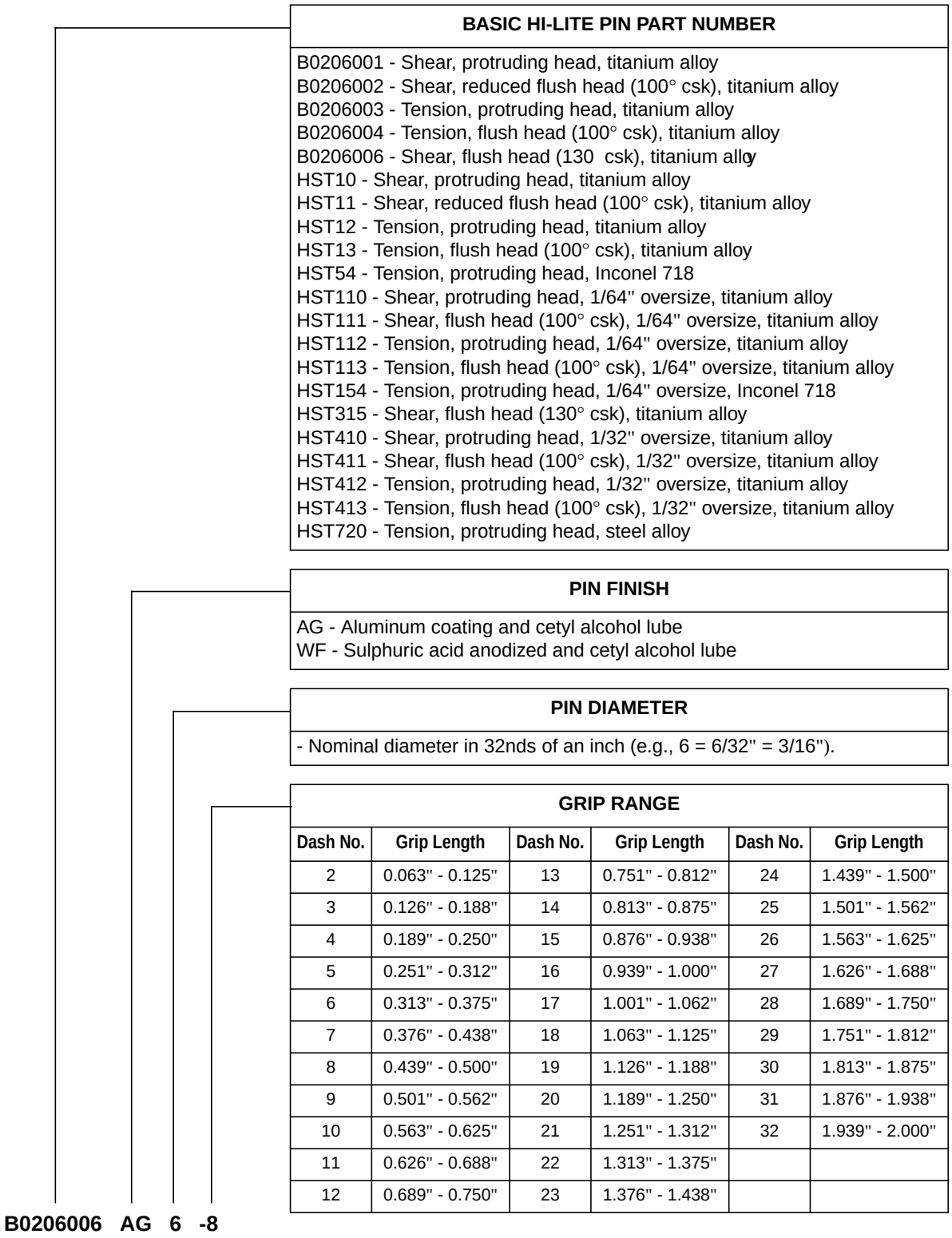


Figure 2 - General Description of Hi-Lite Collars and Washers



Dash No.	Grip Length	Dash No.	Grip Length	Dash No.	Grip Length
2	0.063" - 0.125"	13	0.751" - 0.812"	24	1.439" - 1.500"
3	0.126" - 0.188"	14	0.813" - 0.875"	25	1.501" - 1.562"
4	0.189" - 0.250"	15	0.876" - 0.938"	26	1.563" - 1.625"
5	0.251" - 0.312"	16	0.939" - 1.000"	27	1.626" - 1.688"
6	0.313" - 0.375"	17	1.001" - 1.062"	28	1.689" - 1.750"
7	0.376" - 0.438"	18	1.063" - 1.125"	29	1.751" - 1.812"
8	0.439" - 0.500"	19	1.126" - 1.188"	30	1.813" - 1.875"
9	0.501" - 0.562"	20	1.189" - 1.250"	31	1.876" - 1.938"
10	0.563" - 0.625"	21	1.251" - 1.312"	32	1.939" - 2.000"
11	0.626" - 0.688"	22	1.313" - 1.375"		
12	0.689" - 0.750"	23	1.376" - 1.438"		

Figure 3 - Hi-Lite Pin Part Number Breakdown

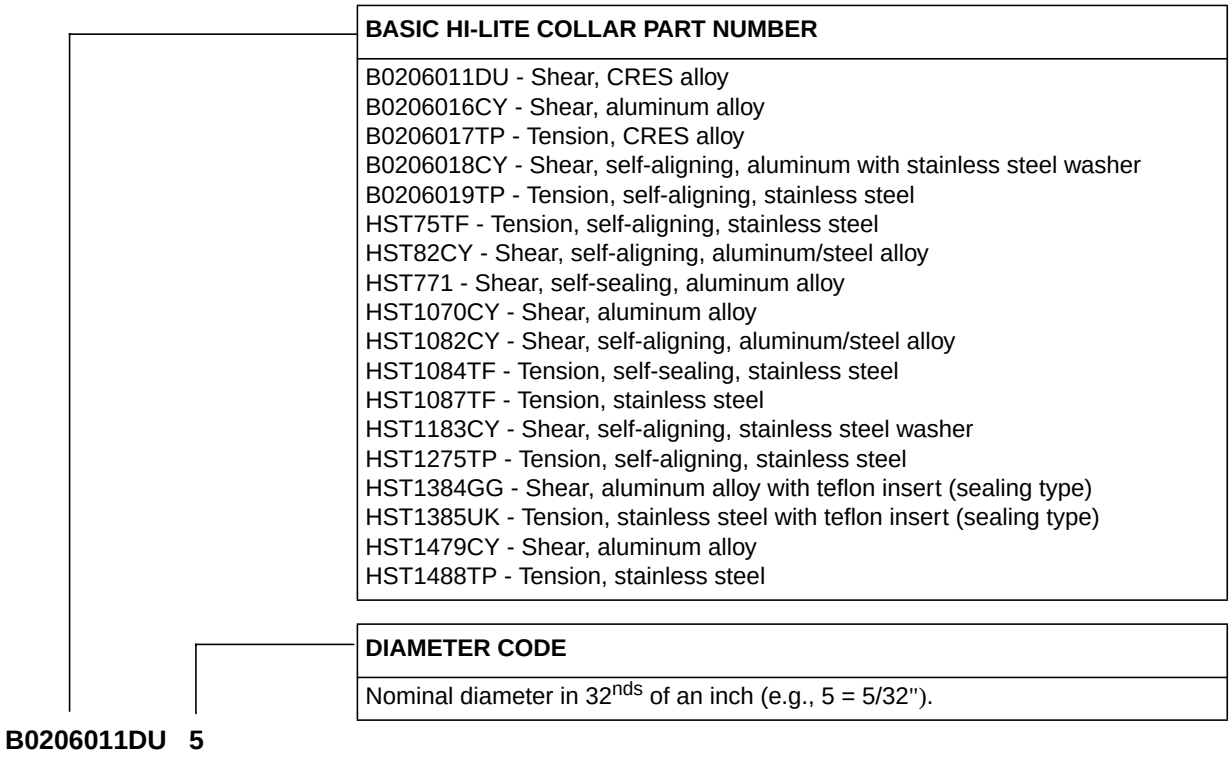


Figure 4 - Hi-Lite Collar Part Number Breakdown

4.2 Equipment

4.2.1 Hi-Shear #2-612 Hi-Lite grip scale.

4.2.2 Aluminum driving cap and support blocks (e.g., SD8853).

4.2.3 Modified rivet set (e.g., TS.412.60.12 MK1).

4.2.4 Impact Hi-Lok set (e.g., TS.411.05.12 (straight), TS.411.05.13 (offset)).

4.2.5 Aluminum driving cap (e.g., TS.411.05.14).

4.2.6 Hi-Lite pin protrusion gauges. For -12 and smaller diameter Hi-Lites, Hi-Shear #2-1522HST gauges may be used. For -14 diameter Hi-lite fasteners, use custom made gauges or suitable measurement tools to determine pin protrusion; ensure that custom made gauges, if used, are clearly marked with the minimum and maximum protrusion being checked using that gauge.

