

# Mark IV™ Structural Panel Fasteners

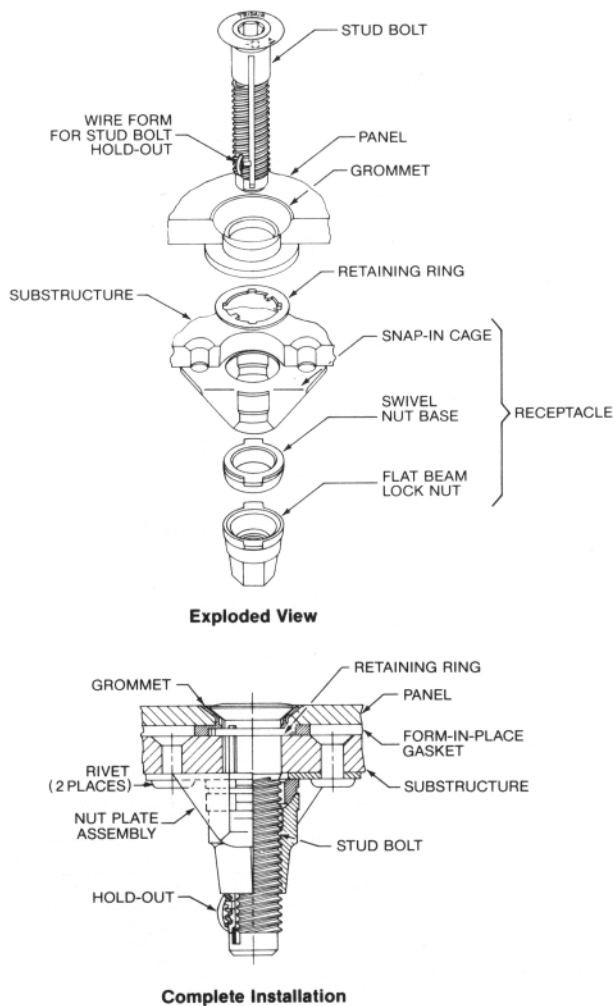
## Design and Features

The Flat Beam Lock design provides excellent resistance to vibration-induced loosening, and has a cycle life of up to 1,500 seated cycles. The stud bolts featured are available in .250 and .375 inch nominal diameters. Positive stud bolt retention and hold-outs are available. The receptacle provides .020 inch minimum radial float and versions allow for angular engagement of nut plate to ease installation of curved panels. Receptacle can be replaced without removing rivets. Optional grommet provides hard seat surface, good load transfer, counterbore for retaining ring and is excellent for gasketed applications.

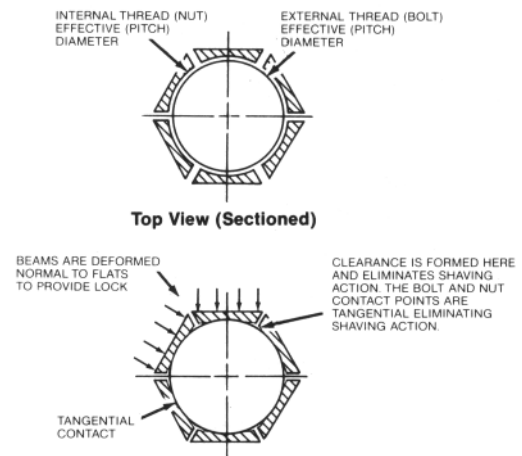
There are other types, styles and sizes available which are not featured in this catalog. Contact us for more details.

### Typical Mark IV™ Fastening System:

(Stud hold-out version shown with angular misalignment capabilities.)



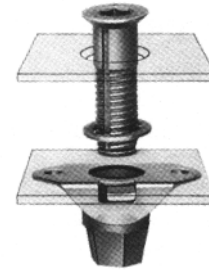
### Flat Beam Lock Nut Eliminates Shaving Action of Bolt.



# Mark IV™ Plug Version.

## Features:

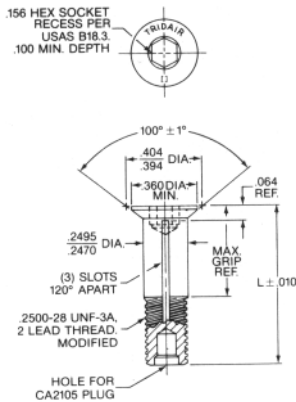
- Flat Beam Lock design for excellent vibration resistance.
- Multiple lead thread for quick operation.
- .250 and .375 inch nominal stud bolt diameters featured.
- Receptacles allow for radial float.
- Up to 1,500 seated cycle life locking feature meets and exceeds NASM25027.
- Accommodates large variations in grip (.140 inch).



## Stud Bolts

### CA2104-( )HS. (1/4 size)

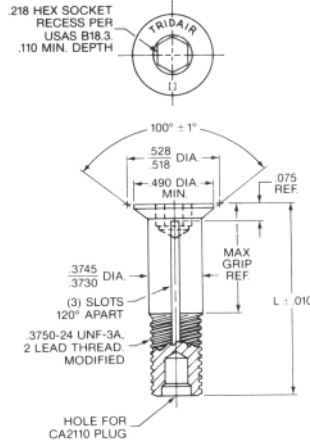
Ultimate tensile strength:  
2,800 pounds min. UTS.  
Ultimate single shear strength:  
4,000 pounds min. through solid shank.  
1,700 pounds min. through hex socket.



**Note:**  
is to be used with a CA2105 plug, CA2106 retaining ring and CA2103 flat beam nut.

### CA2109-( )HS. (3/8 size)

Ultimate tensile strength:  
4,700 pounds min. UTS.  
Ultimate single shear strength:  
7,500 pounds min. through solid shank.  
4,350 pounds min. through hex socket.



**Note:**  
is to be used with a CA2110 plug, CA2111 retaining ring and CA2108 flat beam nut.

**Material:** 8740 or 4140 Alloy Steel  
. Other materials available  
. Heat Treat: 160-180 KSI tensile strength  
. Finish: Cadmium Plated, Type II, Class 2.

## Notes:

1. Surface texture per USAS B46.1: unthreaded shank, conical surface of head 32 $\sqrt{}$ , other surfaces 125 $\sqrt{}$
2. Part number callout examples:

### CA2104-4 HS

Hex Socket Recess  
L = .917;  
max. grip = .430  
Basic Part Number  
1/4 size

### CA2109-4 HS

Hex Socket Recess  
L = 1.075;  
max. grip = .430  
Basic Part Number  
3/8 size

3. Contact AFS for assistance in selecting correct dash number .

Dash Number	Grip Range		CA2104-( )HS		CA2109-( )HS	
	Min.	Max.	Length	Weight per 1000 pcs. (lbs.)	Length	Weight per 1000 pcs. (lbs.)
-2	.150	.290	.777	7.91	9.35	21.61
-4	.291	.430	.917	9.71	1.075	25.75
-6	.431	.570	1.057	11.01	1.215	29.89
-8	.571	.710	1.197	12.21	1.355	34.03
-10	.711	.850	1.337	13.51	1.495	38.17

# Mark IV™

## Plug Version

### Flat Beam Nut Receptacles.

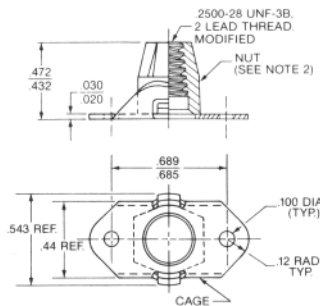
#### CA2103. (1/4 size)

##### Specifications:

Flat Beam Nut Locking Element: Capable of 1,500 seated useable cycles within the prevailing torque limits of 30 in. lbs. max. to 3.5 in. lbs. min. when tested at ambient room temperature with CA2104-( ) JHS stud bolt (Ref.: NASM25027).  
Vibration: Per MIL-STD-1312, Test 7 except vibration life shall be 90,000 cycles min. with no rotation greater than 90°.

##### Mechanical:

Ultimate Tensile Strength: 2,800 lbs. min. ultimate.  
Nut Push-Out: 400 lbs. min. ultimate.  
Nut Torque-Out: 100 in. lbs. min. ultimate.  
Weight: 9.4 pounds/1000.



##### Material:

Nut: 4140 or 8740 Alloy Steel.  
Cage: 17-7 PH CRES.

##### Heat Treat:

Nut: 180-200 KSI tensile strength.  
Cage: Condition TH1050

##### Finish:

Nut: Cadmium Plated per, Class 2 and dry film lubed.  
Cage: Passivated or optional finish of Cadmium Plate Type II, Class 2 if desired.

Part No.	Cage Finish
CA2103	Passivated
CA2103C	Cadmium Plated

##### Notes:

1. Nut floats .020 minimum radially from cage centerline within a .615 maximum envelope.
2. The nut is removable and replaceable: for replacement, order nut P/N CA2103-1, order tool P/N CA18157-T10.
3. This receptacle is to be used with a CA2104-( ) JHS stud bolt.
4. Contact for optional receptacles, including encapsulated types.

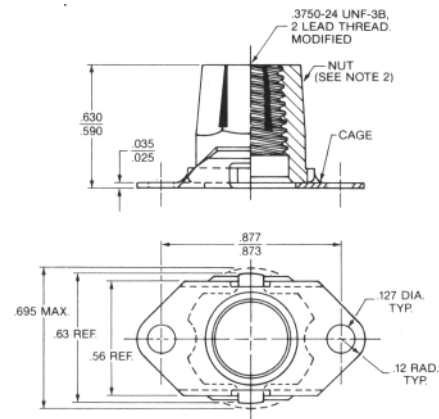
#### CA2108. (3/8 size)

##### Specifications:

Flat Beam Nut Locking Element: Capable of 1,500 seated useable cycles within the prevailing torque limits of 80 in. lbs. max. to 9.5 in. lbs. min. when tested at ambient room temperature with CA2109-( ) JHS stud bolt (Ref.: NASM25027).  
Vibration: Per MIL-STD-1312, Test 7 except vibration life shall be 90,000 cycles min. with no rotation greater than 90°.

##### Mechanical:

Ultimate Tensile Strength: 6,000 lbs. min. ultimate.  
Nut Push-Out: 400 lbs. min. ultimate.  
Nut Torque-Out: 240 in. lbs. min. ultimate.  
Weight: 18.8 pounds/1000.



##### Material:

Nut: 4140 or 8740 Alloy Steel.  
Cage: Steel

##### Heat Treat:

Nut: 180-200 KSI tensile strength.  
Cage: Rc38-42

##### Finish:

Nut Cadmium Plated per T type II, Class 2 and dry film lubed.  
Cage: Cadmium Plated per T type II, Class 2.

