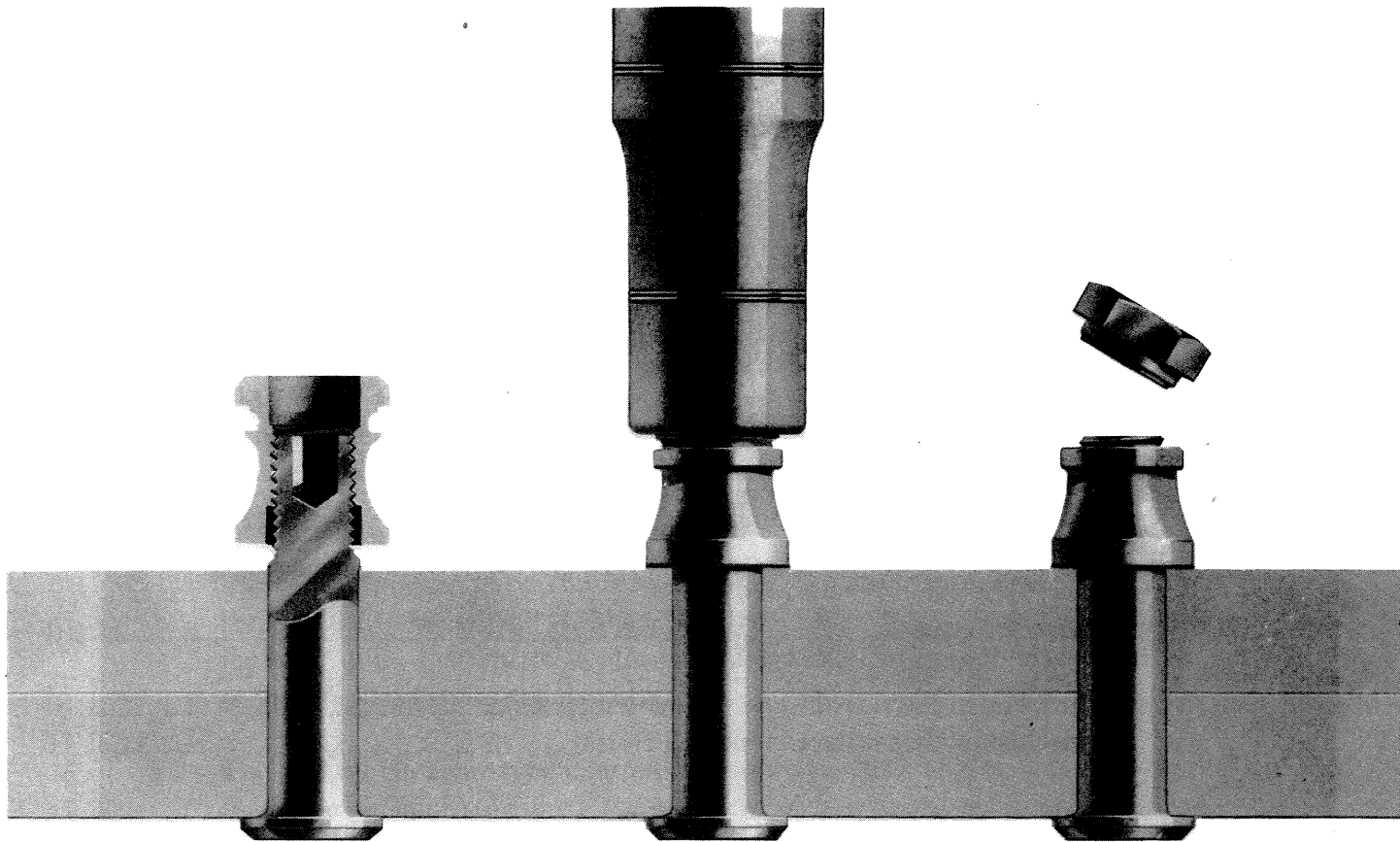




FASTENING SYSTEMS INSTALLATION INSTRUCTIONS



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2-1520

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HI-LOK® AND HI-LOK®/HI-TIGUE® FASTENERS INSTALLATION INSTRUCTIONS

A. GENERAL DESCRIPTION

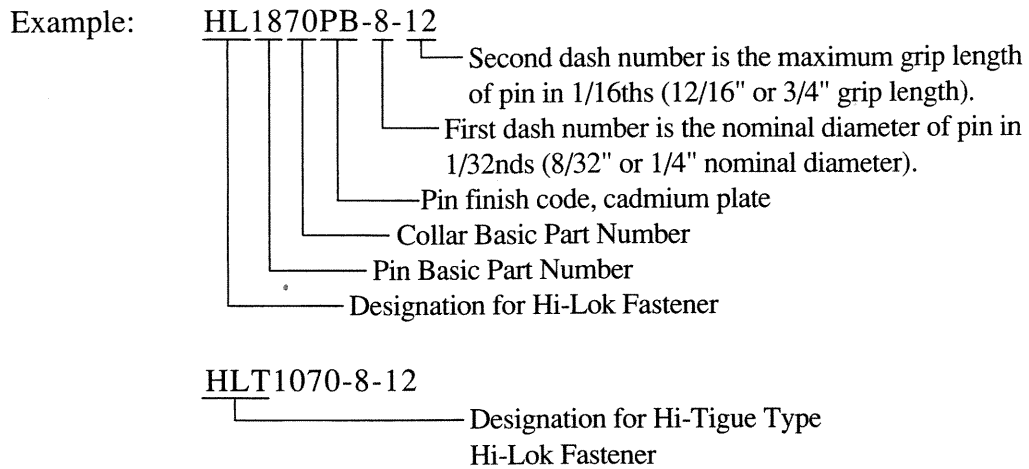
1. The patented, high strength Hi-Lok or Hi-Lok/Hi-Tigue is basically a threaded fastener which combines the best features of a rivet and bolt. Three primary design advantages include:
 - a. A controlled preload or clamp-up is designed into the fastener.
 - b. Minimum size and weight.
 - c. Simple, quiet and rapid installation.
2. The threaded end of the Hi-Lok pin contains a hexagonal shaped recess. The hex wrench tip of the Hi-Lok driving tool engages the recess to prevent rotation of the pin while the collar is being installed. The pin recess also offers a secondary benefit, weight savings.