4.2.7 Single hex collar tightening tools (e.g., socket wrenches, box wrenches, air drivers, torque wrenches and adaptors, etc.).

4.2.8 Reversible stall type angle nutrunners (e.g., 5RNL-10F, 35RNL-20K, 5RNAL174H and 5RNAL-10F).

4.2.9 Double hex collar tightening tools as specified in Table 9.

5 Procedure

5.1 General

5.1.1 In general, the Hi-Lite fastening system is an interference fit fastening system designed for use in high strength structural joints which involves fitting the fastener pin in a close tolerance interference fit hole and installing a self-locking collar on the threaded end of the pin. For composite applications, the fastener is installed in a close tolerance non-interference fit hole. Although clamping action is achieved through the use of a threaded pin and a Hi-Lite collar, these fasteners are used for permanent installation. Hi-Lite fasteners are also used in areas of restricted access where installation of other permanent high strength fasteners such as lockbolts or Hi-Shear rivets would be difficult. As the effectiveness of the fastener is dependent on correct installation, it is essential that the installation procedure specified herein is strictly adhered to.

5.1.2 Hi-Lite pins are lubricated by the manufacturer. Protect fasteners from dust, dirt, moisture and excessive heat. If possible, keep fasteners in their original containers. If this is not possible, use non-absorbent containers. Handle fasteners only from the threaded portion of the shank. Use oldest stock at first.

5.1.3 It is acceptable to install Hi-Lite fasteners using automatic installation equipment provided that the upper anvil is slightly smaller than the fastener head. Also, before each production run the equipment must be used to install fasteners in 3 of 6 holes prepared in a 3" X 10" test panel of the same alloy and combined thickness as the part to be fastened. If the holes and installed fasteners meet the requirements of section 6 the equipment may be used.

5.1.4 In recent years, the Hi-Lite tension pin engineering drawings were changed slightly such that the pin thread length for -14 diameter pins was slightly increased (see Table 1). As a result, it may occur that older and newer pins may be stocked together, as the part number is the same although the two pins are not identical (older pins being slightly shorter than the newer pins). It is acceptable to install either the older (shorter) or the newer (longer) diameter pin where use of -14 Hi-Lite tension pins (e.g., B0206003, HST12, etc.) is specified by the engineering drawing. The only difference in the assembly process is that the pin protrusion limits for the older and newer -14 tension pins are not the same; refer to Table 13 for the pin protrusion limits. Before installing -14 diameter tension pins measure or use a suitable comparator to determine if the pin installed is the older (shorter) or newer (longer) pin so that when checking for pin protrusion the correct pin protrusion limits may be verified.

5.2 Hole Preparation

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

Step 1. Pre-drill as specified in Table 2 using a piloted double margin drill 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")

NOMINAL FASTENER DIAMETER	PRE-DRILL SIZE
-10 (5/16")	L (0.290")
-12 (3/8")	S (0.348")
-14 (7/16")	13/32" (0.406")

Step 2. For flush head pins, countersink as specified in Table 3 using a micro-stop countersink according to PPS 1.33.

Table 3 - Countersinking for Flush Head Fasteners (Notes 1 & 2)

NOMINAL FASTENER DIAMETER	COUNTERSINK PILOT	B0206002 (HST11) 100° COUNTERSINK DIAMETER	B0206004 (HST13) 100° COUNTERSINK DIAMETER	B0206006 130° COUNTERSINK DIAMETER
-5 (5/32")	0.144"	0.246" - 0.256"	0.316" - 0.326"	0.321" - 0.331"
-6 (3/16")	0.177"	0.287" - 0.297"	0.367" - 0.377"	0.373" - 0.383"
-8 (1/4")	0.228"	0.380" - 0.390"	0.492" - 0.502"	0.493" - 0.503"
-10 (5/16")	0.290"	0.459" - 0.469"	0.619" - 0.629"	0.585" - 0.595"
-12 (3/8")	0.348"	0.545" - 0.555"	0.746" - 0.756"	0.691" - 0.701"
-14 (7/16")	0.406"	0.652" - 0.662"	0.871" - 0.881"	n/a

Note 1. The countersink diameters specified herein are for reference only; countersink so that the head protrusion of flush head pins will be 0.000" (i.e., flush) to 0.005" above flush (see Figure 5). It is **NOT** acceptable to shave the heads of Hi-Lite fasteners to meet flushness requirements.

Note 2. Check the countersink diameter using a countersink gauge (e.g., Trulok/Brencor or TS.759.13.13). Refer to PPS 1.33 for the procedure for using a Trulok/Brencor countersink gauge. For TS.759.13.13 countersink gauges, place the countersink gauge on the master gauge, adjust the dial gauge to zero and then place the countersink gauge on the countersunk hole and note any deviation from the master (see Figure 6).