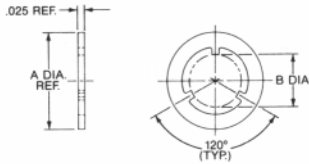
##### Notes:

1. Nut floats .025 minimum radially from cage centerline within a .695 maximum envelope.
2. The nut is removable and replaceable: for replacement, order nut P/N CA2108-1, order tool P/N CA1221-T10.
3. This receptacle is to be used with a CA2109-( ) JHS stud bolt.

# Mark IV™ Plug Version.

## Retaining Rings.

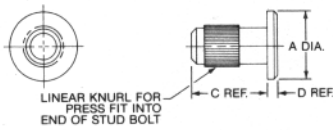
CA2106 and CA2111.



Normal Size	Part No.	A Dia. Ref.	B Dia.	Weight per 1000 pcs. (lbs.)	Material	Heat Treat	Finish
1/4	CA2106	.375	.190 Min.	.43	17-7 CRES	Condition RH 950	Passivated
	CA2106C						Cadmium Plated Type II, Class 2
3/8	CA2111	.515	.295 Min.	.75	Carbon Steel	180-200 KSI	Cadmium Plated Type II, Class 2

## Plugs.

CA2105 and CA2110.



**Material:**  
17-4 PH CRES.  
**Heat Treat:**  
Condition H900.  
**Finish:**  
Passivated.

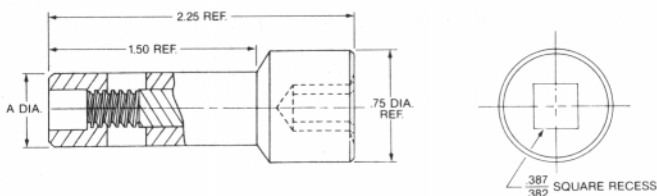
a Nominal Size	Part No.	A Dia.	C Ref.	D Ref.	Weight per 1000 pcs. (lbs.)	Installation Tool Part No.
1/4	CA2105	.217 — .212	.182	.030	0.75	CA2104-T12
3/8	CA2110	.339 — .329	.272	.045	2.80	CA2109-T12

## Plug Installation Tools.

CA2104-T12 and CA2109-T12.

(For field repair.)

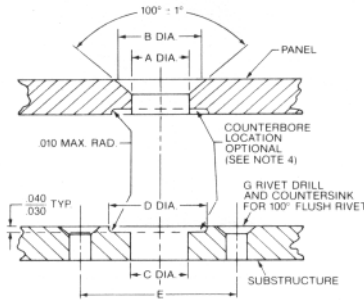
**Note:** Power tooling is also available for plug installation; contact Alcoa Fasteners.



Part No.	A Dia. Ref.
CA2104-T12	.50
CA2109-T12	.63

# Mark IV™ Plug Version

## Panel/Substructure Preparation and Installation Data.

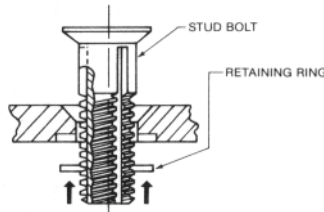


Stud Bolt Basic Part Number	A Dia.	B Dia.	C Dia.	D Dia. Min.	E	G Rivet Size
CA2104-( )HS	.255 .250	.409 .403	.255 .250	.406	.689 .685	3/32
CA2109-( )HS	.380 .375	.533 .527	.385 .375	.547	.877 .873	1/8

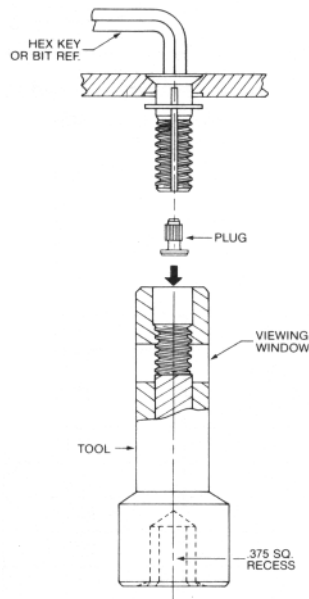
### Notes:

1. Locate and drill "A" Dia. hole through panel.
2. Countersink panel  $101^\circ$  to "B" Dia.  
99°
3. Locate and drill "C" Dia. hole through substructure.
4. Counterbore to "D" Dia. in back side of panel or front side of substructure (location optional if panel thickness meets minimum requirements); otherwise counterbore substructure.
5. Locate, drill and countersink two holes for rivets (not supplied).

6. Place stud bolt in panel.
7. Orient tabs on retaining ring to align slots in stud bolt and slide retaining ring onto stud bolt.

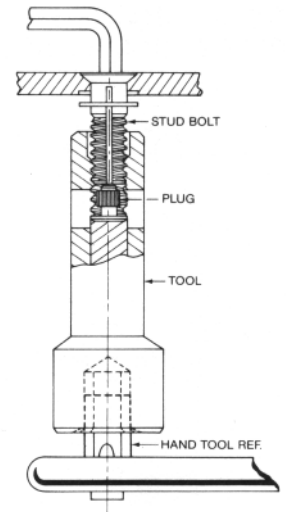


8. Place hex key or bit in hex socket of stud bolt.

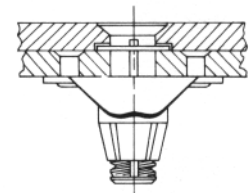


9. Place plug in installation tool. Power installation tool is available; contact Rexnord Specialty Fastener Division.

10. Thread installation tool onto stud bolt using ratchet-type hand tool
11. Turn until plug is fully seated (observe through viewing window). Do not over tighten.



12. Remove tool. Retaining ring is captivated.
13. Rivet receptacle in place, and installation is complete.
14. Contact for replacement retaining rings



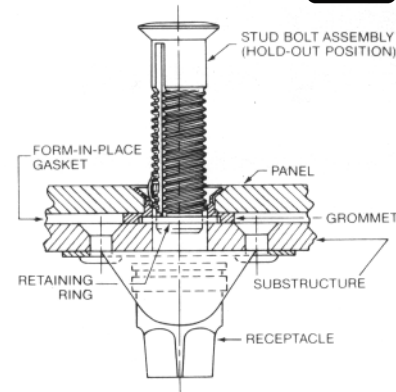
# Mark IV™

## Positive Stud Hold-out Version.

### Features:

Has all the features of the Mark IV plug version, plus:

- Superior strength.
- Positive stud bolt hold-out.
- Grommet design for composite material.
- Grommet is excellent for gasketed applications, provides hard seat surface,
- Superior load transfer and counterbore for retaining ring.
- Retaining ring is replaceable and no installation tool is necessary .
- Unthreaded lead on stud bolt offers probing ability .
- Accommodates large variations in grip (.140 inch).

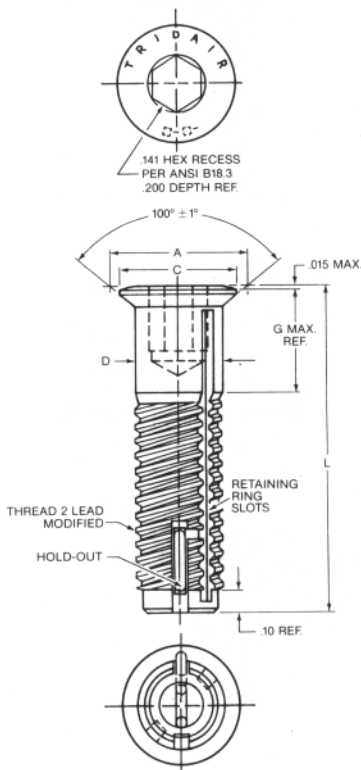


Typical Installation

### Stud Bolt Assemblies

CA21037-4-( )HS. (1/4 size)

CA21037-6-( )HS. (3/8 size)



First Dash Number	Thread Size	A Dia.	C Dia. Min.	D Dia.	Ultimate Tensile Strength	Ultimate Single Shear Strength
-4	.2500-28 UNF-3A, 2 Lead	.440 .430	.375	.2495 .2470	2600 lbs. min.	2500 lbs.
-6	.3750-24 UNF-3A, 2 Lead	.564 .554	.505	.3745 .3730	6000 lbs. min.	5000 lbs.

#### Material:

Stud Bolt: 4140 or 8740 or 8740 Alloy Steel

Hold-out: 17-7 PH CRES MS 5673. Other materials available.

#### Heat Treat:

Stud Bolt: 180-200 KSI

Hold-out: Condition CH900

#### Finish:

Stud Bolt: Cadmium Plated per , Type II, Class 2.

Hold-out: Passivated

#### Notes:

1. Part number callout examples:

CA21037-4-10 HS

Hex Socket Recess  
L = 1.532;  
max. grip = .850  
1/4 size nominal  
Basic Part Number

CA21037-6-10 HS

Hex Socket Recess  
L = 1.630;  
max. grip = .850  
3/8 size nominal  
Basic Part Number

2. Contact Alcoa Fasteners for assistance in selecting correct dash number.

Second Dash Number	G Grip Range		-4 Size		-6 Size	
	Minimum	Maximum	Length	Weight Oz. Ea. Maximum	Length	Weight Oz. Ea. Maximum
-2	.150	.290	.972	.13	1.170	.41
-4	.291	.430	1.112	.16	1.210	.43
-6	.431	.570	1.252	.19	1.350	.48
-8	.571	.710	1.392	.22	1.490	.53
-10	.711	.850	1.532	.25	1.630	.58

# Mark IV™

## Positive Stud Hold-out Version.

### Flat Beam Nut Receptacles.

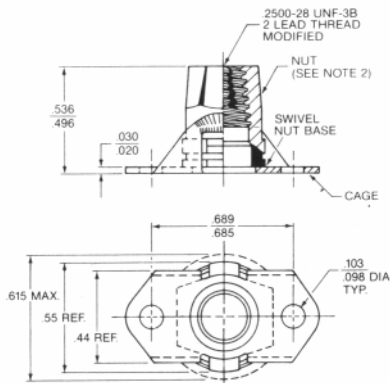
#### CA21021. (1/4 size)

##### Specifications:

Flat Beam Nut Locking Element: Capable of 1,500 seated useable cycles within the prevailing torque limits of 30 in. lbs. max. to 3.5 in. lbs. min. when tested at ambient room temperature with CA21037-4-( )HS stud bolt (Ref.: NASM25027).  
 Vibration: Per MIL-STD-1312, Test 7 except vibration life shall be 90,000 cycles min. with no rotation greater than 90°.

##### Mechanical:

Ultimate Tensile Strength: 2,600 lbs. min. ultimate.  
 Nut Push-Out: 400 lbs. min. ultimate.  
 Nut Torque-Out: 100 in. lbs. min. ultimate.  
 Weight: 10.6 pounds per 1000 pieces.



##### Material:

Nut: 4140.  
 Cage: 17-7 PH CRES.  
 Base: 4140 or C1050.

##### Heat Treat:

Nut and Base: 180-200 KSI.  
 Cage: Cond. TH1050.