The pin is designed in two basic head styles. For shear applications, the pin is made in the lightweight, "Hi-Shear" countersunk style and in a compact protruding head style. For tension applications, the MS24694 (AN509) flush and protruding head styles are available.

3. The Hi-Lok/Hi-Tigue type interference fit pin provides improved fatigue benefits to the airframe structure. The Hi-Tigue feature on the end of the pin shank makes it possible to use a straight shank interference fit fastener in a standard straight drilled hole to obtain the maximum fatigue life of the structure. For complete description see brochure 2-159920.
4. The self-locking, threaded Hi-Lok collar has an internal counterbore at the base to accommodate variations in material thickness. At the opposite end of the collar is a wrenching device which is torqued by the driving tool until it shears off during installation; this shear-off point occurs when a predetermined preload or clamp-up is attained in the fastener during installation. Removal of the collar wrenching surfaces after installation saves additional weight.

B. SELECTING THE FASTENER ASSEMBLY

The basic part number indicates the assembly of the pin and the collar part numbers.



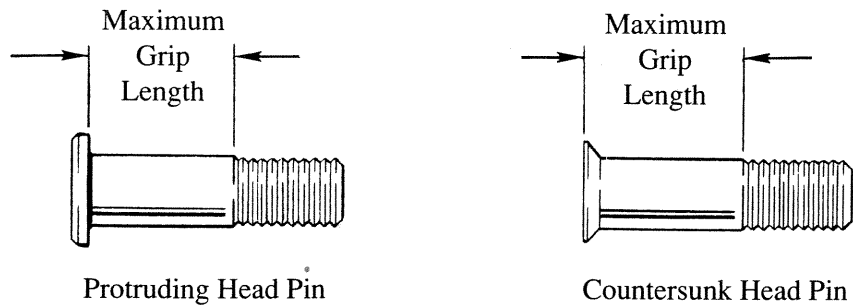
C. MATCHING COLLAR MATERIALS TO PIN HEAD STYLES

1. It is very important that the proper Hi-Lok collar be used with the selected Hi-Lok pin head style (shear or tension types) to maintain a proper design balance between the pin and collar. Refer to Hi-Lok or Hi-Lok/Hi-Tigue standards pages for recommended pin-collar combinations or contact your Standards Engineer.
2. In general, the following pin-collar combinations are acceptable:
 - a. Use aluminum collars (such as HL79 or HL70) with shear head pins made from materials such as alloy steel or titanium.
 - b. In some cases low torque-off type steel collars (such as HL94) are used with shear head pins.
 - c. Where tensile strength is a factor, use tension head pins with higher torque-off collars such as HL86.
 - d. When the Hi-Tigue version of the Hi-Lok system is used, a Hi-Tigue type collar should be used with a Hi-Tigue type pin. The Hi-Tigue collar has a deeper internal counterbore to mate with a Hi-Tigue pin which has the Hi-Tigue feature at the end of its cylindrical shank.

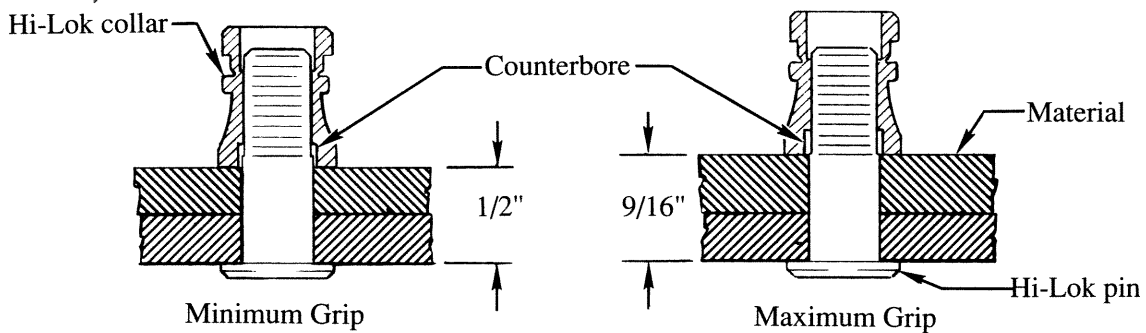
D. SELECTING THE PIN GRIP LENGTH

1. The standard Hi-Lok Fastening System offers pin lengths which are graduated into 1/16" increments.

D. SELECTING THE PIN GRIP LENGTH (continued)



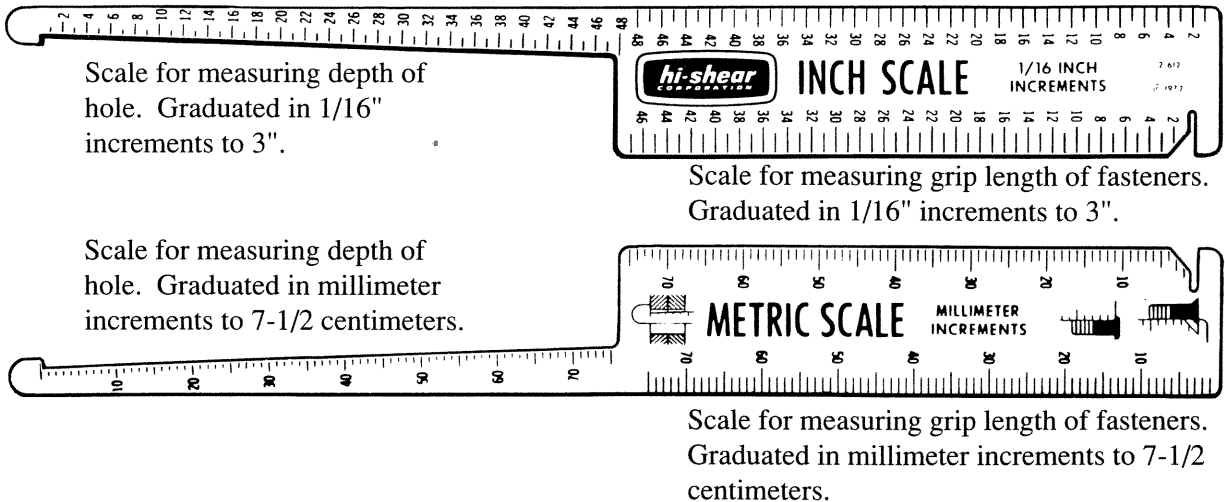
2. The material thickness can vary $1/16$ " without changing pin lengths. Adjustment for variations in material thickness in between the pin $1/16$ " graduations is automatically made by the counterbore in the collar.