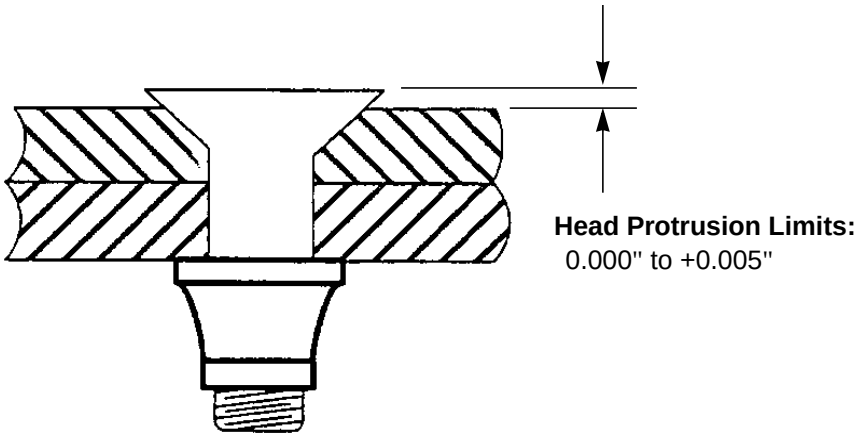


Figure 5 - Head Flushness Requirements

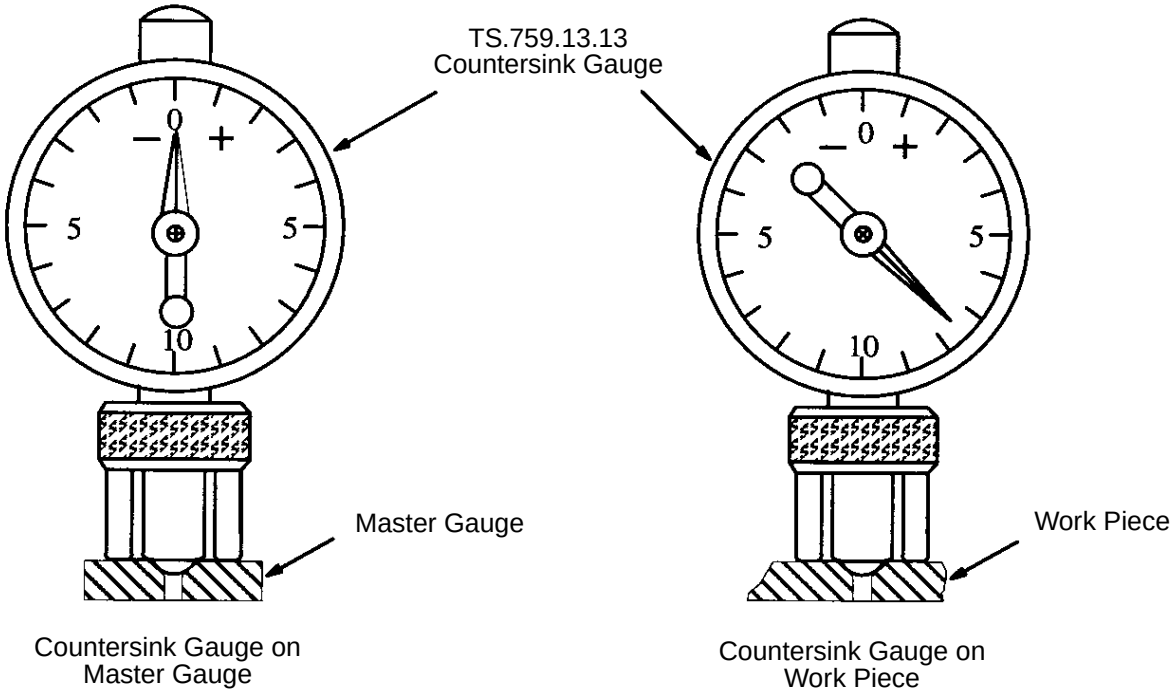


Figure 6 - Countersink Gauge

Step 3. Ream the hole to final size as specified in Table 4 using a piloted reamer according to PPS 1.09.

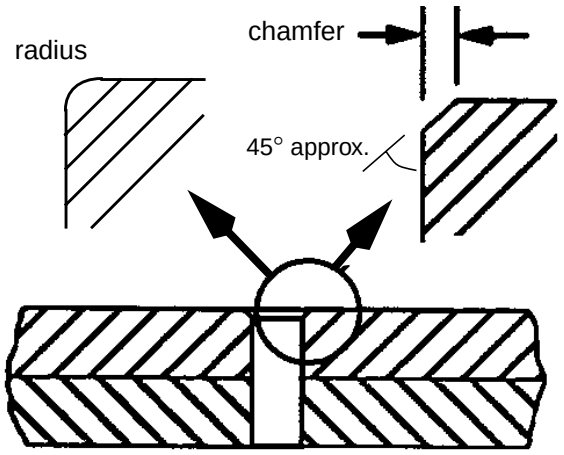
Table 4 - Final Reaming/Drilling of Fastener Holes (Notes 1, 2 & 3)

LEARJET MODEL 45 WING				
NOMINAL FASTENER DIAMETER	GRIP LENGTH LESS THAN OR EQUAL TO 2.5D		GRIP LENGTH GREATER THAN 2.5D AND LESS THAN OR EQUAL TO 4D	
	RECOMMENDED REAMER/DRILL SIZE	HOLE LIMITS	RECOMMENDED REAMER/DRILL SIZE	HOLE LIMITS
-5 (5/32")	0.1605"	0.1605" - 0.1615"	0.1610"	0.1610" - 0.1620"
-6 (3/16")	0.1860"	0.1855" - 0.1875"	0.1870"	0.1870" - 0.1880"
-8 (1/4")	0.2460"	0.2455" - 0.2475"	0.2470"	0.2470" - 0.2480"
-10 (5/16")	0.3085"	0.3080" - 0.3100"	0.3095"	0.3095" - 0.3105"
-12 (3/8")	0.3705"	0.3705" - 0.3725"	0.3720"	0.3720" - 0.3730"
-14 (7/16")	0.4335"	0.4330" - 0.4350"	0.4345"	0.4345" - 0.4355"

DASH 8 AIRCRAFT (SERIES 100, 200, 300 & 400)					
NOMINAL FASTENER DIAMETER	COMPOSITE PARTS (including Hybrid Stack-ups)		NON-COMPOSITE PARTS		
			RECOMMENDED REAMER/DRILL SIZE	HOLE LIMITS	
	RECOMMENDED REAMER/DRILL SIZE	HOLE LIMITS		ALUMINUM	NON-ALUMINUM
-5 (5/32")	0.1650"	0.1640" - 0.1670"	0.1610"	0.1590" - 0.1620"	0.1610" - 0.1625"
-6 (3/16")	0.1900"	0.1900" - 0.1930"	0.1865"	0.1850" - 0.1880"	0.1860" - 0.1880"
-8 (1/4")	0.2500"	0.2500" - 0.2535"	0.2460"	0.2450" - 0.2480"	0.2460" - 0.2480"
-10 (5/16")	0.3125"	0.3125" - 0.3160"	0.3085"	0.3075" - 0.3105"	0.3085" - 0.3105"
-12 (3/8")	0.3750"	0.3750" - 0.3785"	0.3705"	0.3690" - 0.3730"	0.3705" - 0.3725"
-14 (7/16")	0.4375"	0.4375" - 0.4415"	0.4335"	0.4315" - 0.4355"	0.4330" - 0.4355"

Notes
1. If access with a reamer is not possible, it is acceptable to use a special short length piloted double margin drill. Refer to PPS 1.09 for a listing of available piloted reamers and double margin drills.
2. For LearJet Model 45 wing situations in which the grip length is greater than 4D, refer to the engineering drawing for the hole limits.
3. When a stack-up includes both composite and metallic parts it is considered a hybrid stack-up. Unless otherwise specified by the engineering drawing, for all DASH 8 aircraft parts to be included in a hybrid stackup including composite parts, prepare the hole to the limits specified for composite parts.

Step 4. For protruding head fasteners, manually break the edge of the hole to create a slight chamfer or radius as shown in Figure 7 according to PPS 27.05.



FASTENER	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 7 - 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. Insert the collet of the drillmotor into the starting hole and the template boss into the next hole in the template.

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

Step 5. Remove the drill template.

Step 6. 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 7 according to PPS 27.05.

Step 7. 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		
	STANDARD	1/64" OVERSIZE	1/32" OVERSIZE
-5	#17 (0.173")	n/a	n/a
-6	#8 (0.199")	#4 (0.209")	#1 (0.228")
-8	F (0.257")	I (0.272")	L (0.290")
-10	P (0.323")	Q (0.332")	S (0.348")
-12	W (0.386")	X (0.397")	Z (0.413")
-14	29/64" (0.453")	15/32" (0.469")	31/64 (0.485")

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 of Table 4 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 8):

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 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.

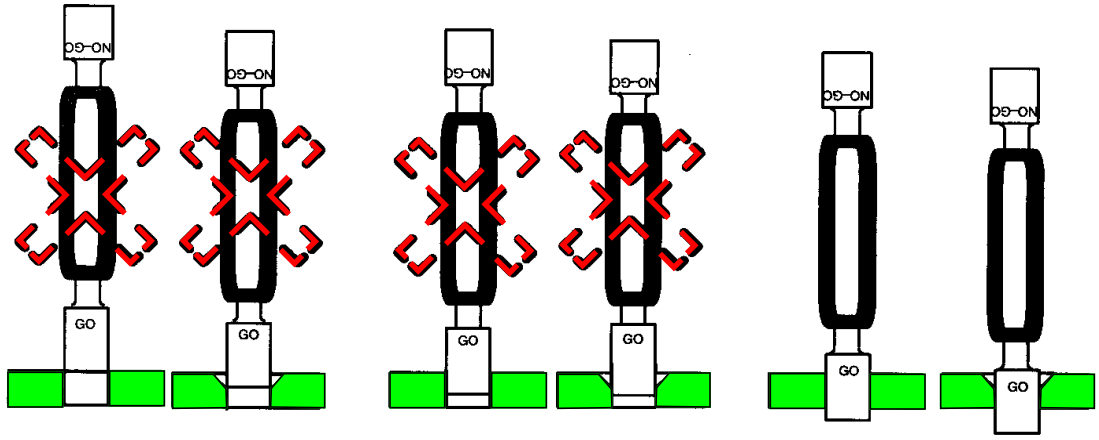
5.4 Fastener Length Selection

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-Lite grip scale. Include all the components to be joined, including CSP 306 saddle washers. Install a fastener of the measured length.