##### Finish:

Nut and Base: Cadmium Plated Type I, Class 2 and dry lubed.  
 Cage: Passivated.

##### Notes:

- The nut shall tilt 4° minimum from the vertical centerline in all directions to accommodate angular misalignment and shall float .025 min. radially from cage centerline within a .615 maximum envelope.
- The nut is removable and replaceable: for replacement, order nut P/N CA21021-1, nut base P/N CA21021-3, cage P/N CA21021-2 or tool P/N CA18157-T10.
- This receptacle is to be used with CA21037-4-( )HS stud bolt.

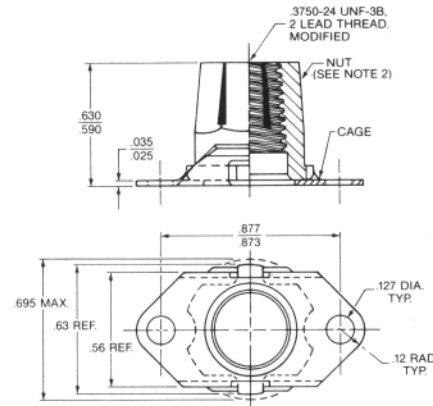
#### CA21024. (3/8 size)

##### Specifications:

Flat Beam Nut Locking Element: Capable of 1,500 seated useable cycles within the prevailing torque limits of 80 in. lbs. max. to 9.5 in. lbs. min. when tested at ambient room temperature with CA21037-4-( )HS stud bolt (Ref.: NASM25027).  
 Vibration: Per MIL-STD-1312, Test 7 except vibration life shall be 90,000 cycles min. with no rotation greater than 90°.

##### Mechanical:

Tensile Strength: 6,000 lbs. min. ultimate.  
 Nut Push-Out: 400 lbs. min. ultimate.  
 Nut Torque-Out: 240 in. lbs. min.  
 Weight: 18.8 lbs. per 1000 pieces.



##### Material:

Nut: 4140 or 8740.  
 Cage: 17-7 PH CRES.

##### Heat Treat:

Nut: 180-200 KSI.  
 Cage: Condition TH1050.

##### Finish:

Nut Cadmium Plated, T type I, Class 2 and dry lube  
 Cage: Passivated, or optional Cadmium Plated Type II, Class 2.

Part No.	Cage Finish
CA21024	Passivated
CA21024C	Cadmium Plated

##### Notes:

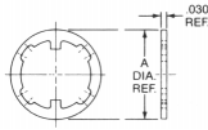
- Nut floats .025 minimum radially from cage centerline within a .695 maximum envelope.
- The nut is replaceable: For replacement, order nut P/N CA21024-1, order tool P/N CA1221-T10 or cage CA21024-2.
- This receptacle is to be used with a CA21037-6-( )HS stud bolt.

# Mark IV™

## Positive Stud Hold-out V ersion.

### Retaining Rings.

CA21037-( )R Series.



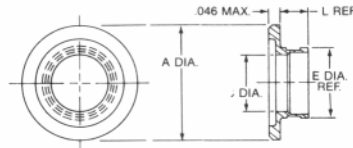
Nominal Size	Part No.	A Dia. Ref.	Material	Heat Treat	Finish	Weight per 1000 pcs. (lbs.) approx.
1/4	CA21037-4R	.355	17-7 PH CRES	Condition RH 950	Passivated	.35 Max.
	CA21037C-4R				Cadmium Plated, Type II, Class 2	
	CA21037CL-4R				Dry Film Lube Over Cadmium Plated, Type I, Class 2	
3/8	CA21037-6R	.480	17-7 PH CRES	Condition RH 950	Passivated	.35 Max.
	CA21037C-6R				Cadmium Plated Type II, Class 2	
	CA21037CL-6R				Dry Film Lube Over Cadmium Plated, Type I, Class 2	

Note: All dimensions apply before plate.

### Grommet.

CA21038-( )-( ) Series.

Note: Grommet can be used for composite material applications. Optional grommets are also available; contact AFS.



Nom. Size	Part No.	L	Grip Range		A	C	E Ref.	Material	Heat Treat	Finish	Weight per 1000 pcs. (lbs.) approx.
			Min.	Max.							
1/4	CA21038-4-1	.115	.075	.095	.505 Max.	.255 .250	.310	304 CRES	Condition A or equivalent	Passivated	1.65
	CA21038-4-2	.135	.096	.115							1.92
	CA21038-4-3	.155	.116	.135							2.19
	CA21038C-4-1	.115	.075	.095						Cadmium Plated, Type II, Class 2	1.65
	CA21038C-4-2	.135	.096	.115							1.92
	CA21038C-4-3	.155	.116	.135							2.19
3/8	CA21038-6-1	.105	.075	.095	.630 Max.	.395 .390	.465	304 CRES	Condition A or equivalent	Passivated.	2.41
	CA21038-6-2	.125	.096	.115							2.81
	CA21038-6-3	.145	.116	.135							3.21
	CA21038C-6-1	.105	.075	.095						Cadmium Plated, Type II, Class 2	2.41
	CA21038C-6-2	.125	.096	.115							2.81
	CA21038C-6-3	.145	.116	.135							3.21

Note: All dimensions apply before plate.



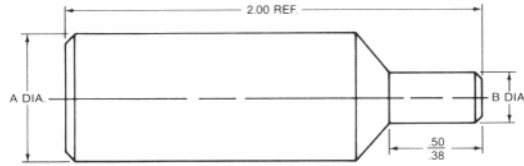
# Mark IV™

## Positive Stud Hold-out Version.

### Installation Tools.

#### Swage Tool CA21038-( )-T11

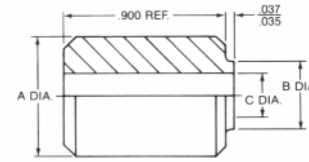
Use to install CA21038-( )-( ) series grommet.



Nominal Size	Part No.	A Dia.	B Dia. Ref.
1/4	CA21038-4-T11	.635 .615	.249
3/8	CA21038-6-T11	.760 .740	.389

#### Anvil CA21038-( )-T10

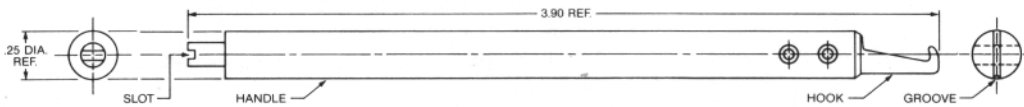
Use to install CA21038-( )-( ) series grommet.



Nominal Size	Part No.	A Dia.	B Dia.	c Dia.
1/4	CA21038-4-T10	.635 .615	.365 .355	.260 .252
3/8	CA21038-6-T10	.760 .740	.488 .478	.396 .391

#### Hold-out Tool CA21037-T12

Use with both 1/4 and 3/8 size CA21037-( )-( )HS stud bolts.



**To Remove Hold-out:**

**Figure 1**  
Place groove in hook on hold-out.

**Figure 2**  
Turn and push tool into stud bolt.

**Figure 3**  
Slide tool down.

**Figure 4**  
Place hook on hold-out and pull out.

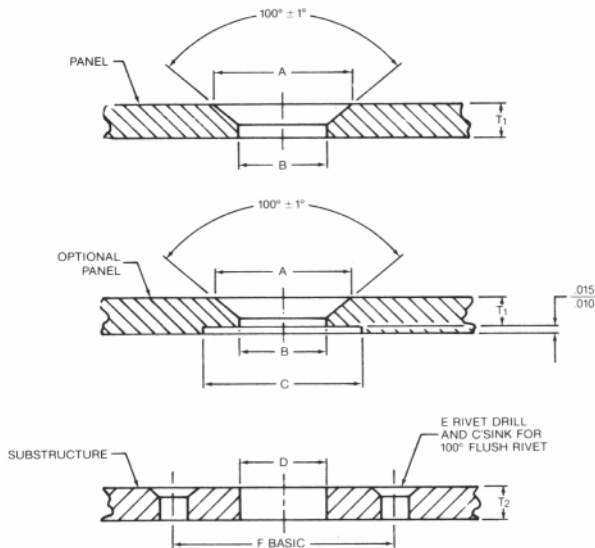
**To Install Hold-out:**

**Figure 5**  
Place hold-out in stud bolt. Align slot of tool with hold-out and push in. Turn tool to orientate hold-out with slot in stud bolt.

# Mark IV™

## Positive Stud Hold-out Version.

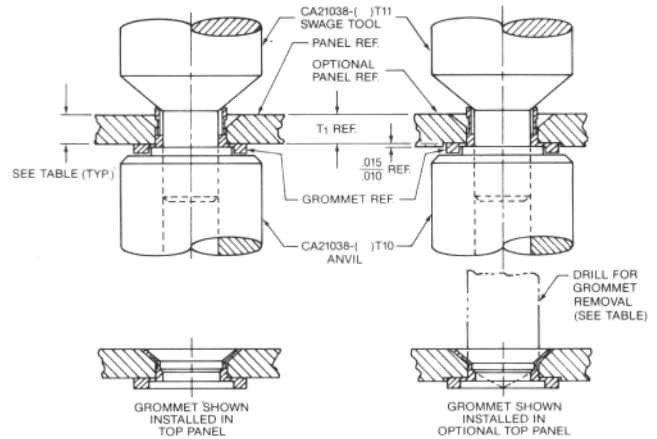
### Panel/Substructure Preparation and Installation Data.



Nominal Size	A C'Sink Dia.	B Hole Dia.	C C'Bore Dia.	D Min. Dia.	E Rivet Dia.	F Basic
1/4	.450 .445	.315 .312	.531	.250	3/32	.688
3/8	.575 .570	.472 .468	.656	.375	1/8	.875

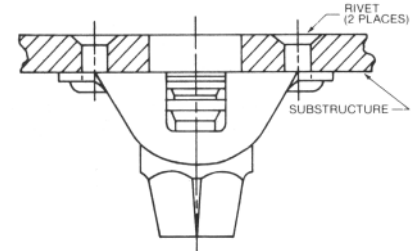
#### Notes:

1. "T<sub>1</sub>" must correspond to panel grip range for CA21038-( )-( ) or CA2103C-( )-( ) grommets.
2. Locate and drill "B" Dia. hole through panel.
3. Countersink panel  $101^\circ$  to "A" Dia.  
 $99^\circ$
4. Counterbore back side of panel .015 deep to "C" Dia.  
 $.010$   
(optional) to provide lower grommet profile
5. Locate and drill "D" Dia. hole through substructure.
6. Locate, drill and countersink two holes for rivets (not supplied).