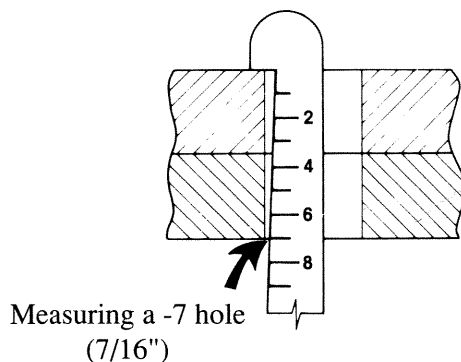
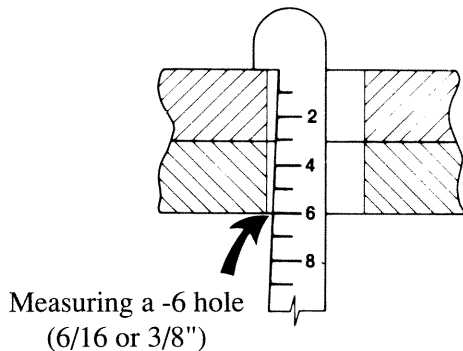
3. In the pin part number, HL18PB-8-9, the last dash number, -9, is used to specify the maximum grip length of the pin shank. In this instance a $9/16$ " grip length is required, indicating use of a -9 pin. Grip scales as shown are used as an aid to measure hole depth and to check the pin shank for correct grip length.

D. SELECTING THE PIN GRIP LENGTH (continued)

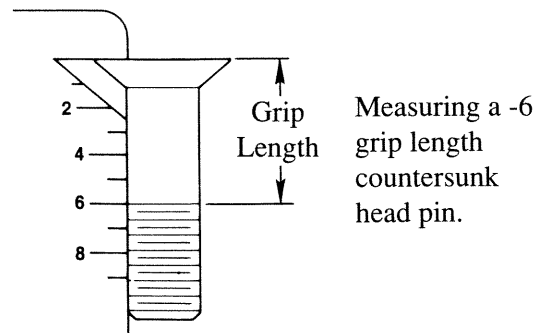
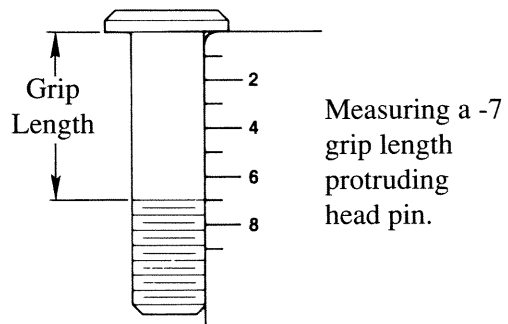
To save shop time for riveters and inspectors, Grip Scales measure the grip length of countersunk and flathead HI-SHEAR pins and work thickness or rivet hole depths in increments corresponding to the HI-SHEAR dash number system of pin grip lengths. The Scale is 0.020 spring temper stainless steel and 3/4" x 6-1/4" in size. The finish is satin with red and black lettering.



To measure hole depth, hook on bottom of hole, read highest number even with structure on other end.

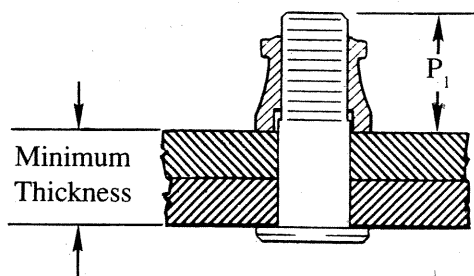


To measure fastener grip length, place fastener against gage as shown. Read highest number opposite last point of full shank diameter.

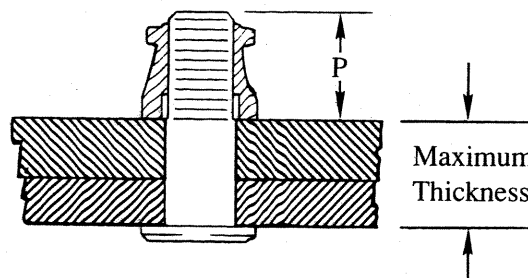


D. SELECTING THE PIN GRIP LENGTH (continued)

4. For standard Hi-Lok and Hi-Lok/Hi-Tigue pins, the protrusion of the threaded end shall be within the limits as indicated in the table below. For pins with different thread lengths such as mechanical lock pins, oversize diameter pins, and pins with lock wire holes contact your Standards Engineer.



MINIMUM GRIP
(Maximum Protrusion)



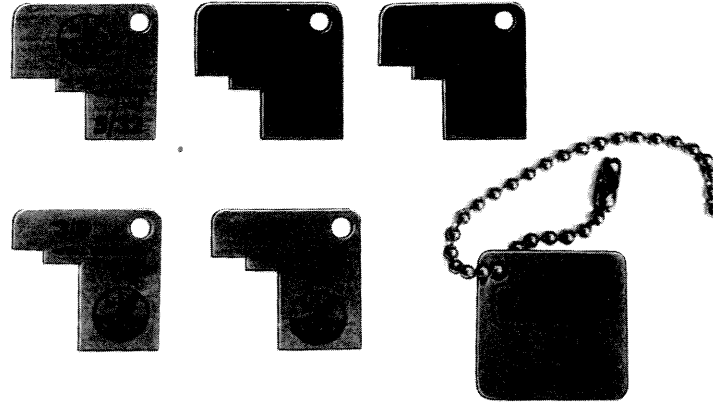
MAXIMUM GRIP
(Minimum Protrusion)