5.4.2 The hole depth number shown on the grip scale corresponds to the Hi-Lite pin grip length dash number. Always read to the next higher number as shown in Figure 9 (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.

5.4.3 If the head markings of pins do not show the grip dash number, check the grip length of Hi-Lite pins using the grip scale as shown in Figure 9. Refer to Figure 3 for a listing of the grip length ranges for each grip dash number.

5.4.4 Except when using self sealing collars, if Hi-Lite pins of the correct length are not available, it is acceptable to use the next longer pin length, shimmed with the washer specified in Table 7, provided that the requirements of Figure 12 will be met. If necessary it is acceptable to use up to 2 washers to shim to a maximum combined thickness of 0.0625". Always place the washer, or washers, on the nut or collar side. Use the thinnest possible washer, or washers, which allow the requirements of Figure 12 to be met. Do not use washers under self sealing collars.

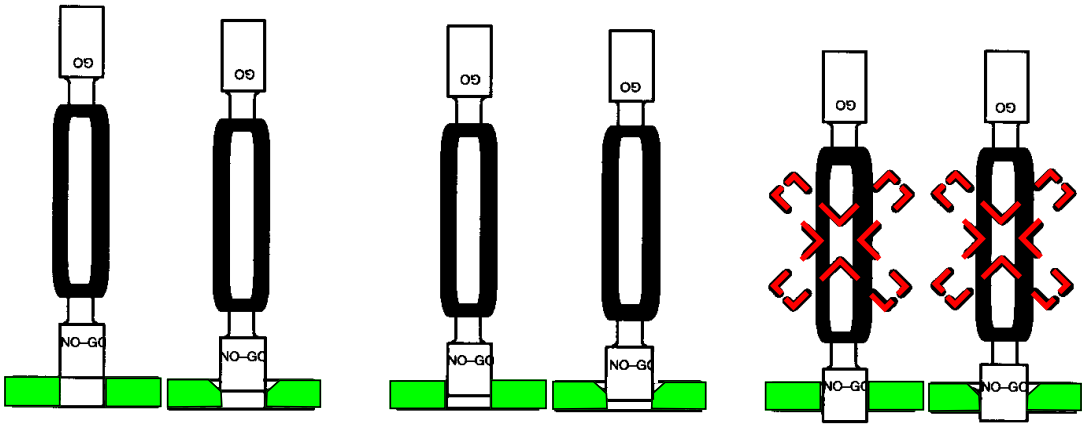


Does not go in.
UNDERSIZE HOLE

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 8 - Use of Go/No-Go Gauges

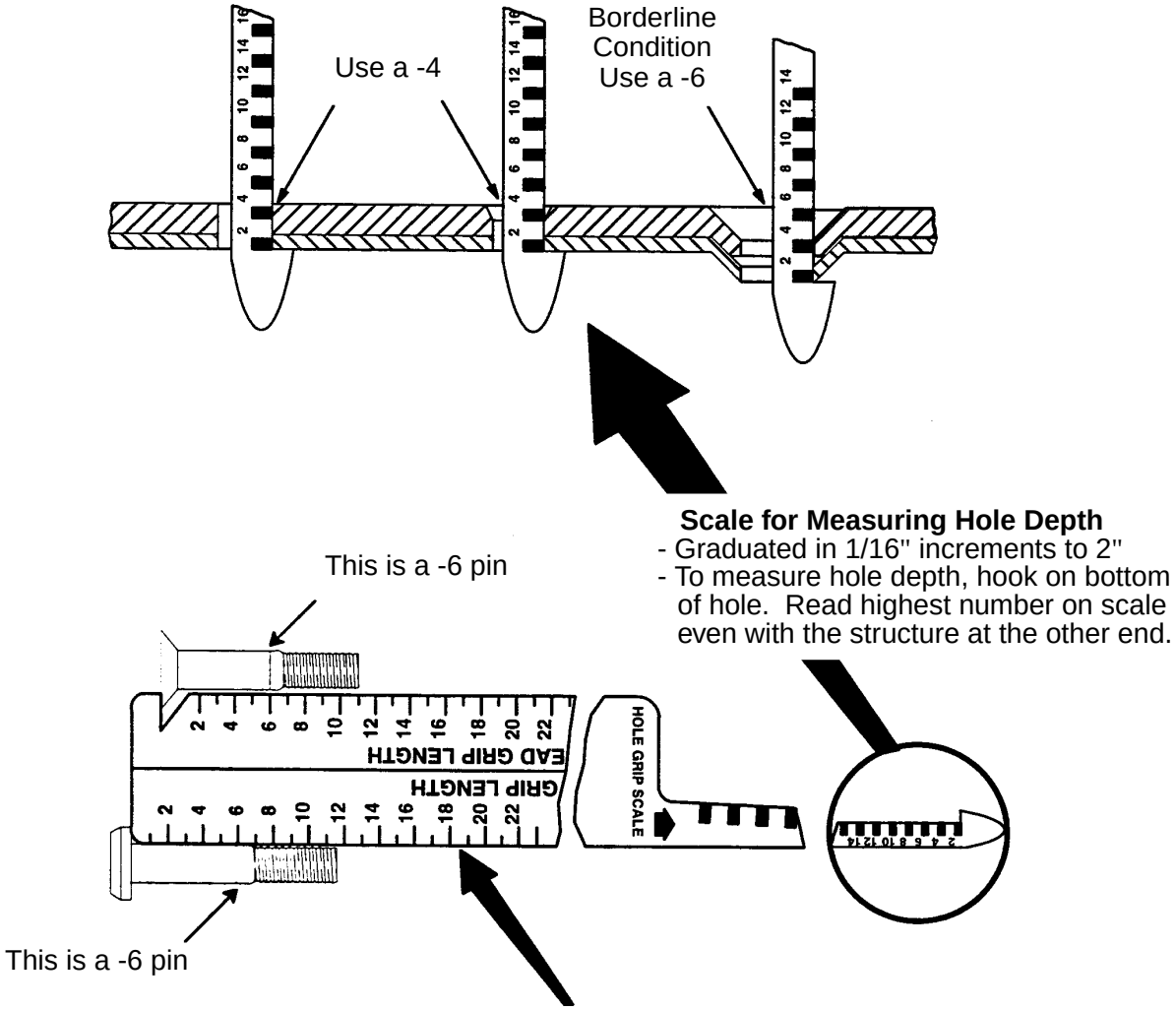


Figure 9 - Grip Scale (Hi-Shear #2-612)

Table 7 - Selection of Shimming Washers

FASTENER		SHIMMING WASHER	
BOMBARDIER PART NUMBER	**HI-SHEAR PART NUMBER**	**ALUMINUM STRUCTURE ON WASHER SIDE**	**NON-ALUMINUM STRUCTURE ON WASHER SIDE**
B0206001	HST10	Aluminum Washer(s) (AN960D, NAS1149D or NAS1252) or CRES Washer(s) (AN960C or NAS1149CXXXXR)	CRES Washer(s) (AN960C or NAS1149CXXXXR)
B0206002	HST11		
B0206003	HST12		
B0206004	HST13		
B0206006	HST315	CRES Washer(s) (AN960C or NAS1149CXXXXR)	Steel Alloy Washer(s) (MS21206 or MS14183)
n/a	HST54		
n/a	HST720		

Note 1. For installation of oversize Hi-Lites, if use of shimming washers is required, use the shimming washer specified for the standard size Hi-Lite and drill out the washer, if necessary. Alternatively, if drilling out the washer specified herein is necessary, it is acceptable to use the appropriate B0202025 washers as shimming washers.

