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.

**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.

Material: 8740 or 4140 Alloy Steel.
Other materials available.
Finish: Cadmium Plated, Type II, Class 2.

Notes:
1. Surface texture per USAS B46.1:
   - unthreaded shank, conical surface of head 32
   - other surfaces 125
2. Part number callout examples:
   - CA2104-4 HS
     - Basic Part Number 1/4 size
   - CA2109-4 HS
     - Basic Part Number 3/8 size
3. Contact AFS for assistance in selecting correct dash number.

### Mark IV™ Plug Version

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#### Stud Bolts

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Ultimate tensile strength: 2,800 pounds min. UTS.
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**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.

Material: 8740 or 4140 Alloy Steel.
Other materials available.
Finish: Cadmium Plated, Type II, Class 2.

Notes:
1. Surface texture per USAS B46.1:
   - unthreaded shank, conical surface of head 32
   - other surfaces 125
2. Part number callout examples:
   - CA2104-4 HS
     - Basic Part Number 1/4 size
   - CA2109-4 HS
     - Basic Part Number 3/8 size
3. Contact AFS for assistance in selecting correct dash number.

<table>
<thead>
<tr>
<th>Dash Number</th>
<th>Grip Range</th>
<th>CA2104-(    )HS</th>
<th>CA2109-(    )HS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
<td>Length</td>
</tr>
<tr>
<td>-2</td>
<td>.150</td>
<td>.290</td>
<td>.777</td>
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<tr>
<td>-4</td>
<td>.291</td>
<td>.430</td>
<td>.917</td>
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<td>-6</td>
<td>.431</td>
<td>.570</td>
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<td>-8</td>
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<td>1.197</td>
</tr>
<tr>
<td>-10</td>
<td>.711</td>
<td>.850</td>
<td>1.337</td>
</tr>
</tbody>
</table>

**Tridair Products** 34
**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-( )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: 2,800 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: Steel

**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.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Cage Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA2103</td>
<td>Passivated</td>
</tr>
<tr>
<td>CA2103C</td>
<td>Cadmium Plated</td>
</tr>
</tbody>
</table>

**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-( )HS stud bolt.
4. Contact for optional receptacles, including encapsulated types.

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**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-( )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: 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: 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.

**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 CA1821-T10.
3. This receptacle is to be used with a CA2109-( )HS stud bolt.
4. Contact for optional receptacles, including encapsulated types.
Mark IV™ Plug Version.
Retaining Rings.
CA2106 and CA2111.

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

Plugs.
CA2105 and CA2110.

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

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

Plug Installation Tools.
CA2104-T12 and CA2109-T12.
(For field repair.)

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

<table>
<thead>
<tr>
<th>Part No.</th>
<th>A Dia. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA2104-T12</td>
<td>.50</td>
</tr>
<tr>
<td>CA2109-T12</td>
<td>.63</td>
</tr>
</tbody>
</table>
Mark IV™
Plug Version
Panel/Substructure Preparation and Installation Data.

Notes:
1. Locate and drill “A” Dia. hole through panel.
2. Countersink panel 101° to “B” Dia.
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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CA2104-( )HS</td>
<td>.255</td>
<td>.409</td>
<td>.255</td>
<td>.406</td>
<td>.689</td>
<td>3/32</td>
</tr>
<tr>
<td>CA2109-( )HS</td>
<td>.380</td>
<td>.533</td>
<td>.385</td>
<td>.547</td>
<td>.877</td>
<td>1/8</td>
</tr>
</tbody>
</table>

Tridair Products 37
Mark IV™
Positive Stud Hold-out V ersion.

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).

Stud Bolt Assemblies
CA21037-4-(   )HS. (1/4 size)
CA21037-6-(   )HS. (3/8 size)

<table>
<thead>
<tr>
<th>First Dash Number</th>
<th>Thread Size</th>
<th>A Dia.</th>
<th>C Dia. Min.</th>
<th>D Dia.</th>
<th>Ultimate Tensile Strength</th>
<th>Ultimate Single Shear Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>.2500-28 UNF-3A, 2 Lead</td>
<td>.440</td>
<td>.375</td>
<td>.2495</td>
<td>2600 lbs. min.</td>
<td>2500 lbs.</td>
</tr>
<tr>
<td>-6</td>
<td>.3750-24 UNF-3A, 2 Lead</td>
<td>.564</td>
<td>.505</td>
<td>.3745</td>
<td>6000 lbs. min.</td>
<td>5000 lbs.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Second Dash Number</th>
<th>Grip Range</th>
<th>-4 Size</th>
<th>-6 Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>Maximum</td>
<td>Length</td>
<td>Weight</td>
</tr>
<tr>
<td>1/4</td>
<td></td>
<td>.972</td>
<td>.13</td>
</tr>
<tr>
<td>3/8</td>
<td></td>
<td>1.112</td>
<td>.16</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>1.252</td>
<td>.19</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>1.392</td>
<td>.22</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>1.532</td>
<td>.25</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>1.715</td>
<td>.30</td>
</tr>
</tbody>
</table>

Tridair Products 38
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. lvs. 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:
1. 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.
2. 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.
3. 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. ultimate.
Weight: 18.8 lbs. per 1000 pieces.