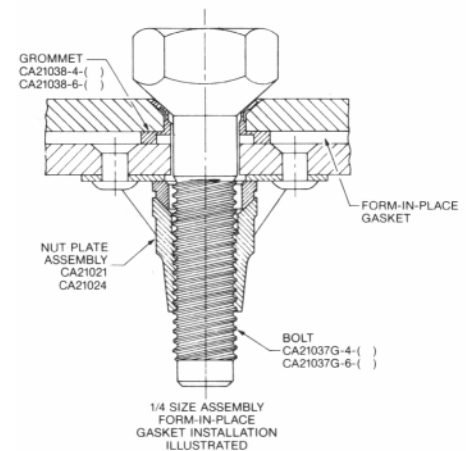
Nominal Size	Drill Size
1/4	.312
3/8	.469

7. Install grommet using referenced tools as illustrated above.
8. Note proper grommet removal procedure above (if required).



9. Rivet nut plate receptacle in place.

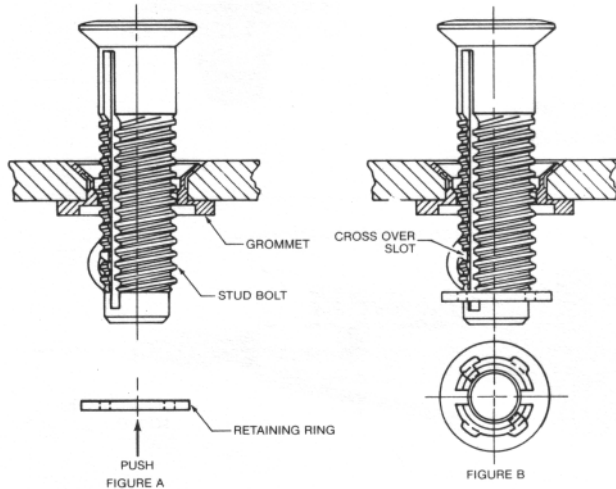
10. Procedure to install form-in-place gasket material. a) Apply form-in-place gasket material. b) Install bolt. c) Torque to 100 in. lbs. d) After cure, remove bolt. Bolt is reusable.



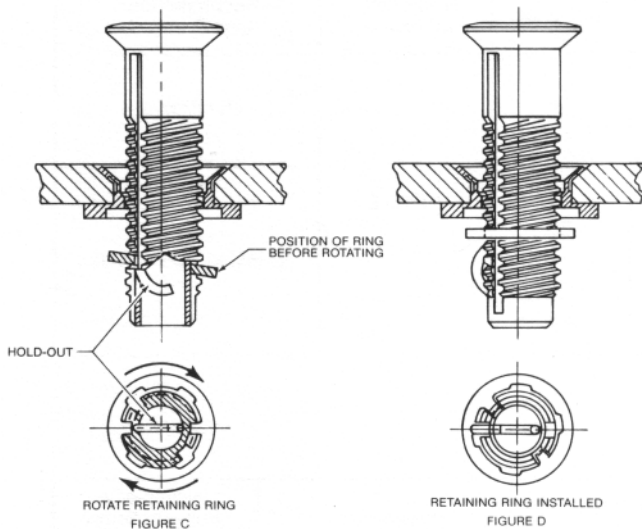
# Mark IV™ Positive Stud Hold-out Version.

## Panel/Substructure Preparation and Installation Data (continued).

### Retaining Ring Installation.

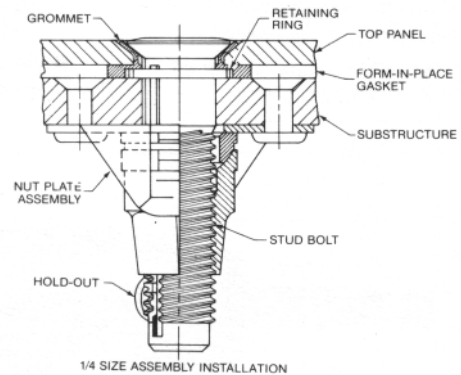


11. Place stud bolt assembly through grommet (Figure A).
12. Push retaining ring onto installation slots (Figure B).

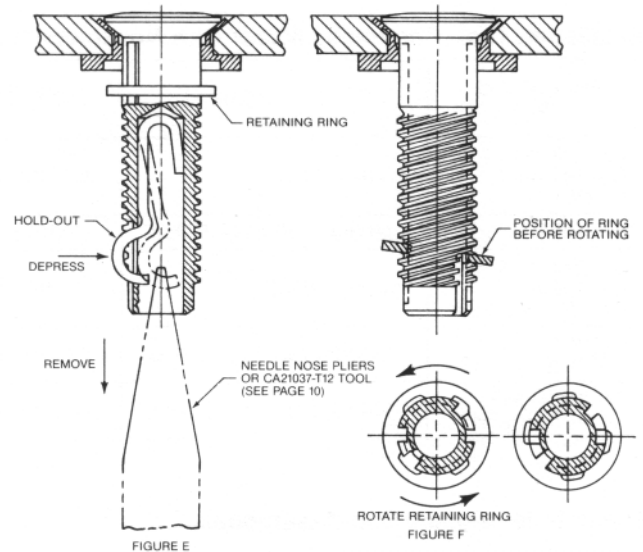


13. Continue to push retaining ring until hold-out feature is deflected as shown in Figure C.
14. Rotate retaining ring clockwise to longitudinal slots.
15. Retaining ring is installed (Figure D).

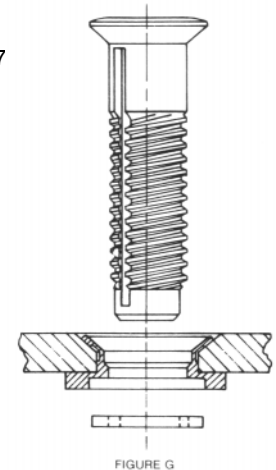
16. Installation is complete.



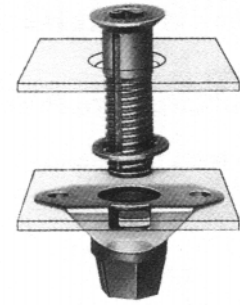
cleaning and/or replacement.



- a) Use needle nose pliers or CA21037 T12 tool to depress and remove wire form (Figure E).
- b) Rotate retaining ring counter-clockwise (Figure F).
- c) At this time all components can be cleaned or replaced (Figure G).
- d) To reassemble reverse removal procedure.

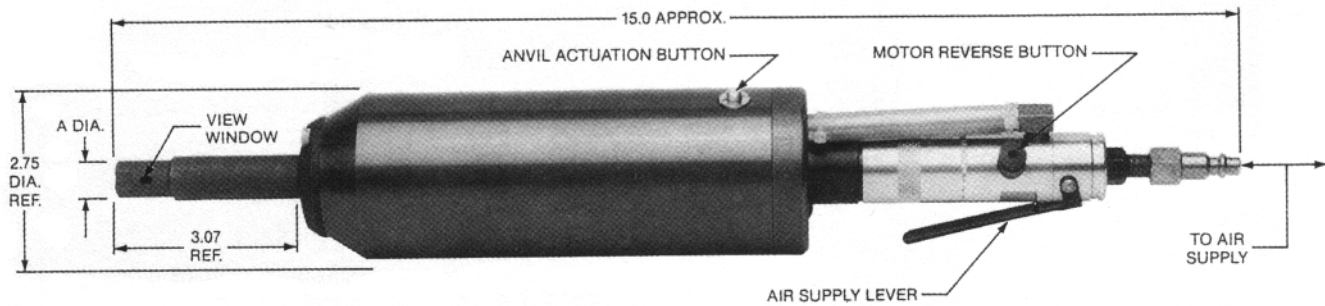


# Mark IV™ Pneumatic Plug Installation Tool. For Captivating Ring on Plug Version Mark IV™ Studs.



## Features:

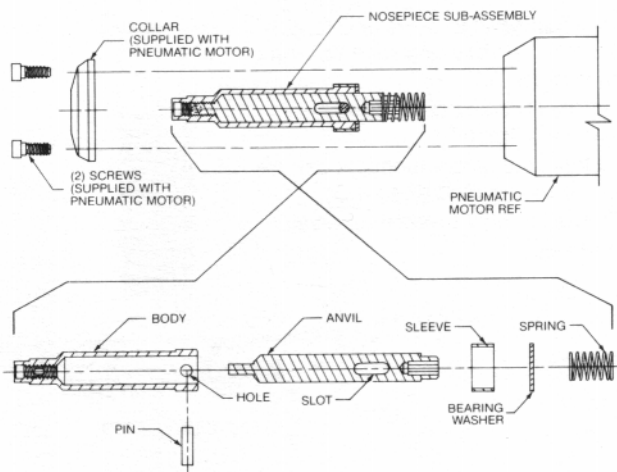
- Forward and reverse pneumatic motor .
- Quick disconnect air coupling.
- Interchangeable nosepieces for all plug versions of Mark IV™ studs.
- Reduces installer's fatigue during moderate to long production runs.
- View window for proper installation verification before tool disengagement.



## Installation Tool (Pneumatic Motor with Nosepiece Sub-Assembly)

Mark IV™ Stud (Ref.)	Thread Size	Installation Tool Part Number	A Diameter Ref.	Motor Only Part Number	Recommended Line Pressure
CA2193-3-( ) CA2194-3-( ) CA21017-3-( )	.1900-32UNJF	CA2100-T13-31L	.38	70950-6	40 PSI Max.
CA21094-3-( )	.1900-32UNF, 2 Lead, Mod.	CA2100-T13-32L			
CA2193-4-( ) CA2194-4-( ) CA21017-4-( )	.2500-28UNJF	CA2100-T13-41L	.50		80 PSI to 110 PSI Max.
CA2104-( )HS CA21070-4-( )HS	.2500-28UNF, 2 Lead, Mod.	CA2100-T13-42L			
CA2109-( )HS CA21070-6-( )HS	.3750-24UNF, 2 Lead, Mod.	CA2100-T13-62L	.63		

## Separate Nosepiece Sub-Assemblies



Mark IV Stud (Ref.)	Thread Size	Nosepiece Sub-Assembly Part Number
CA2193-3-( ) CA2194-3-( ) CA21017-3-( )	.1900-32UNJF	CA2100-T13-31SL
CA21094-3-( )	.1900-32UNF, 2 Lead, Mod.	CA2100-T13-32SL
CA2193-4-( ) CA2194-4-( ) CA21017-4-( )	.2500-28UNJF	CA2100-T13-41SL
CA2104-( )HS CA21070-4-( )HS	.2500-28UNF, 2 Lead, Mod.	CA2100-T13-42SL
CA2109-( )HS CA21070-6-( )HS	.3750-24UNF, 2 Lead, Mod.	CA2100-T13-62SL