5.5 Installation of Hi-Lite Pins

5.5.1 Install Hi-Lite pins as follows:

Step 1. Unless the engineering drawing specifies wet installation of fasteners (i.e., with sealant), prime countersinks with F1 zinc chromate primer according to PPS 34.02, F19 Type 2 epoxy-polyamide primer according to PPS 34.08 or apply F16 jointing compound to the countersink according to PPS 34.05

Step 2. If necessary to aid insertion, apply a light coating of liquid Boelube to the shank of the pin.

Step 3. Fully Insert the pin into the prepared hole so that the head is seated against the structure.

- If possible insert the pin using a squeeze gun fitted with a flush rivet set on the fixed jaw and a TS.412.60.12 modified rivet set on the moving jaw. Refer to PPS 1.12 for the procedure and requirements for the use of squeeze riveters.
- If it is not possible to use a squeeze riveter, it is acceptable to insert pins using a light rivet gun fitted with a suitable rivet set (e.g., a TS.411.05 rivet set, a standard rivet set with a TS.411.05.14 aluminum driving head, etc.) provided that the rivet set does not damage the pin head or structure.
  If the driving force required is high, (i.e., maximum interference or thick material gauge) support the reverse side of the structure using an aluminum faced support block (see Figure 10). This is particularly important when inserting pins into bonded structure as delamination could occur if the reverse side is not properly supported.
- If it is not possible to insert the pin using either a squeeze gun or a rivet gun, insert the pin using an SD8948 installation tool (see Figure 11).
- If the pin can be inserted without noticeable resistance (i.e., interference), re-verify the hole diameter and ensure that the correct Hi-Lite pin is being installed.

Step 4. Check that the head protrusion of flush head fasteners meets the requirements of Figure 5. If the head protrusion limits are exceeded, remove the fastener according to section 5.10 and increase the countersink diameter so that the head protrusion limits will be met.

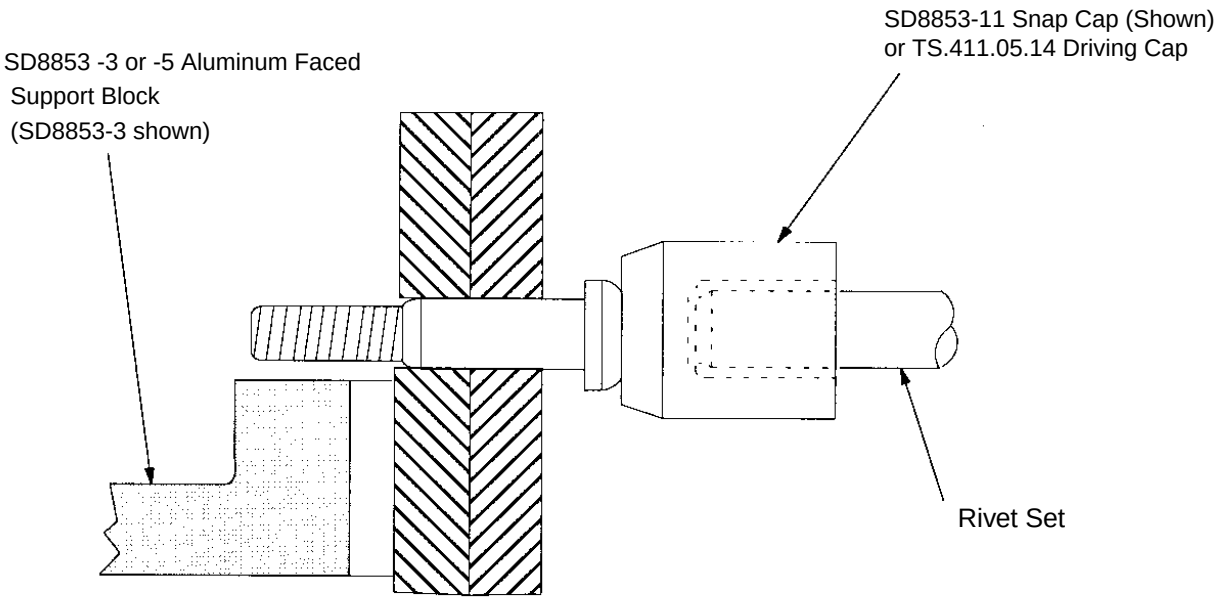


Figure 10 - Seating of Pin using a Rivet Gun

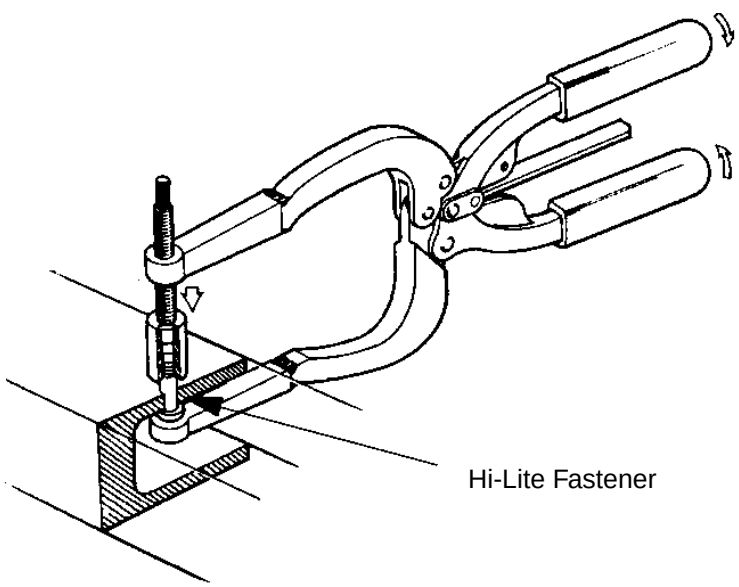


Figure 11 - Use of SD8948 Insertion Tool

Step 5. Immediately after insertion of the fastener, remove all traces of sealant or Boelube, if any, from the protruding threads and surrounding surfaces.

5.6 Grip Length Verification

5.6.1 After the Hi-Lite pin has been fully seated, verify the grip length meets the requirements shown in Figure 12. Visually examine the pin to ensure the threads are located correctly as shown in Figure 12. Threads in bearing are acceptable in CSP306 saddle washers and in non-structural packers and brackets, such as attachment clips for electrical wiring and plumbing. Except when installing self sealing collars, it is acceptable to use up to 2 flat washers (see Table 7) to shim to a maximum combined thickness of 0.0625". Use the thinnest possible washer, or washers, which allow the requirements of Figure 12 to be met. If a self sealing collar is used, do not use a washer under the collar.

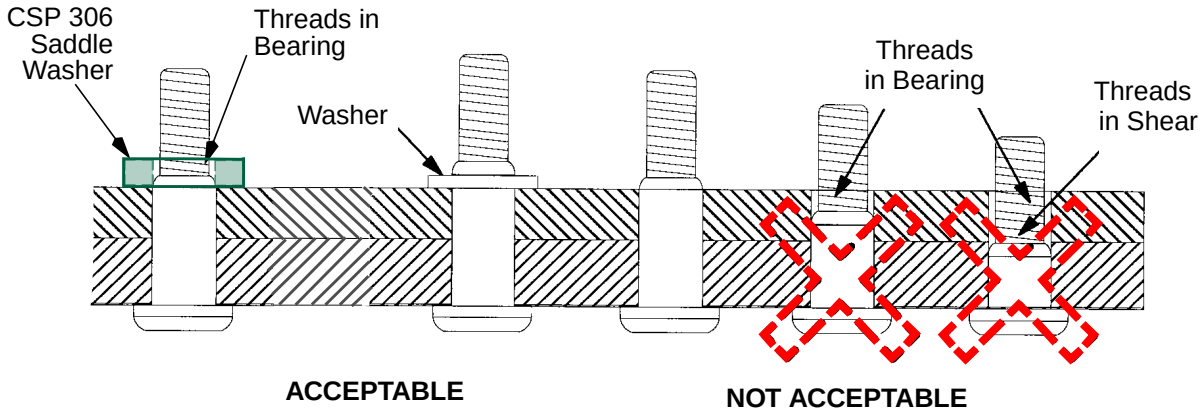


Figure 12 - Grip Length Verification

5.6.2 Check the pin protrusion using a protrusion gauge. If a washer is to be used under a Hi-Lite collar, measure the pin protrusion from the surface of the washer (or an equivalent thickness) as shown in Figure 13.