Standard Hi-Lok Pin		Minimum Protusion P	Maximum Protusion P ₁
First Dash Number	Nominal Diameter		
-5	5/32	.302	.384
-6	3/16	.315	.397
-8	1/4	.385	.467
-10	5/16	.490	.572
-12	3/8	.535	.617
-14	7/16	.625	.707
-16	1/2	.675	.757
-18	9/16	.760	.842
-20	5/8	.815	.897
-24	3/4	1.040	1.122
-28	7/8	1.200	1.282
-32	1	1.380	1.462

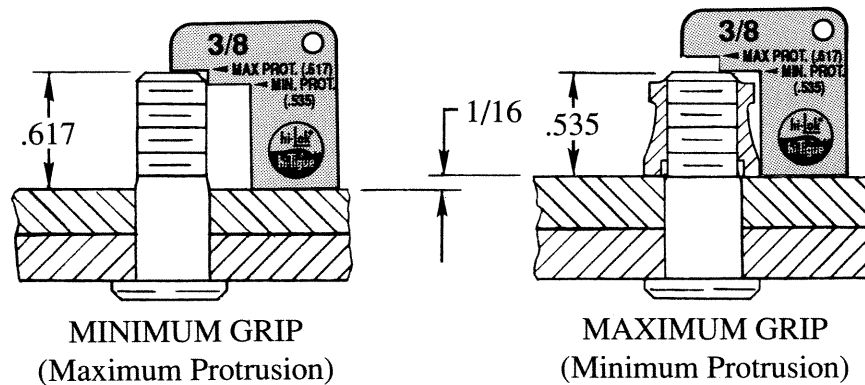
Table showing installed Hi-Lok Pin protrusion limits.

D. SELECTING THE PIN GRIP LENGTH (continued)

5. The Hi-Lok Protrusion Gages (Part No. 2-1522) offer a convenient method to check Hi-Lok pin protrusion limits after the Hi-Lok pin has been inserted in the hole and before or after collar installation. Individual gages accommodate Hi-Lok pin diameter sizes 5/32, 3/16, 1/4, 5/6, and 3/8. Gages are made of .012 stainless steel and are assembled as a set on a key chain.



Standard Hi-Lok Protrusion Gages



For Standard Hi-Lok Pins

In the above example measurement, the 3/8 gage is used to check the protrusion of a -12 or 3/8 diameter Hi-Lok pin. Left sketch shows the minimum grip condition with an allowable protrusion limit of .617. Right sketch shows how the gage can extend over an assembled Hi-Lok; in maximum grip the minimum protrusion limit is .535. Any protrusion between .535 and .617 is satisfactory.

E. SELECTING THE PIN DIAMETER

1. The pin diameters are graduated in 1/32" increments.
2. In the pin part number HL18PB-8-10, the first dash number, -8, is used to specify the nominal diameter of the pin. In this instance an 8/32" or 1/4" diameter pin is required, indicating use of a -8 pin.
3. The shank diameters of the pins conform to the dimensions given in NAS618.

E. SELECTING THE PIN DIAMETER (continued)

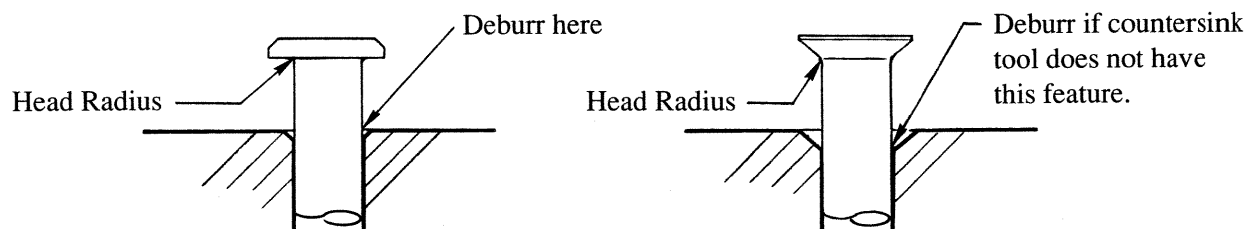
4. The major diameter of the thread has been reduced from the shank diameter (reference "TD" dimension on Standards Pages) to prevent damage to the threads when the pin is installed into an interference fit hole.

F. SELECTING THE COLLAR

1. In the collar part number HL70-8, the dash number indicates the inside nominal diameter of the collar in 1/32" increments. In this instance an 8/32" or 1/4" inside diameter collar is designated, indicating use of a -8 collar for a .125" diameter pin.
2. Also see paragraph C, "Matching Collar Materials to Pin Head Styles."

G. HOLE PREPARATION

1. The straight wall drilled holes shall be prepared in accordance with NAS618. For standard Hi-Lok pins in aluminum structure, it is generally recommended that the maximum interference fit shall not exceed 0.0015 inch. Standard Hi-Lok pins are not recommended for interference fit in steel, titanium or other hard materials. The Hi-Tigue type Hi-Lok pin is normally installed in a hole at 0.002 to 0.004 inch diametral interference.
2. The Hi-Lok pin has a slight radius under its head. After drilling, deburr the edge of the hole. This permits the head to fully seat in the hole. See appropriate Hi-Lok Standards Pages for head radius dimension. For instance, the 3/16 protruding head has a .015/.025 radius while the 3/16 flush head has a .025/.030 radius.



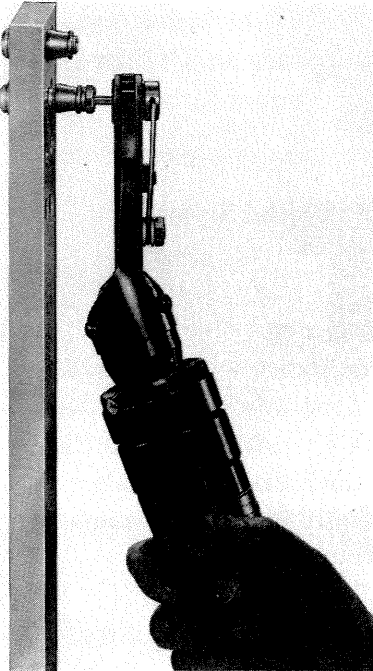
H. TOOLING

1. Hi-Loks are rapidly and quietly installed by one person working from one side of the work using standard power or hand tools and Hi-Lok adaptor tools.
2. Hi-Lok adaptor tools are fitted to high speed, pistol grip and ratchet wrench drivers in straight, 90°, offset, extension and automatic collar-feed configurations. Refer to Hi-Shear Corporation's Hi-Lok/Hi-Tigue Tool Catalog for a complete description of a wide variety of Hi-Lok drivers and accessories.