### Note:

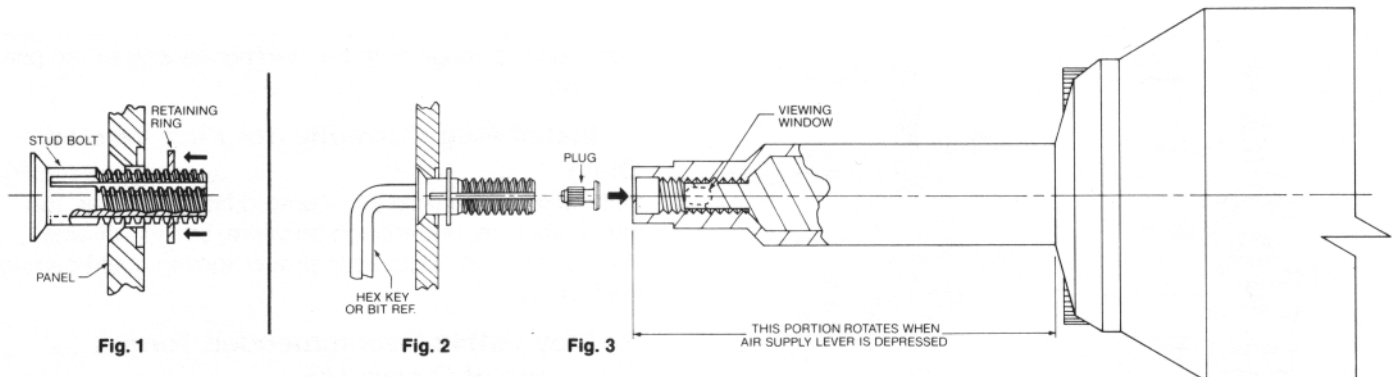
Pneumatic motor part number 70950-6 can utilize any of the nosepiece sub-assembly part numbers listed. To install more than one size plug, order only one pneumatic motor with as many nosepiece sub-assemblies as required.

*Unless otherwise noted, all dimensions are in inches.*

# Mark IV™ Pneumatic Plug Installation Tool.

## Installation Instructions

1. Locate and drill hole in panel with drill size specified.
2. Countersink and counterbore panel as specified.



3. Place stud bolt in panel (Fig. 1).
4. Orient tabs on retaining ring to align slots in stud bolt and slide retaining ring onto stud bolt. (Fig. 1).
5. Place recess tool in recess of stud bolt (fig. 2).
6. Place pug in installation tool (Fig. 3).
7. Thread installation tool on to stud bolt by depressing Air Supply Lever, at rear of tool (Fig. 4).
8. Press Button 1 to actuate anvil and press plug into stud bolt (Fig. 5).
9. Remove tool by depressing Button 2 along with the Air Supply Lever. Tool motor reverses and will unthread from stud bolt (Fig. 6).
10. Retaining ring is captivated.
11. Contact should replacement retaining rings be required.
12. **CAUTION:** Damage to stud bolt may occur if user exceeds recommended line pressure.

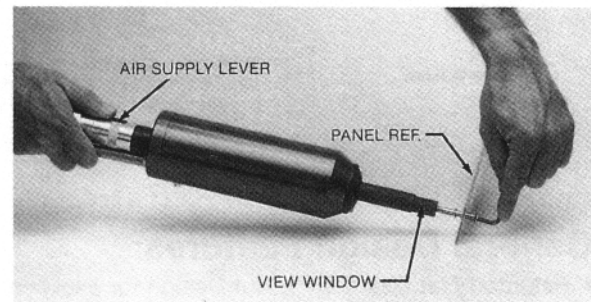


Fig. 4

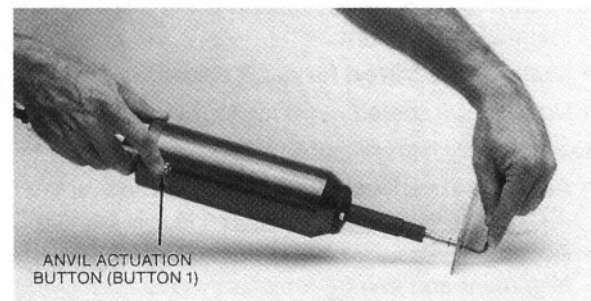


Fig. 5



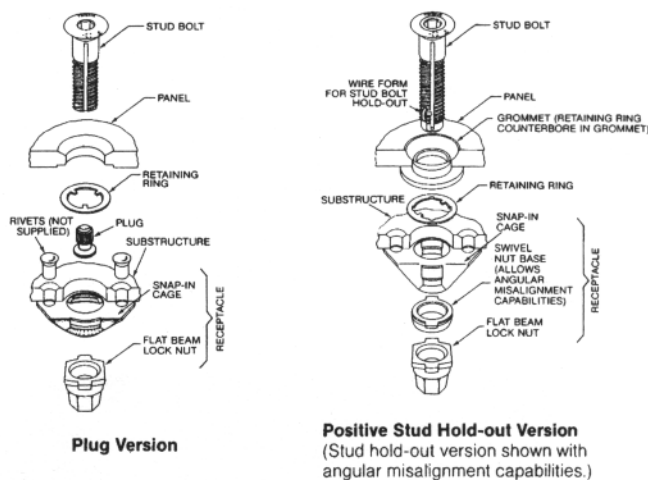
Fig. 6

Specifications subject to change without notice.

# Mark IV™ Structural Panel Fasteners

The Mark IV™ fastener assures the ultimate in reliability for high performance aircraft. Two versions are discussed in this book, the Plug Version and the Positive Stud Hold-out Version.

## Typical Mark IV™ Fastening System:



## General Design Features:

- Flat Beam Lock Nut Design for excellent resistance to vibration-induced loosening.
- Positive stud hold-out version is excellent for composite material applications.
- Multiple lead thread for quick operation.
- Up to 1,500 seated cycle life locking feature for exceptionally high reusability.
- Available in various nominal stud diameters, the .250 and .375 inch diameters are featured in this catalog.
- Receptacle provides radial float to accommodate misalignment and can be replaced without removing rivets.
- Positive stud bolt retention; versions also available with positive hold-out to facilitate curved door handling.

## Important 'Do's and Don'ts'.

### 1. There Must Be a Counterbore.

Because the retaining ring turns as the stud bolt turns, there must be a counterbore to allow the retaining ring to spin freely.

### 2. Prepare Counterbore Per Specifications.

Make sure the retaining ring counterbore is drilled to the correct depth and diameter to allow the retaining ring to spin freely. When using a grommet or spacer, the counterbore is provided.

### 3. Remove Any Foreign Material from Counterbore.

Remove any gasket material, metal chips or other foreign debris from counterbore which could keep the retaining ring from spinning freely.

### 4. Use Approved Installation Tools.

Use only approved installation tools. Use of "homemade" tools could damage both the fastener as well as the parent material.

### 5. Install Plug Correctly (for Plug Version Only).

Installation of the plug into the stud bolt is critical. Too much pressure, not enough pressure, striking of plug, installation at an angle, or improper tooling could damage the fastener.

### 6. Stay Within Recommended Torque Tolerance at Clamp-Up.

Over-torquing of the stud bolt at clamp-up could deform both fastener and the parent material. Under-torquing would not provide adequate pre-load to joint.

### 7. Prepare Countersink Per Specifications.

Countersinks prepared too shallow or too deep could damage parent material and fastener.

### 8. Rivet Holes.

Drill rivet holes in line with center hole otherwise stud bolt may not engage threads in receptacle. All receptacles do have a built-in float feature that allow some misalignment of the rivet holes with the center hole. Do not exceed float limit, however.

### 9. Rivet Installation.

Install rivets flush to surface of substructure. Panel and substructure must be flush at clamp-up unless spacer or grommet is used.

### 10. Through Hole Alignment.

Be sure to align through holes in both panel and substructure for proper fit of stud bolt and receptacle.

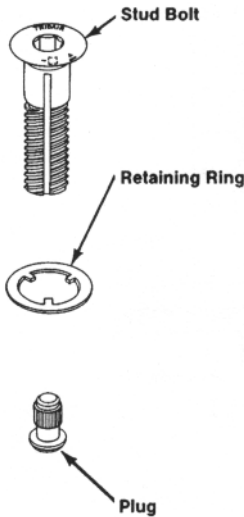
### 11. Hexagon Key.

- Select quality hexagon key. Pay special attention to "across the corners" dimension. (See Page 16).
- Insert tool to full depth of hexagon recess.
- Do not apply side load to hexagon key.

# Mark IV™ , Plug Version

## Stud Bolt:

Stud bolt is held in panel by a retaining ring. Care must be taken to choose the proper length stud bolt to suit specific grip ranges. Stud bolts should be torqued with the correct hexagon key as shown on Page 16.



1. 2-lead thread for quick installation and operation.
  2. Hexagon socket for reliable, high torque transfer capability without cam-out.
  3. Carries high shear and tension load at joint.
- Retaining Ring
1. Non-stressed.
  2. Captivates stud bolt to panel to prevent:
    - Loss of stud bolt.
    - Installation of incorrect bolts into wrong holes.
    - Foreign object damage from stud bolt.

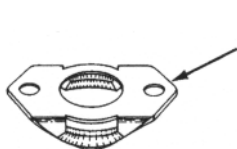
**Note:** Care should be taken not to damage tangs in these rings. The retaining ring counterbore should always be checked to make sure it is clear of all debris. If a ring is ever damaged, it should be replaced immediately using the tools shown on Page 9 (requires engineering approval).

1. Positively captivates retaining ring to stud bolt.

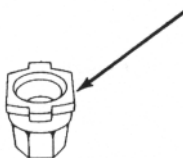
## Receptacle:

Allows radial float. Lock nut is held in place behind mounting hole by the cage which is riveted to substructure.

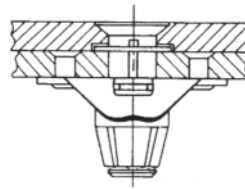
The nut provides radial float and some versions allow for angular engage to ease installation of curved panels. The nut is removable and replaceable.



- Cage**
1. Snap-in design allows nut to be replaced without removing cage.



- Flat Beam Lock Nut**
1. Flexible flat beams provide high cycle life (up to 1500 seated cycles), and vibration resistance.
  2. Nut can be replaced without removing cage.



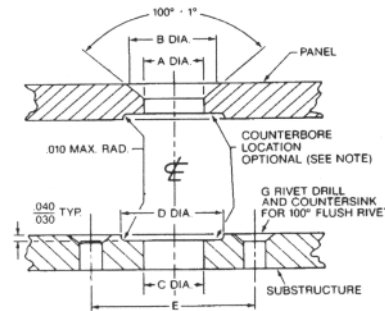
## Complete Installation:

Receptacle is riveted in place and retaining ring is captivated.

# Panel/Substructure Preparation and Installation Data.

## Basic hole preparation

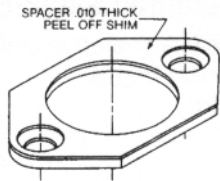
(Counterbore and rivet countersink not required if spacer or grommet is used.)