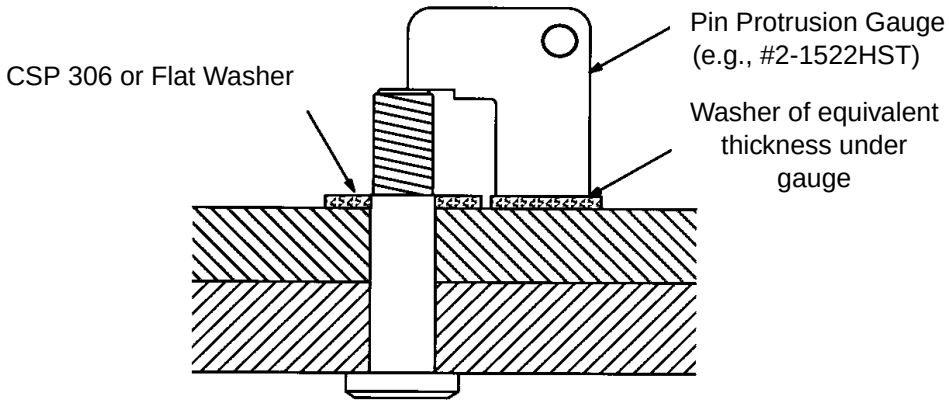


Figure 13 - Pin Protrusion Measurement when Washers are Used

5.6.3 If the pin length is too short, drive out the pin according to the section 5.10 and re-check the material thickness and pin length using a grip scale.

5.7 Installation of Hi-Lite Collars or Nuts

5.7.1 Install Hi-Lite collars and nuts as follows:

Step 1. If F16 jointing compound was applied to the countersink, remove any F16 jointing compound from the threaded portion of the fastener by solvent wiping according to PPS 31.17.

Step 2. If use of a washer is specified by the engineering drawing, place the washer over the pin. For CSP306 saddle washers, position the prepared washer (i.e., drilled out 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 3. Thread the specified nut or collar onto the pin by hand. The threads of the nut or collar 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. Discard the nuts or collars which permit the pin to pass through the self-locking portion when tightened by hand alone. If the pin has been installed with its proper interference fit, free rotation of the pin during installation should not occur. Any rotation of the pin during **run down** of the collar or nut indicates insufficient interference and is not acceptable.

Step 4. Torque **nuts** according to PPS 14.01 to the value specified on the engineering drawing. Refer to Table 8 for the torque values for K-Fast nuts. If the pin has been installed with its proper interference fit, in most cases free rotation of the pin during torquing should not occur. However, if necessary, it is acceptable to use an Allen key to prevent rotation.

Tighten **single hex collars** using a suitable socket wrench or box wrench until the hex end of the collar has been torqued off. Alternatively, in limited access areas the collar may be tightened using a stall type nutrunner. In most cases free rotation of the pin during torquing should not occur if the pin has been installed with its proper interference fit. However, use an Allen key to prevent any rotation, as necessary.

Tighten **double hex collars** using the socket specified in Table 9 until the outer hex end of the collar has been torqued off. These tools are specifically designed with a shallow socket to engage only the break away hex. As above, use an Allen key to prevent pin rotation, if necessary.

Step 5. Except as noted below, for single hex and double hex **aluminum** collars where the hex end of the 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 the collar 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.

Table 8 - Torque Values for K-Fast Nuts (ref. EO 7446)

NOMINAL FASTENER DIAMETER	TORQUE (IN.LBS)	
	B0203013 & B0203016 K-FAST NUTS (for shear fasteners)	**B0203014 & B0203015 K-FAST NUTS** (for tension fasteners)
-5 (5/32")	20	30
-6 (3/16")	30	35
-8 (1/4")	70	90
-10 (5/16")	125	175
-12 (3/8")	180	310

Table 9 - Sockets for Tightening Double Hex Collars

DOUBLE HEX COLLAR		COLLAR DIAMETER	INSTALLATION SOCKET
B0206016CY B0206017TP B0206018CY B020619TP	HST1183CY HST1275TP HST1384GG HST1385UK HST1479CY HST1488TP	-5	HLH102-218s
		-6	HLH102-250S
		-8	HLH102-312S
		-10	HLH102-375S or HLH102A-375S
		-12	HLH102-437S

Note 1. All of the sockets specified in this table have a 1/4" square drive size except the HLH102A which has a 3/8" square drive.
Note 2. It is acceptable to use alternative sockets for installation of double hex collars provided that the alternative equipment will engage **only** the break away hex.

5.8 Installation of Oversize Hi-Lite Pins

5.8.1 Oversize Hi-Lites may be used to salvage slightly oversize holes only if authorized, in writing, by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB. Install oversize Hi-Lites as follows:

Step 1. Select the appropriate oversize Hi-Lite from Table 10. Use the same grip number for the oversize pin as required for the standard size pin. Use 1/32" oversize pins only when the hole damage exceeds the hole diameter specified for 1/64" oversize pins. If an oversize pin is required for a -5 pin, use a -6 pin of the same basic part number.

Step 2. Open up the fastener hole for the oversize pin to the size specified in Table 11 using a piloted double margin drill or reamer according to PPS 1.09.

Step 3. Check the hole for conformance to the hole limits requirements of Table 11 using a go/no-go gauge, a plug gauge or other hole measuring gauge. Also check the hole ovality according to paragraph 5.2.4.1. Refer all non-conforming holes to Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB for disposition.

Step 4. For flush head fasteners, check the countersink diameter to ensure the requirements of Figure 5 will be met. Except for 1/32" oversize 100° flush head shear pins (i.e., HST411), the countersink diameter requirements for the corresponding oversize pin are the same as those for the standard size pin. The head of HST411 is larger than the HST11 head and consequently a slightly larger countersink diameter (see Table 12) is required.

Step 5. For protruding head pins, break the hole edges to produce a slight chamfer as shown in Figure 7.

Step 6. If CSP306 saddle washers are specified on the engineering drawing, drill-out the washers using the drill size specified in Table 5.

Step 7. Install oversize pins in prepared holes using the same procedure and tools as for standard size pins.

Step 8. Install the nut or collar specified by Bombardier Toronto (de Havilland) MRB or Bombardier Toronto (de Havilland) delegated MRB (e.g., via fastpath RNC).

Table 10 - Oversize Hi-Lite Pin Selection

STANDARD SIZE		MATERIAL & HEAD STYLE		1/64" OVERSIZE		1/32" OVERSIZE	
PART NUMBER	HEAD MARKING			PART NUMBER	HEAD MARKING	PART NUMBER	HEAD MARKING
B0206001 HST10	HST10 hs8		Titanium, protruding head	HST110	HST110 hs8	HST410	HST410 hs8
B0206002 HST11	HST11 hs8		Titanium, 100° reduced flush head	HST111	HST111 hs8	HST411	HST411 hs8
B0206003 HST12	HST12 hs8		Titanium, protruding head	HST112	HST112 hs8	HST412	HST412 hs8
B0206004 HST13	HST13 hs8		Titanium, 100° MS24694 flush head	HST113	HST113 hs8	HST413	HST413 hs8
B0206006 HST315	HST315 hs8		Titanium, 130° flush head	n/a		n/a	
HST54	HST54 hs8		Inconel 718, protruding head	HST154	HST154 hs8	n/a	
HST720	HST720 hs8		Steel, protruding head	n/a		n/a	

Note 1. The upper alpha-numeric code is the part number of the pin; the lower alpha-numeric code is the manufacturers trademark (hs or H denotes Hi Shear).