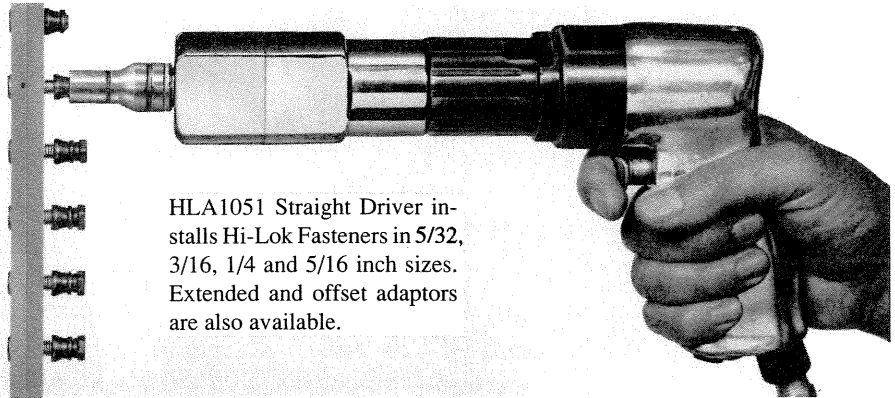
H. TOOLING (continued)

1. STANDARD POWER DRIVERS

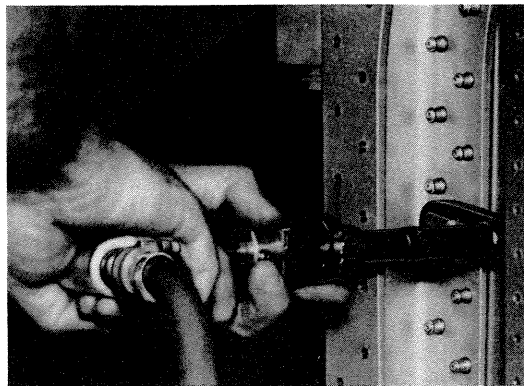
With light weight, compact tooling, HI-LOKS are easily installed and require the minimum of employee training. HI-LOK adaptor tools can be fitted to high speed power air drivers. The installation is fast and quiet without conventional riveting noise.



HLA2008 20° Offset Ratchet Wrench Driver installs Hi-Lok Fasteners in 5/32, 3/16 and 1/4 inch sizes. Extended sockets are available. Larger drivers will install larger size Hi-Loks.



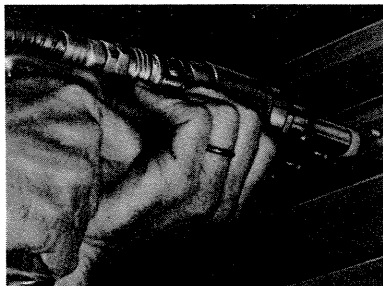
HLA1051 Straight Driver installs Hi-Lok Fasteners in 5/32, 3/16, 1/4 and 5/16 inch sizes. Extended and offset adaptors are also available.



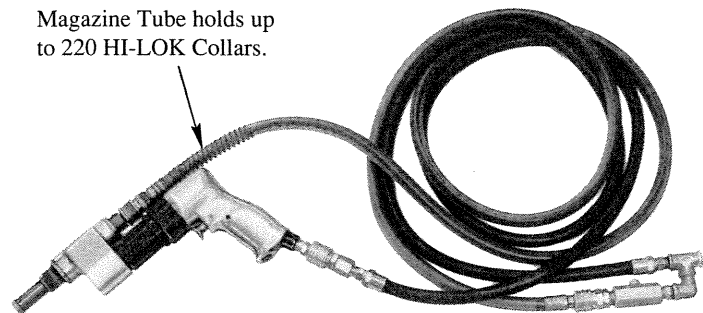
Left:
HLA1076 2° Offset Driver simplifies the installation of Hi-Loks into wide flanged beams and in otherwise inaccessible areas. In one instance, the offset driver reduced a 2-man, 32-hour job to a 1-man, 4-hour job.

2. AUTOMATIC COLLAR-FEEDING DRIVERS

The HI-LOK Automatic Feed Driver assembles HI-LOK collars (3/16 and 1/4 dia.) onto HI-LOK pins without reloading and at an assembly rate of up to 45 per minute.



Above:
Automatic Driver assembles HI-LOK Collar on Pins. Interference fit holes can be prepared and HI-LOK Pins inserted by Drivmatic Riveter method.

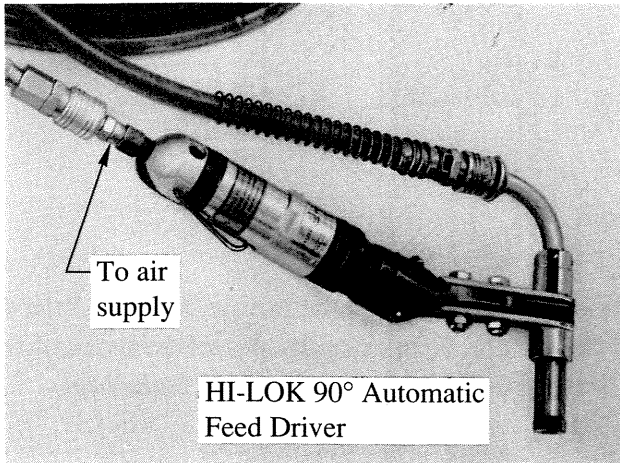


Magazine Tube holds up to 220 HI-LOK Collars.

HLA1008 Straight Collar Automatic-Feed Driver

H. TOOLING (continued)

2. AUTOMATIC COLLAR-FEEDING DRIVERS (continued)

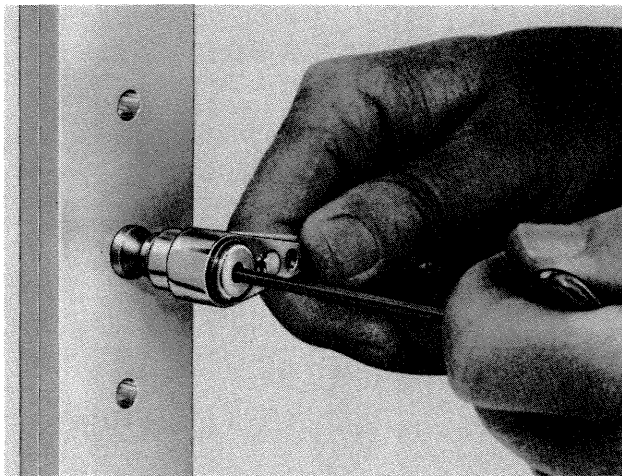


Left:

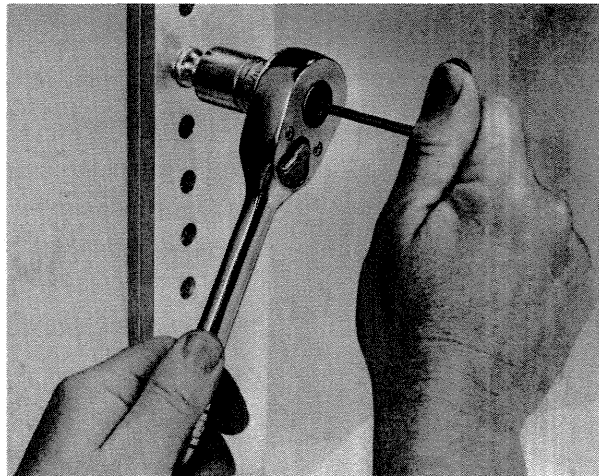
HLA2015 Automatic-Feed Ratchet Wrench Driver for interference fit Hi-Lok installation. Collars (3/16 or 1/4 dia.) are magazine tube fed through Driver. Larger Drivers for larger Hi-Loks are available.

3. HAND TOOLS

- a. The Hi-Lok fastener may be installed with hand tools, Allen hex keys and open-end or ratchet type wrenches. See photos below. Refer to Hi-Lok/Hi-Tigue Tool Catalog for complete description of hand tools available.
- b. Follow installation steps as outlined in paragraph I1 following.



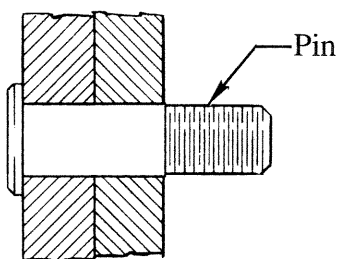
HLH311
HAND TOOL ASSEMBLY



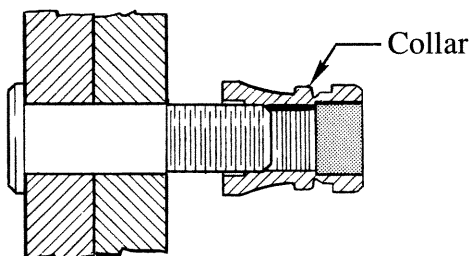
HLH110
HAND TOOL ASSEMBLY

I. FASTENER INSTALLATION

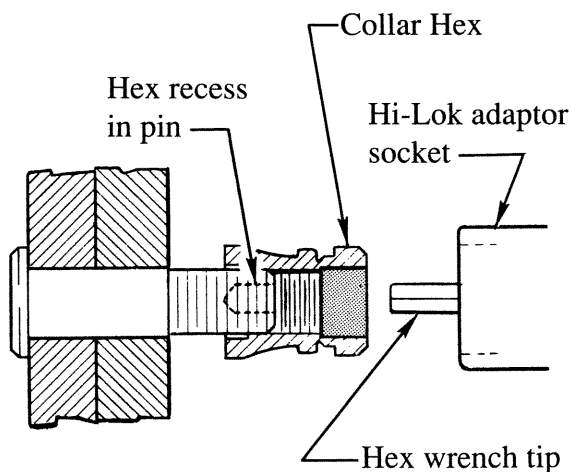
1. INSTALLATION STEPS (HI-LOK PIN IN NON-INTERFERENCE FIT HOLE)



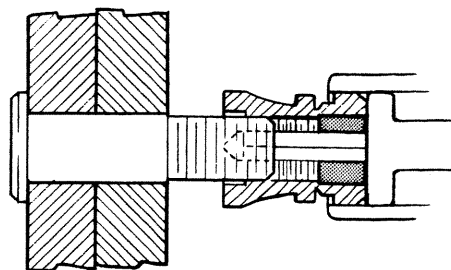
- a. Insert the pin into the prepared non-interference fit hole.



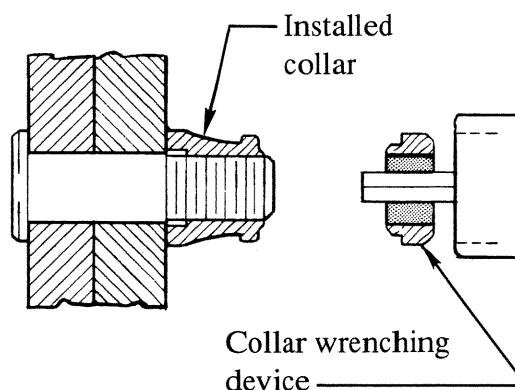
- b. Manually thread the collar onto the pin.



- c. Insert the hex wrench tip of the power driver into the pin's hex recess, and the socket over the collar hex. This prevents rotation of the pin while the collar is being installed.

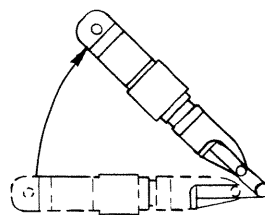


- d. Firmly press the power driver against the collar, operate the power driver until the collar's wrenching device has been torqued off.