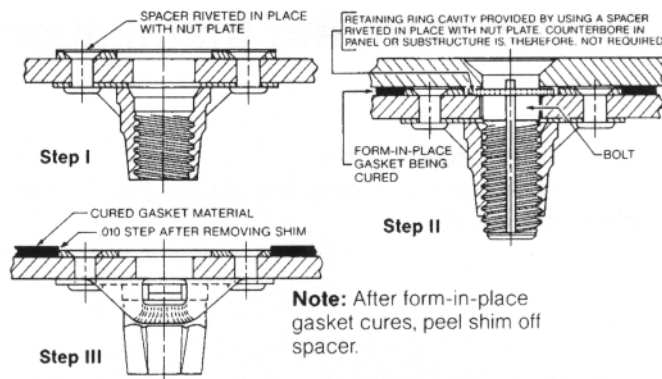
Stud Bolt Thread Size Ref.	A Dia.	B Dia.	C Dia.	D Dia. Min.	E	G Rivet Size
.2500-28 UNF-3A 2 Lead	.255 .250	.409 .403	.255 .250	.406	.689 .685	3/32
.3750-24 UNF-3A 2 Lead	.380 .375	.533 .527	.380 .375	.547	.877 .873	1/8

**Note:** Counterbore location optional if panel thickness meets minimum requirements.

## Installation using optional spacer and form-in-place gasket.



## Installation of form-in-place gasket using mating bolt.



## Selecting Proper Grip Range For Stud Bolt:

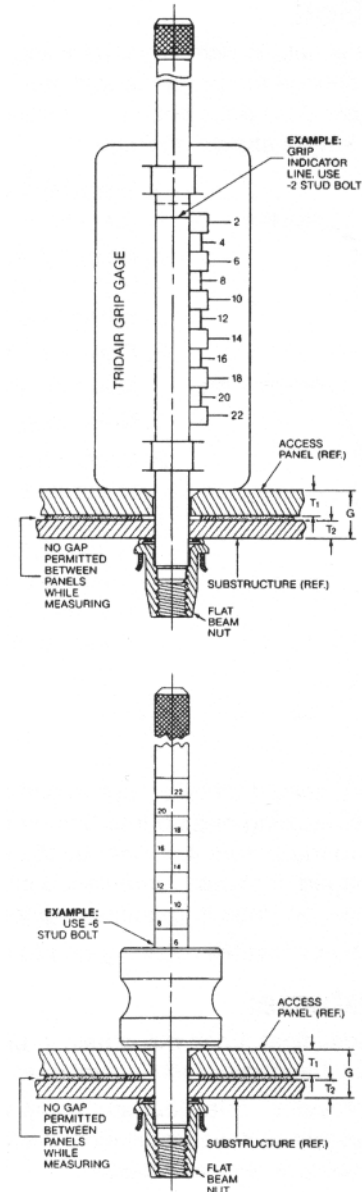
Different grip ranges are sometimes used in the same panel, or stud bolts sometimes need to be replaced. It is important that stud bolts be selected with the proper grip range. This range may be selected using a reading from one of the grip gages shown here. These gages may be obtained from Alcoa Fasteners Tridair Products.

### To Use Grip Gages:

1. Place gage in through hole of both panel and substructure and seat in receptacle.
2. No gap is permitted between panel and substructure while measuring, unless "Form-In-Place" gasket is used.
3. Grip gages measure total grip ( $T_1 + T_2 +$  "Form-In-Place" gasket if used).
4. Grip indicator number indicates correct stud bolt dash number to be used.
5. If borderline grip condition, use lower dash number .

## Typical Grip Gages:

### Typical Grip Gages:

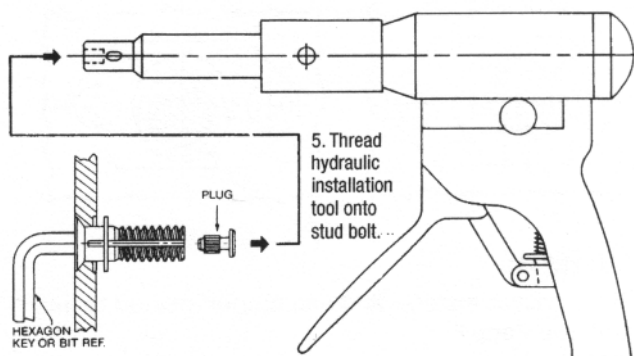
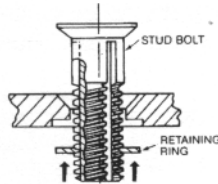




## When Proper Grip Range Is Determined, Installation Of Plug Is As Follows:

### Manual tool for small quantities

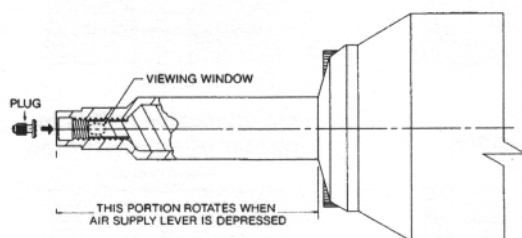
1. Place stud bolt in panel.
2. Orient tabs on retaining ring to align slots in stud bolt and slide retaining ring onto stud bolt.
3. Place hexagon key or bit in hex socket of stud bolt.
4. Place plug in installation tool.



6. Pump handle squeeze to actuate hydraulic cylinder to press Plug into stud bolt. Plug must be fully seated (observe through viewing window).
7. To remove stud bolt, release button and press to release hydraulic cylinder.

### Power tool for large quantities

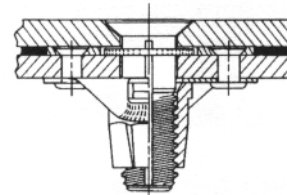
Follow procedures No. 1 through 4 above, then follow steps outlined below:



5. Thread installation tool onto stud bolt by depressing Air Supply Lever, at rear of tool.
6. Press button on cylinder to actuate anvil and press plug into stud bolt.
7. Remove tool by depressing reverse button at rear of cylinder along with the Air Supply Lever. Tool motor reverses and will unthread from stud bolt.
8. Retaining ring is captivated.
9. See Page 9 should replacement retaining rings be required.

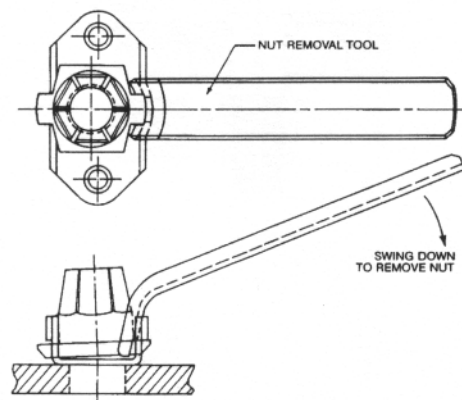
10. **CAUTION:** Damage to stud bolt may occur if user exceeds recommended line pressure. Recommended line pressure for .1900-32 thread size is 40 PSI Max. Recommended line pressure for .2500-28 and .375-24 sizes is 80 PSI to 110 PSI.

### Proper Installation



### Flat Beam Nut Removal:

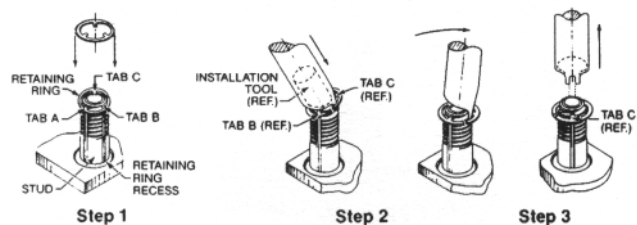
Use Tridair tools to remove nut.



### Retaining Rings Used For Repair:

**Note:** Please contact Alcoa Fasteners, or consult your engineering department before using split retaining rings.

When the original retaining ring becomes disassembled from a stud bolt with the plug already installed, split retaining rings (correct size) may be installed as shown. These split retaining rings are not to be used other than for repair. Use Tridair installation tools.

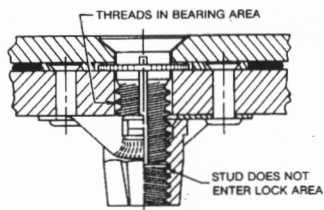


Install tabs A and B of the retaining ring into two of the stud bolt grooves as shown in Step 1. Lower the installation tool, straddling tab C as shown, then swing tool in the direction shown in Step 2 to snap tab C into third groove of stud bolts. Remove tool from assembly as shown in Step 3.

## Improper Fastener Installation

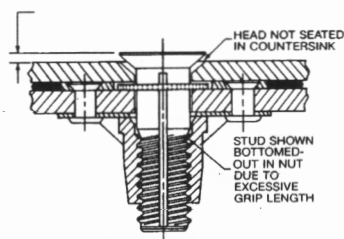
(Also see Problems/Solutions starting this page.)

### ... When studs are too short



### ... When studs are too long

1. Stud protrudes from panel.
2. No preload is applied to joint.



## Problems/Causes/Solutions

### 1. Problem:

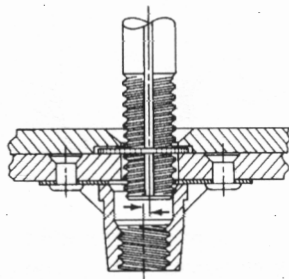
Stud will not engage threads in nut.

#### Cause:

Rivet holes in substructure not in line with center hole. Nut not able to float far enough to compensate for error.

#### Solution:

Relocate rivet holes in proper alignment with center line.

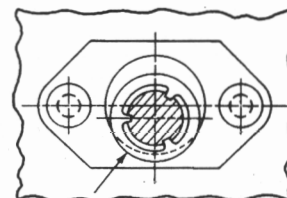
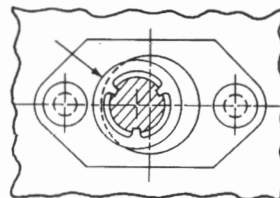
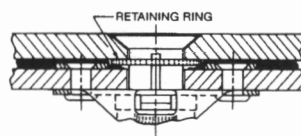


### 2. Problem:

Retaining ring breaks and stud bolt falls free from panel.

#### Cause:

Gasket Material in ring counterbore, cavity or spacer, or grommet, if used. Or, holes in substructure not in line causing ring to be pinched between panel and substructure or spacer, if used, during clamp-up.



#### Solution:

Remove gasket material and use proper method to install gasket. See Page 6.

#### Solution:

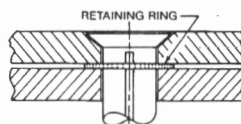
Drill new rivet holes in line with center hole.

### 3. Problem:

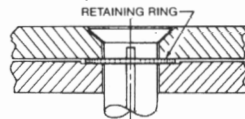
Retaining ring breaks and stud bolt falls free from panel.