Table 11 - Final Reaming/Drilling of Fastener Holes for Oversize Fasteners (Note 1)

1/64" OVERSIZE				
ORIGINAL NOMINAL FASTENER DIAMETER	LEARJET MODEL 45 WING	DASH 8 AIRCRAFT (SERIES 100, 200, 300 & 400)		
		COMPOSITE PARTS (including Hybrid Stack-Ups)	NON-COMPOSITE PARTS	
			ALUMINUM	NON-ALUMINUM
-6 (3/16")	0.1986" - 0.2006"	0.2035" - 0.2065"	0.1985" - 0.2015"	0.1995" - 0.2015"
-8 (1/4")	0.2611" - 0.2631"	0.2655" - 0.2685"	0.2605" - 0.2635"	0.2615" - 0.2635"
-10 (5/16")	0.3236" - 0.3256"	0.3280" - 0.3315"	0.3230" - 0.3260"	0.3240" - 0.3260"
-12 (3/8")	0.3861" - 0.3881"	0.3905" - 0.3940"	0.3845" - 0.3885"	0.3860" - 0.3880"
-14 (7/16")	0.4486" - 0.4506"	0.4530" - 0.4570"	0.4470" - 0.4510"	0.4485" - 0.4505"
1/32" OVERSIZE				
ORIGINAL NOMINAL FASTENER DIAMETER	LEARJET MODEL 45 WING	DASH 8 AIRCRAFT (SERIES 100, 200, 300 & 400)		
		COMPOSITE PARTS (including Hybrid Stack-Ups)	NON-COMPOSITE PARTS	
			ALUMINUM	NON-ALUMINUM
-6 (3/16")	0.2142" - 0.2162"	0.2190" - 0.2220"	0.2140" - 0.2170"	0.2150" - 0.2170"
-8 (1/4")	0.2767" - 0.2787"	0.2810" - 0.2840"	0.2760" - 0.2790"	0.2770" - 0.2790"
-10 (5/16")	0.3392" - 0.3412"	0.3435" - 0.3470"	0.3385" - 0.3415"	0.3395" - 0.3415"
-12 (3/8")	0.4017" - 0.4037"	0.4060" - 0.4095"	0.4000" - 0.4040"	0.4015" - 0.4035"
-14 (7/16")	0.4642" - 0.4662"	0.4685" - 0.4725"	0.4625" - 0.4665"	0.4640" - 0.4660"

Note 1. It is recommended that a double margin drill or reamer, as close as possible to the minimum required hole diameter, be used to prepare holes for oversize fasteners. Refer to PPS 1.09 for a listing of available reamers and double margin drills.

Table 12 - Countersink Requirements for HST411 Pins

1/32" OVERSIZE HST411 FASTENER (Notes 1 & 2)	
NOMINAL FASTENER DIAMETER	COUNTERSINK DIAMETER (100° ANGLE)
-6 (7/32")	0.315" - 0.325"
-8 (9/32")	0.411" - 0.421"
-10(11/32")	0.490" - 0.500"
-12(13/32")	0.577" - 0.587"
-14(15/32")	0.683" - 0.693"

Note 1: The countersink diameter dimensions specified in this table are for reference only; install flush head fasteners so that the head protrusion limits specified in Figure 5 are met.

Note 2. If possible, use a countersink with a pilot slightly smaller than the diameter of the fastener hole.

5.9 Post Installation Clean-Up

5.9.1 After the installation of the fastener is complete, remove excess F1 zinc chromate primer or F16 jointing compound by solvent wiping according to PPS 31.17.

5.10 Removal of Installed Fasteners (see Figure 14)

5.10.1 If it is possible to remove the installed nut or collar using a wrench or pliers, remove Hi-Lite fasteners as follows:

Step 1. Back off the nut (using a suitable wrench) or collar (using pliers) flush with the end of the pin. If necessary, use an Allen wrench 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 or -5 aluminum faced support block and lightly tap the end of the pin/nut with a hammer or a light rivet gun (i.e., CP-2X or RRH 04P) fitted with a flat snap to break the pin loose.

Step 3. Remove the nut from the pin.

Step 4. Using a flat punch with slightly rounded corners to prevent damage to the walls of the fastener hole, drive the pin out completely. Discard removed pins, nuts and collars; do not re-use.

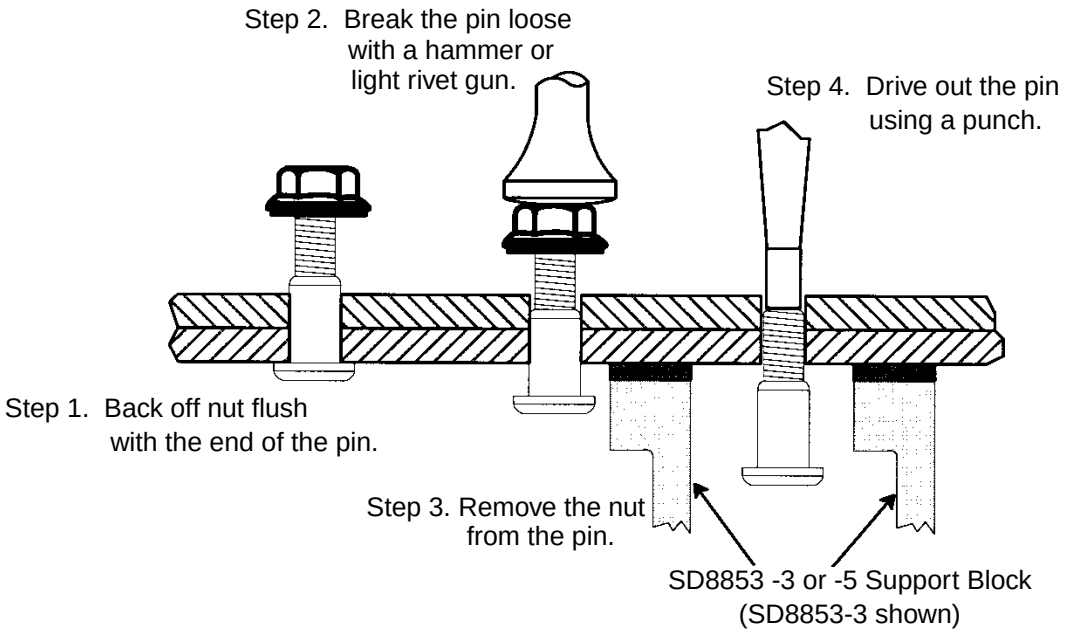


Figure 14 - Removal of Installed Fasteners - Back Off Method

5.10.2 If it is not possible to remove the installed nut or collar using a wrench or pliers, remove Hi-Lite fasteners as follows:

Step 1. Place a drill guide block over the fastener head. Refer to PPS 1.09 for a selection of drill guide blocks.

Step 2. Align the centre of the drill guide block target with the centre of the fastener head.

Step 3. Remove the drill guide block target and assemble the applicable renewable slip bushing to the drill guide block.

Step 4. Using a centre drill, drill-off the fastener head without damaging the walls of the fastener hole.

Step 5. Support the opposite side of the structure using an SD8853-3 or -5 aluminum faced support block.

Step 6. Drive the pin shank out of the hole by lightly tapping the shank end, using a flat punch with slightly rounded corners to prevent damage to the walls of the fastener hole. Do not attempt to salvage collars as they cannot be re-used.

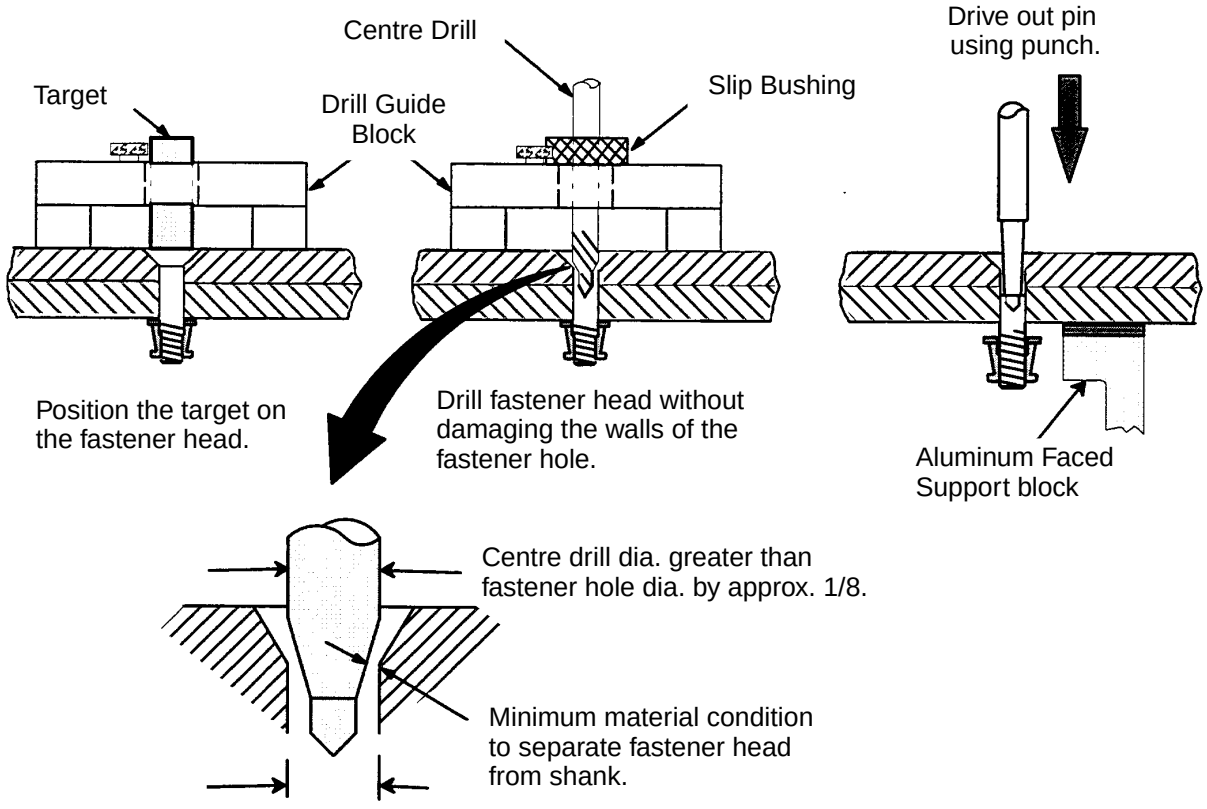


Figure 15 - Removal of Installed Fasteners - Drill Out Method

6 REQUIREMENTS

6.1 The head protrusion of flush head pins must be 0.000" (i.e., flush) to 0.005" above flush (see Figure 5). It is **NOT** acceptable to shave the heads of Hi-Lite fasteners to meet flushness requirements.

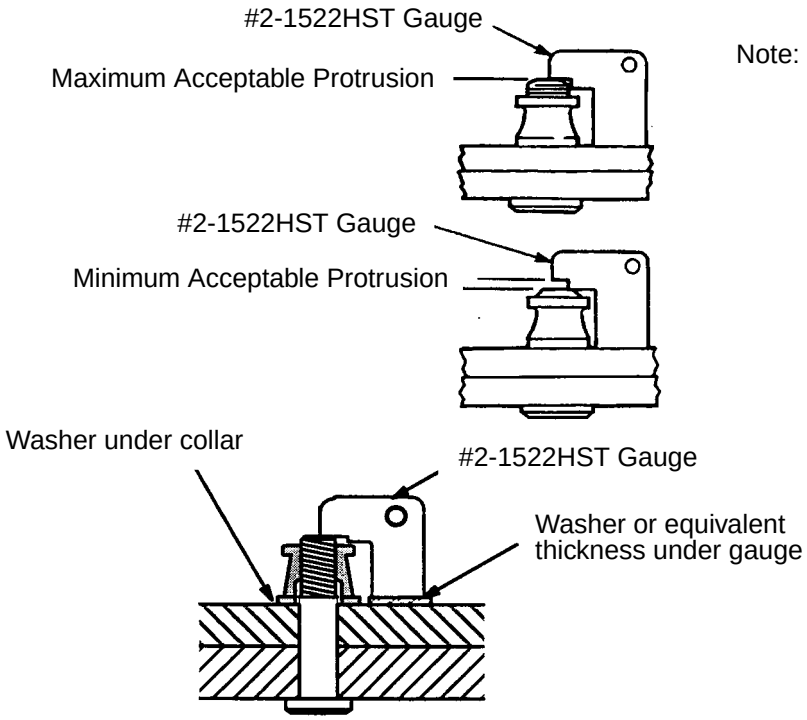
6.2 Except where dome sealing of the collar is specified, ensure that for single hex and double hex **aluminum** collars where the hex end of the collar has been torqued off, the exposed bare metal of the collar in the break-off area has been touched-up with F19 Type 2 epoxy primer according to PPS 34.08, or, in fuel tank areas **only**, with F21 Type II epoxy primer according to PPS 21.03.

6.3 Refer to Table 13 for the pin protrusion requirements. For -12 and smaller nominal diameter Hi-Lite fasteners, the pin protrusion can be checked using Hi-Lite protrusion gauge #2-1522HST as shown in Figure 16.

Table 13 - Pin Protrusion Limits

Hi-Lite Pin		Pin Protrusion	
Nominal Pin Diameter	**Pin Type**	**Minimum**	**Maximum**
-5	All	0.270"	0.352"
-6	All	0.280"	0.362"
-8	All	0.310"	0.392"
-10	All	0.370"	0.452"
-12	All	0.410"	0.492"
-14 (Note 1)	Older & Newer Shear Type	0.475"	0.557"
	Older Tension Type		
	Newer Tension Type	0.490"	0.572"

Note 1. In recent years, the data for -14 diameter tension pins was changed slightly such that the pin thread length was slightly increased (see Table 1). As a result, it may occur that older and newer pins may be stocked together, as the part number is the same although the two pins are not identical (older pins being slightly shorter than the newer pins). It is acceptable to install either the older (shorter) or the newer (longer) diameter pin where use of -14 diameter tension pins (e.g., B0206003, HST12, etc.) are specified by the engineering drawing. The only difference in the assembly process is that the pin protrusion limits for the older and newer -14 tension pins are not the same.



Note: The #2-1522HST gauge is only suitable for -12 and smaller diameter Hi-Lites. For -14 diameter Hi-lite fasteners, use custom made gauges or suitable measurement tools to determine pin protrusion; ensure that custom made gauges, if used, are clearly marked with the minimum and maximum protrusion being checked using that gauge.

Figure 16 - Pin Protrusion Gauge

6.4 The maximum acceptable gap under one side of the head, nut or collar of an installed fastener must not exceed 0.002" (see Figure 17). For flush head Hi-Lites, any gap under the head must also not extend to the shank of the pin and the bearing surface must extend at least 240° around the circumference of the fastener head.

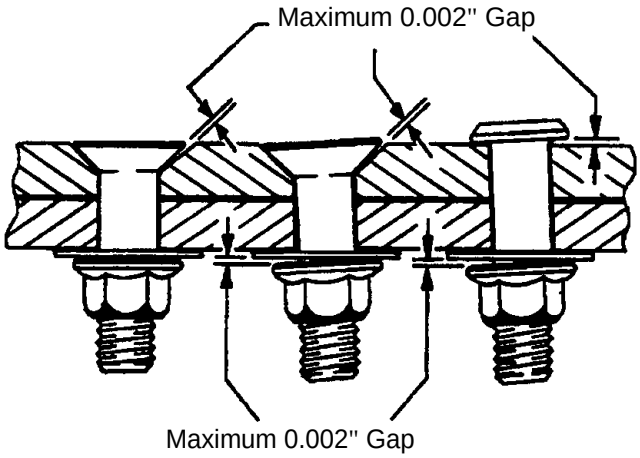


Figure 17 - Incomplete Head or Nut Seating

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.