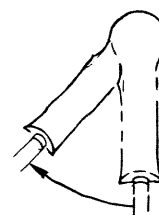


- e. This completes the installation of the Hi-Lok Fastener Assembly.

NOTE:



Ratchet Wrench Driver

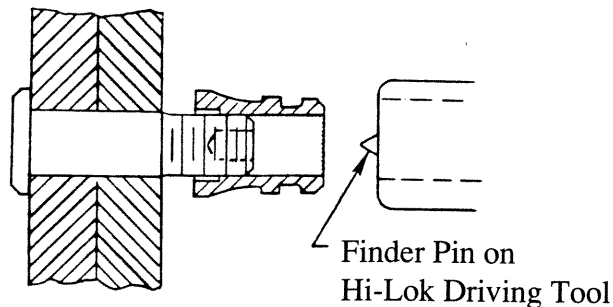


Pistol Grip Driver

To ease the removal of the driving tool's hex wrench tip from the hex recess of the pin after the collar's wrenching device has sheared off, simply rotate the entire driver tool in a slight clockwise motion.

I. FASTENER INSTALLATION (continued)

2. INSTALLATION STEPS (HI-LOK PIN IN INTERFERENCE FIT HOLE)



When Hi-Lok pins are pressed or driven into interference fit holes, the fit is sufficiently tight to grip the pin to prevent it from rotating during assembly with the collar. This means that the driving tool hex wrench tip engagement is not required to keep the pin from rotating. Hi-Lok driver tools are available using a finder pin instead of the hex wrench tip to locate the tool on the collar and pin. Except for this difference, the fastener installation is the same as described in paragraph 1 above.

Refer to Hi-Lok Tool Catalog for further details.

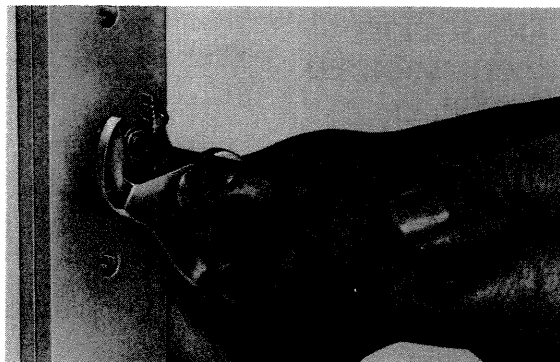
J. INSPECTION AFTER INSTALLATION

Hi-Lok fasteners are visually inspected. No inspection tools or torque wrenches are required.

K. REMOVAL OF INSTALLED FASTENER

1. COMMON TOOLS

In non-interference fit holes, Hi-Loks can be removed with common hand tools in a manner similar to removing a nut from a bolt. Use an Allen hex wrench to prevent the pin from rotating while the collar is being unscrewed with pliers. If not damaged during collar removal, the Hi-Lok pin can be reused.

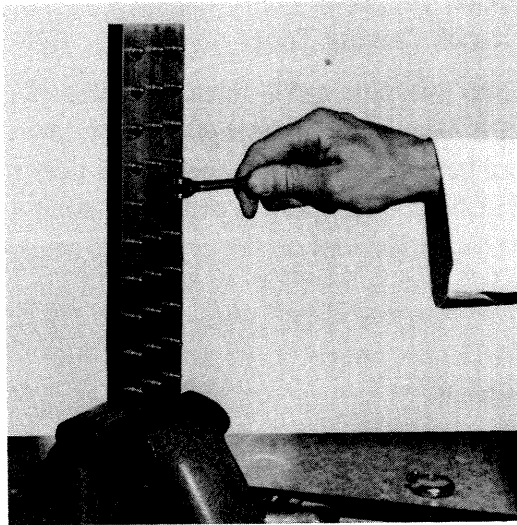


Removing a Hi-Lok collar with Allen hex wrench and pliers.

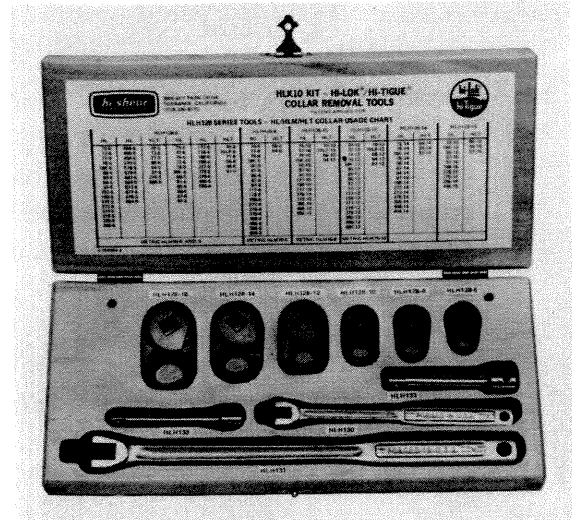
K. REMOVAL OF INSTALLED FASTENER (continued)

2. HI-LOK COLLAR REMOVAL HAND TOOLS

To more easily remove Hi-Lok collars from pins installed in interference fit holes and in limited access areas, the HLH128 series of hand tools are available in individual sizes or in sets as in the HLK10 Hi-Lok/Hi-Tigue Collar Removal Tool Kit. The Hi-Lok pin can be reused.



HLH128 Collar Removal Tool



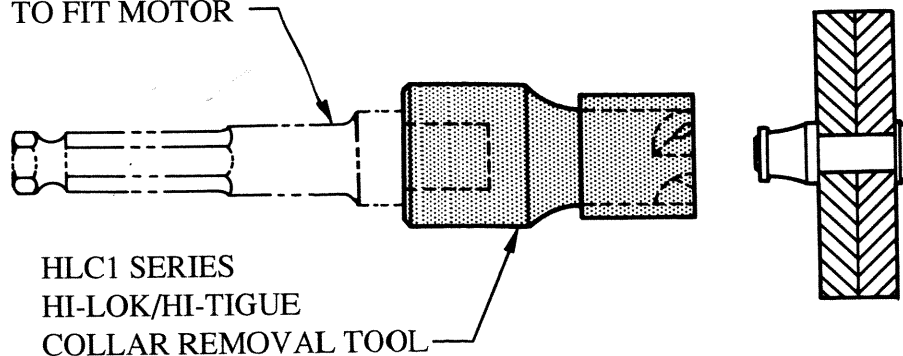
HLK10 Kit

3. HI-LOK COLLAR REMOVAL TOOLS

In interference fit holes, ALUMINUM Hi-Lok/Hi-Tigue collars can be removed with an HLC1 Hi-Lok Collar Removal Tool fitted to a 3/8 square socket drive and companion air motor. The tool is pressed firmly over the Hi-Lok Collar and rotated until the tool teeth bite sufficiently into the collar material to grip and unscrew the collar from the pin.

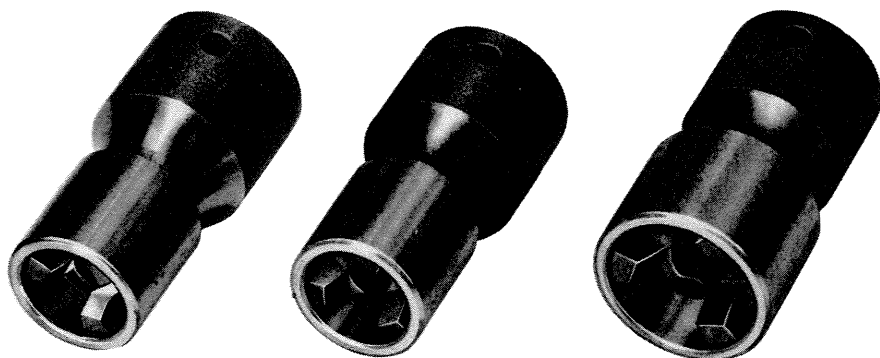
NOTE: Initial loosening of the -8 and larger Hi-Lok collars with the HLH128 Removal Tool is recommended.

3/8 SQUARE SOCKET
DRIVE RECOMMENDED
TO FIT MOTOR



K. REMOVAL OF INSTALLED FASTENER (continued)

3. HI-LOK COLLAR REMOVAL TOOL (continued)



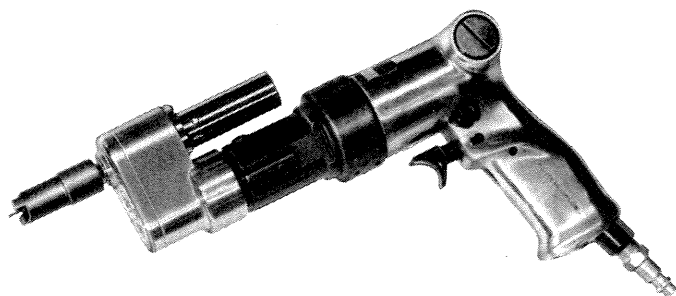
HLC1 HI-LOK/HI-TIGUE COLLAR REMOVAL TOOLS

From left, -5, -6 and -8 sizes shown. Tools are available for -10 and -12 collar sizes. For dimensional data refer to HLC1 tool in HI-LOK/HI-TIGUE Tool Catalog.

The Hi-Lok/Hi-Tigue pin can be reused.

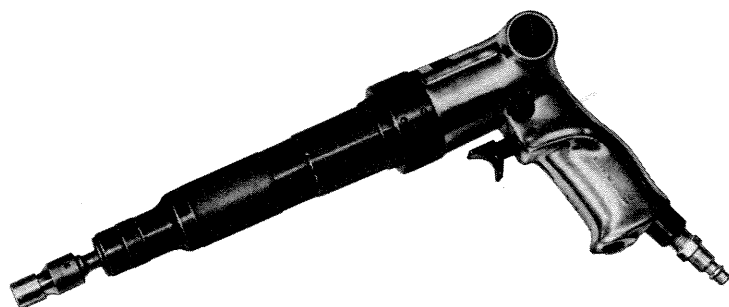
4. COLLAR REMOVAL DRIVERS

Designed for production use to remove Hi-Lok collars from pins, pistol grip power drivers with cutter-type nosepieces are available. The Hi-Lok pin can be reused.



HLA6000 Hi-Lok/Hi-Tigue Straight Air Driver Collar Removal Assembly.

Removes aluminum Hi-Lok/Hi-Tigue collars from pins installed in non-interference fit holes. Remove 5/32, 3/16 and 1/4 diameter Hi-Lok collars. Check Tool Catalog for the Hi-Lok pin hex recess sizes accommodated by the Driver's hex wrench.



HLA6005 Hi-Lok/Hi-Tigue Straight Air Driver Collar Removal Assembly.

Removes aluminum Hi-Lok/Hi-Tigue collars from pins installed in interference fit holes. Removes 5/32, 3/16 and 1/4 diameter Hi-Lok collars. On steel collars, initial loosening of the collar with the HLH128 Hand Tool is required.

**ADDITIONAL INFORMATION CONCERNING THE
HI-LOK® AND HI-LOK®/HI-TIGUE® FASTENING SYSTEMS
AVAILABLE FROM HI-SHEAR CORPORATION**

2-1501 STANDARDS PAGES. Contain dimensions and specifications for standard Hi-Lok pins and Hi-Lok collars.

2-1597 STANDARDS PAGES. Contain dimensions and specifications for Hi-Lok/Hi-Tigue pins and collars.

2-1506 BROCHURE. Describes basic Hi-Lok design advantages, applications, configurations, and installation tooling.

2-159920 BROCHURE. Describes the Hi-Lok/Hi-Tigue Fastening System which extends the fatigue life of airframe structure.

2-1599147 CATALOG. Hi-Lok/Hi-Tigue Installation Tooling. Contains dimensions and specifications for installation and removal tooling.

2-612 FASTENER GRIP SCALE. One-piece scale measures hole depth and pin grip length in 1/16 inch increments.

2-1522 HI-LOK PROTRUSION GAGE SET. Serves as inspection aid by measuring pin protrusion of the installed fastener.