#### Cause:

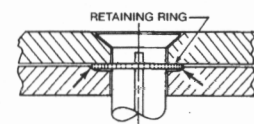
Ring becomes captive between panel and substructure and will not turn with stud, retaining ring tabs shear off.



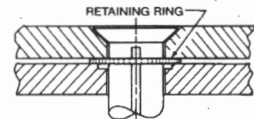
Caused by:  
no counterbore.



Or, shallow counterbore.



Or, excessive radius in  
corner of counterbore.



Or, counterbore diameter  
undersize.

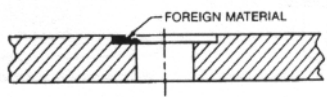
#### Solution:

Rework counterbore as show on Page 6.

**Note:** Counterbores on curved surfaces must meet minimum depth requirements at all points around circumference of counterbore.

#### 4. Problem:

Retaining ring breakage.



#### Cause:

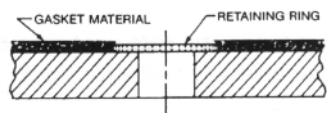
Metal chips or gasket material in counterbore.

#### Solution:

Clean out all foreign material from counterbore.

#### 5. Problem:

Retaining ring breakage.



#### Cause:

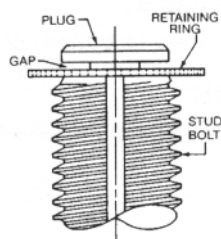
Not using spacer or grommet with form-in-place gasket to provide retaining ring cavity. Gasket material migrates under compressive load and captures retaining ring.

#### Solution:

Use spacer or grommet with form-in-place gasket. See Page 6.

#### 6. Problem:

Retaining ring rotates on end of stud bolt.



#### Cause:

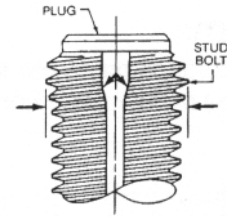
Plug not fully seated in end of stud bolt.

#### Solution:

Install plug completely into end of stud bolt. See page 8.

#### 7. Problem:

End of stud bolt expands.



#### Cause:

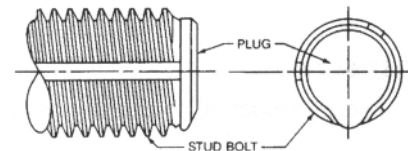
Excessive installation pressure when installing plug.

#### Solution:

Reduce installation pressure. See Page 8 for proper installation.

#### 8. Problem

Plug edge peened over resulting in thread interference.



#### Cause:

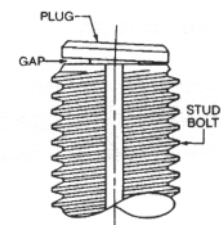
Striking plug instead of using proper tools.

#### Solution:

Use correct installation tool and follow installation procedure. See Page 8.

#### 9. Problem:

Gap between plug and stud bolt at one point only.



#### Cause:

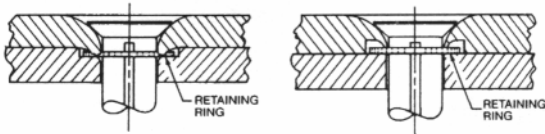
Plug installed at an angle.

#### Solution:

Use proper tool to seat plug.

### 10. Problem:

Head breaking through panel and top panel being dimpled into retaining ring counterbore. Possible retaining ring breakage.



#### Cause:

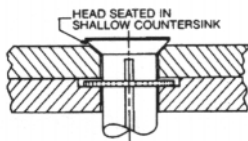
Excessive torque being applied to stud bolt during clamp-up. Or, deep counterbore in  $T_1$  weakens panel and allows panel to deform under torque.

#### Solution:

Use proper installation torque. Consult your engineering department.

### 11. Problem

Stud bolt head protrudes above surface of panel.



#### Cause:

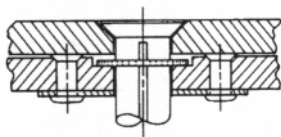
Shallow countersink.

#### Solution:

Rework countersink to proper dimension. See page 6.

### 12.Problem:

Panels do not mate correctly.



#### Cause:

Head of rivet protrudes above surface of  $T_2$ .

#### Solution:

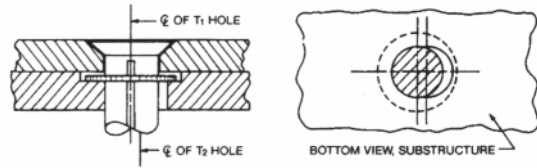
Rework rivet countersinks to proper dimension as shown on Page 6.

### 13. Problem:

Elongated hole in substructure.

#### Cause:

Hole in panel not aligned to hole in substructure and stud bolt rubs against side of hole.



#### Solution:

Correct hole alignment.

### 14.Problem

Hexagon recess in stud bolt damaged.

#### Cause:

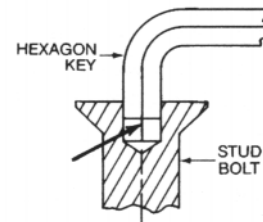
Hexagon key or bit does not dimensionally conform to ANSI B18.3 requirements and strength level is too low.

#### Solution:

Use only hexagon key or bit that conforms to ANSI B18.3 requirements. See below for selector guide.

#### Or another Cause:

Excessive torque applied during clamp-up.



#### This Solution:

Control maximum installation torque.

#### Or, a third Cause:

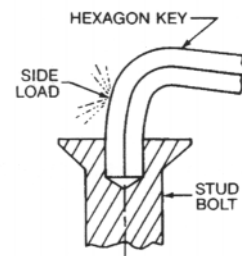
Hexagon key not pushed to bottom of hexagon recess.

#### This Solution:

Seat key bit fully into hexagon recess before applying torque.

### 15.Problem:

Hexagon key breaks off in recess.



#### Cause:

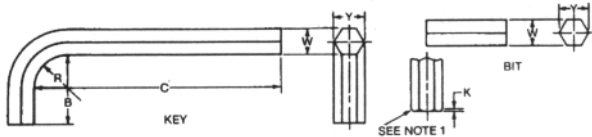
Side load applied to hexagon key in addition to torque.

**Solution:**

Take care not to apply side load.

**Selector Guide For Hexagon Key or Bit**

The following chart shows correct dimension for hexagon key or bit.



Nominal Key or Bit and Socket Size	W		Y		B		
	Hexagon Width Across Flats		Hexagon Width Across Corners		Length of Short Arm		
	Max.	Min.	Max.	Min.	Max.	Min.	
1/8	0.125	0.1250	0.1235	0.1418	0.1390	0.844	0.656
9/64	0.141	0.1406	0.1391	0.1593	0.1566	0.891	0.703
5/32	0.156	0.1562	0.1547	0.1774	0.1745	0.938	0.750
3/16	0.188	0.1875	0.1860	0.2135	0.2105	1.031	0.844
7/32	0.219	0.2187	0.2172	0.2490	0.2460	1.125	0.938
See Note				2			

Nominal Key or Bit and Socket Size	C				R	K	
	Length of Long Arm				Radius of Bend	Chamfer	
	Short Series		Long Series				
	Max.	Min.	Max.	Min.	Min.	Max.	
1/8	0.125	2.344	2.156	3.844	3.656	0.125	0.015
9/64	0.141	2.469	2.281	4.031	3.844	0.141	0.016
5/32	0.156	2.594	2.406	4.219	4.031	0.156	0.016
3/16	0.188	2.844	2.656	4.594	4.406	0.188	0.022
7/32	0.219	3.094	2.906	4.969	4.781	0.219	0.024
See Note							1

**Notes:**

- Each end shall be square with the axis of each arm within 4° and edges may be sharp or chamfered at the option of the manufacturer, the chamfer not to exceed the values listed.
- Any truncation or rounding of hexagon corners within the specified across corners dimensions shall be evident on all corners.

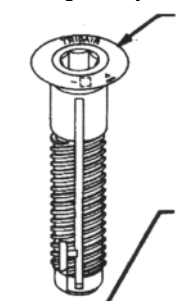
# Mark IV™ , Positive Stud Bolt Holdout V version

**Stud bolt**

Stud bolt is held in panel by a retaining ring. Care must be taken to choose the proper length stud bolt to suit specific grip ranges. Stud bolts should be torqued with the correct hexagon key as shown on Page 16.

**Stud Bolt**

- 2-lead thread for quick installation.
- Hexagon socket for reliable, high torque transfer capability without cam out.
- Carries high, shear and tension loads at joint.

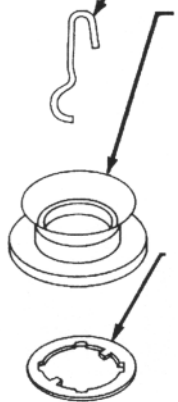


**Stud Bolt Hold-Out**

- Retains stud bolt in holdout position to ease installation of curved panel.

**Grommet (shown in flared condition)**

- Provides hard seat surface.
- Superior load transfer.
- Provides counterbore for retaining ring.
- Excellent for gasketed or composite applications.



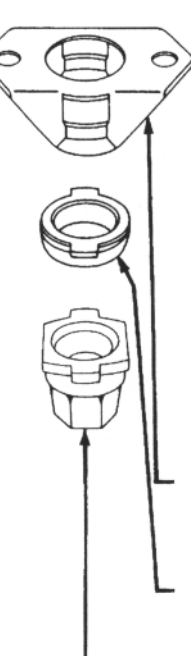
**Retaining Ring**

- Non-stressed.
- Captivates stud bolt to panel to prevent:
  - Loss of stud bolt.
  - Installation of incorrect stud bolts into wrong holes.
  - Foreign object damage from stud bolt.

**Note:** Care should be taken not to damage tangs in these rings. The retaining ring cavity should always be checked to make sure it is clear of all debris. If a ring is ever damaged, it should be replaced immediately.

**Receptacle: Allows Radial Float.**

Some version provide angular alignment. The lock nut is held in place behind mounting hole by cage which is riveted to substructure.



**Cage**

- Snap-In design allows nut to be replaced without replacing rivet.

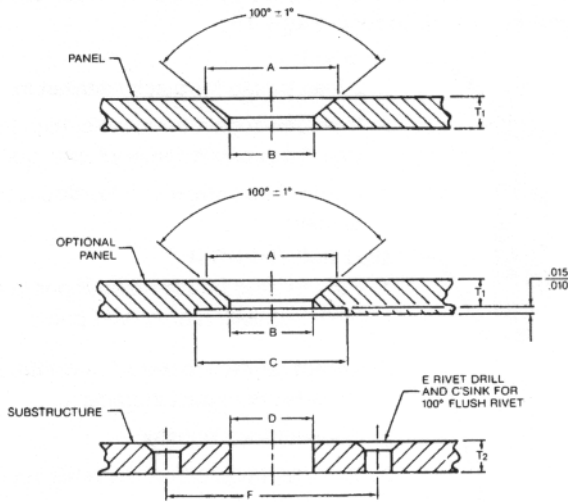
**Swivel Nut Base (Optional)**

- Allows angular misalignment capability.
- Can be replaced without removing cage.

**Flat Beam Lock Nut**

- Flexible flat beam provides high cycle life (up to 1,500 seated cycles), and vibration resistance.
- Nut can be replaced without removing cage.

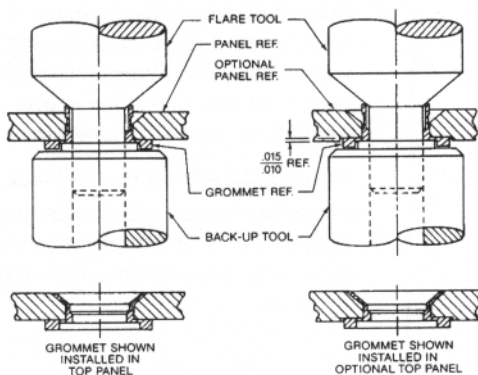
# Panel/Substructure Preparation and Installation Data.



Stud Bolt Thread Size Ref.	A C'Sink Dia.	B Hole Dia.	C C'Bore Dia.	D Dia.	E Rivet Dia.	F
.2500-28 UNF-3A, 2 Lead	.450 .445	.315 .312	.531	.255 .250	3/32	.689 .685
.3750-24 UNF-3A, 2 Lead	.575 .570	.472 .468	.656	.380 .375	1/8	.877 .873

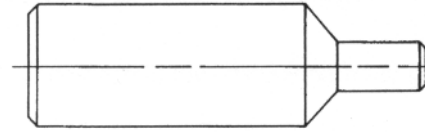
Note: Counterbore in panel provides lower grommet profile.

## Grommet Installation:

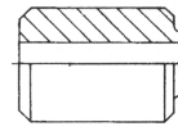


## Tridair Tools For Installing Stud Bolt Hold-Out Version.

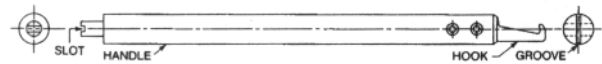
### Flare Tool



### Back-Up Tool

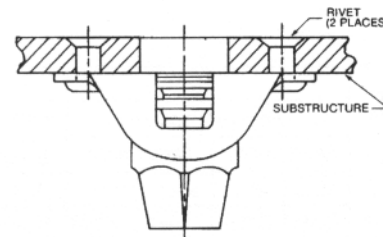


### Hold-out Tool



## Receptacle:

Nut plate is riveted in place.

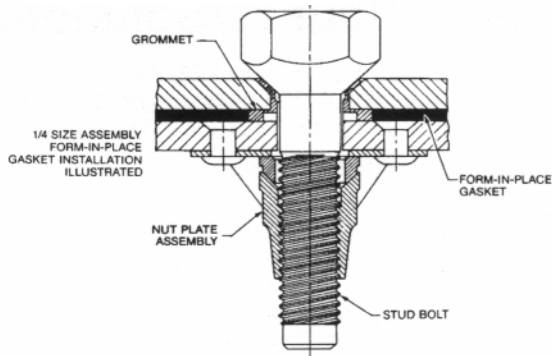


## Procedure to install from-in-place gasket material.

Use only hexagon key or bit that conforms to ANSI B18.3 requirements. See Page 16 for selector guide.

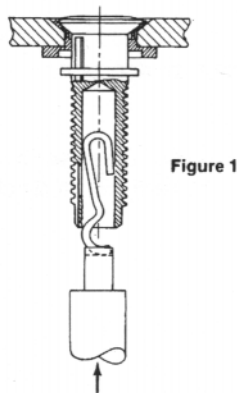
## Or another Cause:

1. Apply form-in place gasket material.
2. Install bolt.
3. Torque to 100 in-lbs.
4. After cure, remove bolt. Bolt is reusable.



# Retaining Ring Installation and Removal.

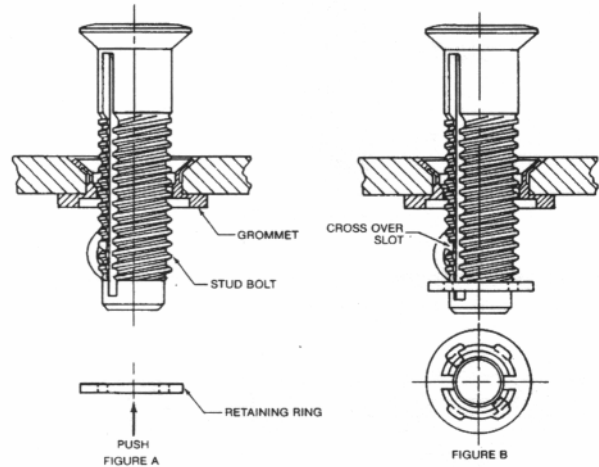
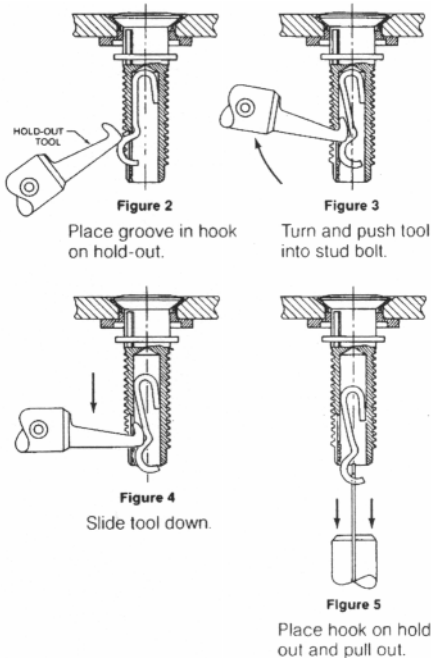
## To Install Hold-Out:



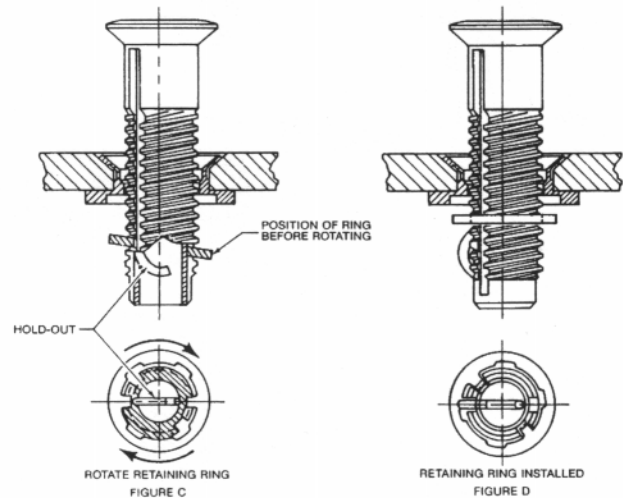
Place hold-out in stud bolt. Align slot of tool with hold-out and push in. Turn tool to orientate hold-out with slot in stud bolt.

## To Remove Hold-Out:

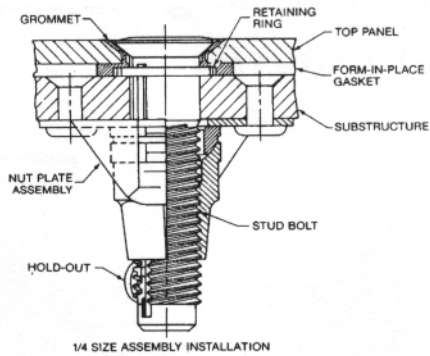
### To Remove Hold-Out:



1. Place stud bolt assembly through grommet (Figure A).
2. Push retaining ring onto installation slots (Figure B).



3. Continue to push retaining ring until hold-out feature is deflected as shown in Figure C.
4. Rotate retaining ring clockwise to longitudinal slots.
5. Retaining ring is installed (Figure D).
6. Installation is complete.



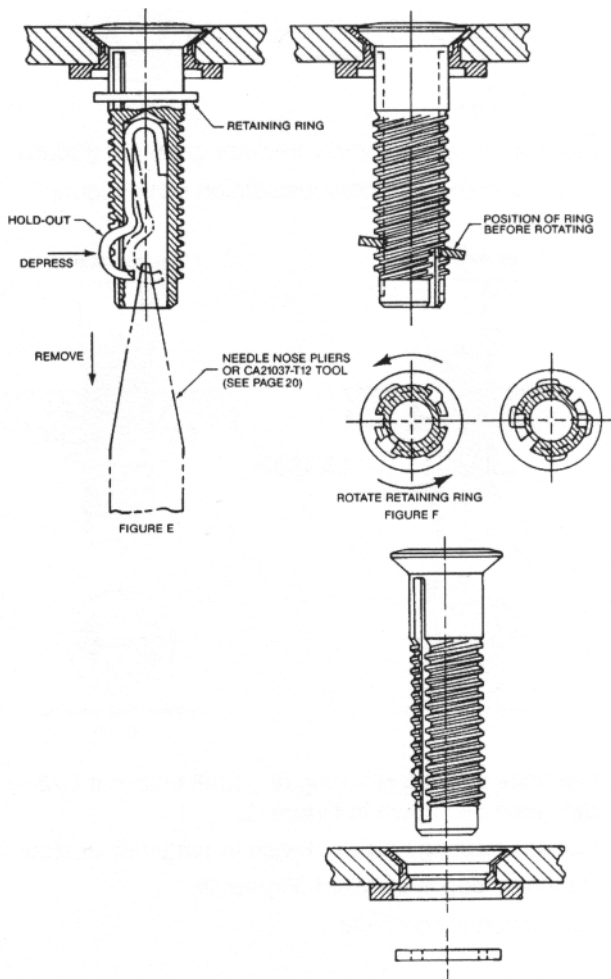
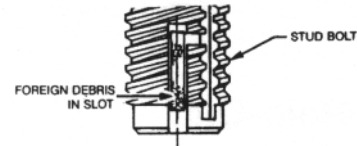
## Problems/Causes/ Solutions

The positive stud hold-put version has similar problems/causes/solutions as the plug version. See Pages 10-16, Numbers 1,2,4,10,11,12,13,14,15, and 16.

### Problem:

Hold-out feature does not work.

7. Procedure to remove hold-out and retaining ring for cleaning and/or replacement.



### Cause:

Foreign debris in slot of stud bolt.

### Solutions:

Remove hold-out wire form. Clean slot and wire form. Replace clean wire form back into stud bolt.

## NOTES:

- Use needle nose pliers or CA21037-T12 tool to depress and remove wire form (Figure E).
- Rotate retaining ring counterclockwise (Figure F).
- At this time all components can be cleaned or replaced (Figure G).
- To reassemble reverse removal procedure.