Material:
Nut: 4140 or 8740.
Cage: 17-7 PH CRES.
Base: 4140 or C1050.

Heat Treat:
Nut and Base: 180-200 KSI.
Cage: Condition TH1050.

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

Notes:
1. 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 .695 maximum envelope.
2. The nut is removable and replaceable: for replacement, order nut P/N CA21024-1, order tool P/N CA2121-T10 or cage CA21024-2.
3. This receptacle is to be used with a CA21037-6-( )HS stud bolt.
# Mark IV™ Positive Stud Hold-out V er sion.

**Retaining Rings.**

CA21037-( )R Series.

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

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.

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>1/4</td>
<td>CA21038-4-1</td>
<td>.115</td>
<td>.075 .095</td>
<td>.505</td>
<td>.255</td>
<td>.310</td>
<td>304 CRES</td>
<td>Condition A or equivalent</td>
<td>Passivated, Cadmium Plated, Type II, Class 2</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td>CA21038-4-2</td>
<td>.135</td>
<td>.096 .115</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>1.92</td>
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<tr>
<td></td>
<td>CA21038C-4-1</td>
<td>.155</td>
<td>.075 .095</td>
<td>.505</td>
<td>.255</td>
<td>.310</td>
<td>304 CRES</td>
<td>Condition A or equivalent</td>
<td>Passivated, Cadmium Plated, Type II, Class 2</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td>CA21038C-4-2</td>
<td>.135</td>
<td>.096 .115</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>1.92</td>
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<td>CA21038C-4-3</td>
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<td>.116 .135</td>
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<td>2.19</td>
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<tr>
<td>3/8</td>
<td>CA21038-6-1</td>
<td>.105</td>
<td>.075 .095</td>
<td>.630</td>
<td>.395</td>
<td>.465</td>
<td></td>
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<td>.096 .115</td>
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<td>.116 .135</td>
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<td>3.21</td>
</tr>
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</table>

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.

Anvil CA21038-(    )-T10
Use to install CA21038-(    )-(    ) series grommet.

Hold-out Tool CA21037-T12
Use with both 1/4 and 3/8 size CA21037-(    )-(    )HS stud bolts.

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Part No.</th>
<th>A Dia.</th>
<th>B Dia. Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>CA21038-4-T11</td>
<td>.635</td>
<td>.249</td>
</tr>
<tr>
<td>3/8</td>
<td>CA21038-6-T11</td>
<td>.760</td>
<td>.389</td>
</tr>
</tbody>
</table>

To Install Hold-out:

1. 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.

2. Place hook on hold-out and pull out.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5
Mark IV™
Positive Stud Hold-out Version.

Panel/Substructure Preparation and Installation Data.

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.

Notes:
1. “T,” must correspond to panel grip range for CA21038-( )-( ) or CA2103C-( )-( ) grommets.
2. Locate and drill “B” Dia. hole through panel.
3. Countersink panel 101° to “A” Dia.
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).

<table>
<thead>
<tr>
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<tr>
<td>1/4</td>
<td>.450 .445</td>
<td>.315 .312</td>
<td>.531</td>
<td>.250</td>
<td>3/32</td>
<td>.688</td>
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</table>

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

Panel/Substructure Preparation and Installation Data.
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.
15. Retaining ring is installed (Figure D).

16. Installation is complete.

a) Use needlenose pliers or CA21037 T12 tool to depress and remove wire form (Figure E).
b) Rotate retaining ring counterclockwise (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)

<table>
<thead>
<tr>
<th>Mark IV™ Stud (Ref.)</th>
<th>Thread Size</th>
<th>Installation Tool Part Number</th>
<th>A Diameter Ref.</th>
<th>Motor Only Part Number</th>
<th>Recommended Line Pressure</th>
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<tbody>
<tr>
<td>CA2193-3-( )</td>
<td>.1900-32UNJF</td>
<td>CA2100-T13-31L</td>
<td>.38</td>
<td>70950-6</td>
<td>40 PSI Max.</td>
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<tr>
<td>CA2194-3-( )</td>
<td>.1900-32UNF, 2 Lead, Mod.</td>
<td>CA2100-T13-32L</td>
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<tr>
<td>CA21094-3-( )</td>
<td>.2500-28UNJF</td>
<td>CA2100-T13-41L</td>
<td>.50</td>
<td></td>
<td>80 PSI to 110 PSI Max.</td>
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<tr>
<td>CA2104-() HHS</td>
<td>.2500-28UNF, 2 Lead, Mod.</td>
<td>CA2100-T13-42L</td>
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<tr>
<td>CA2109-() HHS</td>
<td>.3750-24UNF, 2 Lead, Mod.</td>
<td>CA2100-T13-62L</td>
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</table>

### Separate Nosepiece Sub-Assemblies

<table>
<thead>
<tr>
<th>Mark IV Stud (Ref.)</th>
<th>Thread Size</th>
<th>Nosepiece Sub-Assembly Part Number</th>
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</thead>
<tbody>
<tr>
<td>CA2193-3-()</td>
<td>.1900-32UNJF</td>
<td>CA2100-T13-31SL</td>
</tr>
<tr>
<td>CA2194-3-()</td>
<td>.1900-32UNF, 2 Lead, Mod.</td>
<td>CA2100-T13-32SL</td>
</tr>
<tr>
<td>CA21094-3-()</td>
<td>.2500-28UNJF</td>
<td>CA2100-T13-41SL</td>
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<tr>
<td>CA2104-() HHS</td>
<td>.2500-28UNF, 2 Lead, Mod.</td>
<td>CA2100-T13-42SL</td>
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<tr>
<td>CA2109-() HHS</td>
<td>.3750-24UNF, 2 Lead, Mod.</td>
<td>CA2100-T13-62SL</td>
</tr>
</tbody>
</table>

**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 onto 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.

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 unusually 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.

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.

Install rivets flush to surface of substructure. Panel and substructure must be flush at clamp-up unless spacer of 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 recess.

Tridair Products 46
Mark IV™, Plug 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.

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.
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.)

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

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>.2500-28 UNF-3A</td>
<td>.255</td>
<td>.409</td>
<td>.255</td>
<td>.406</td>
<td>.689</td>
<td>3/32</td>
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<td>.250</td>
<td>.685</td>
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<td>.3750-24 UNF-3A</td>
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<td>.533</td>
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<td>.547</td>
<td>.877</td>
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<td>.527</td>
<td>.375</td>
<td>.873</td>
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</tbody>
</table>

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 ($T_1 + T_2 + "\text{Form-In-Place}"$ 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.
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.

5. Pump handle squeeze to actuate hydraulic cylinder to press Plug into stud bolt. Plug must be fully seated (observe through viewing window).
6. 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

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

... 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.

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 T1 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 counterwink to proper dimension. See page 6.

12. **Problem**
Panels do not mate correctly.

**Cause:**
Head of rivet protrudes above surface of T1.

**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.

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.

15. **Problem**
Hexagon key breaks off in recess.

**Cause:**
Side load applied to hexagon key in addition to torque.
Mark IV™, Positive Stud Bolt Holdout 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
1. 2-lead thread for quick installation.
2. Hexagon socket for reliable, high torque transfer capability without cam out.
3. Carries high, shear and tension loads at joint.

Stud Bolt Hold-Out
1. Retains stud bolt in holdout position to ease installation of curved panel.

Grommet (shown in flared condition)
1. Provides hard seat surface.
2. Superior load transfer.
3. Provides counterbore for retaining ring.
4. Excellent for gasketed or composite applications.

Retaining Ring
1. Non-stressed.
2. 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.

Notes:
1. 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.
2. Any truncation or rounding of hexagon corners within the specified across corners dimensions shall be evident on all corners.

Selector Guide For Hexagon Key or Bit
The following chart shows correct dimension for hexagon key or bit.

<table>
<thead>
<tr>
<th>Nominal Key or Bit and Socket Size</th>
<th>W</th>
<th>Y</th>
<th>B</th>
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<tbody>
<tr>
<td></td>
<td>Hexagon Width Across Flats</td>
<td>Hexagon Width Across Corners</td>
<td>Length of Short Arm</td>
</tr>
<tr>
<td>1/8 0.125</td>
<td>0.1250</td>
<td>0.1235</td>
<td>0.1418</td>
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<td>9/64 0.141</td>
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See Note

<table>
<thead>
<tr>
<th>Nominal Key or Bit and Socket Size</th>
<th>C</th>
<th>R</th>
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<tr>
<td></td>
<td>Length of Long Arm</td>
<td>Radius of Bend</td>
<td>Chamfer</td>
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<td>2.906</td>
<td>4.969</td>
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See Note

Solution:
Take care not to apply side load.
Panel/Substructure Preparation and Installation Data.

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<td>.315</td>
<td>.531</td>
<td>.255</td>
<td>3/32</td>
<td>.689 .685</td>
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</table>

Note: Counterbore in panel provides lower grommet profile.

Grommet Installation:

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.
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:

Place hold-out in hook. Turn and push tool into stud bolt. Slide tool down. Place hook on hold-out and pull out.

Retaining Ring Installation and Removal.

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.
7. Procedure to remove hold-out and retaining ring for 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 counterclockwise (Figure F).

c) At this time all components can be cleaned or replaced (Figure G).

d) To reassemble reverse removal procedure.

Problems/Causes/Solutions

The positive stud hold-out 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.

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: