



South Bay & Kelkheim Operations

Captive Screws



FAIRCHILD FASTENERS

CAPTIVE SCREWS

TRIDAIR PRODUCTS

Supplied for all types of electronic packaging applications.
Wide range of head styles, recesses, sizes, configurations and materials

NOTE

This brochure is meant to be used as a Design Guide only. Sales drawings with full details are available for all captive screws shown in this Guide. Separate catalogs are also available from the inserts shown in this Guide.

Most of the part numbers shown in this brochure are basic numbers only. For ordering purposes, full part numbers will include dash numbers and/or letters indicating size, length, headstyle, material and finish options. Request the appropriate sales drawing for full details.

Most captive screws, whether standard or special designs, are manufactured to customer order. Customers should check lead times with Fairchild Fasteners well in advance of the date need. Contact Fairchild Fasteners for other sizes and materials not shown in this Guide.

Design Guide Index Page

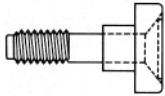


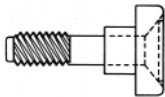


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CAPTIVE SCREWS



These Plus Flush Captive Screws are offered in a variety of materials, finishes, head styles and recesses to accommodate virtually any front panel. They are partially retractable and feature a swage type cativation for permanent installation.

PLUS FLUSH, SWAGE TYPE.

Configuration and Basic Part Number	Head Styles	Size	Material		Finish
			Housing	Screw	
P/N CA11020 Single Lead 	  Slotted Recess Philips Recess	6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide
P/N CA1450 4-Lead 	  Slotted Recess Philips Recess	6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide

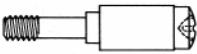





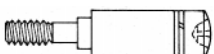




For dimensions and full specifications please use the appropriate sales drawings available from Fairchild Fasteners.

CAPTIVE SCREWS



Spring-loaded, swage type module fasteners are available in fully retractable versions. The fully retracting types automatically retract flush with the panel when released from mating threads. This feature allows equipment to be removed or installed without the possibility of jamming or damage. Swage type housings are ideal for permanent installation.

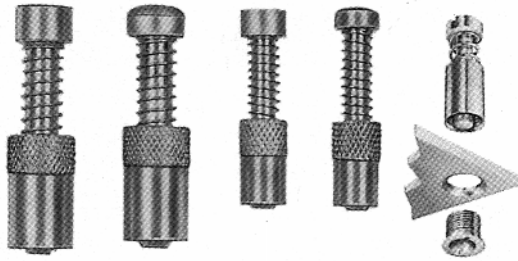
FULLY RETRACTING, SPRING LOADED, SWAGE TYPE.

Configuration and Basic Part Number	Head Styles	Size	Material		Finish
			Housing	Screw	
P/N CA29040 Single Lead 	 Phillips Knurled  Phillips Recess  Slotted Knurled  Slotted Recess  Hex Socket	2-56 4-40 6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide
P/N CA29041 Non-Floating with Captive Lock Washer  Installed and Retracted 	 Phillips Recess  Slotted Recess  Hex Socket	2-56 4-40 6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide

For dimensions and full specifications please use the appropriate sales drawings available from Fairchild Fasteners.

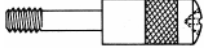

















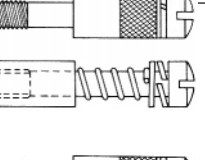







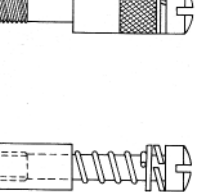










Contact Fairchild Fasteners for information on other sizes and materials.

CAPTIVE SCREWS



Nut Retainer type module fasteners are fully retracting and automatically retract flush with the panel when released from mating threads. This feature allows equipment to be removed or installed without the possibility of jamming or damage. The fastener can be installed or removed easily without special tools for ease of maintenance.

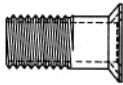

FULLY RETRACTING, SPRING LOADED, NUT RETAINER TYPE.

Configuration and Basic Part Number	Head Styles	Size	Material		Finish
			Housing	Screw	
P/N CA28080 Single Lead 	   Phillips Knurled Phillips Recess    Slotted Knurled Slotted Recess   Hex Socket	4-40 6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide
P/N CA29040 4-Lead 	   Phillips Knurled Phillips Recess    Slotted Knurled Slotted Recess   Hex Socket	6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide
P/N CA28106 Floating with Captive Lock Washer, Single Lead Installed and Retracted 	  Slotted Recess    Phillips Recess   Hex Socket	4-40 6-32 8-32 10-32 1/4-24 5/16-24	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide
P/N CA28102 Non-Floating with Captive Lock Washer 	  Slotted Recess    Phillips Recess   Hex Socket   Unslotted Hex Head	6-32 8-32 10-32 1/4-28	300 Series CRES.	300 Series CRES. or A286 CRES.	Passivated per QQ-P-35 or Black Oxide
Installed and Retracted 					

NUT RETAINER.



To be used with Captive Screws
 Part Nos. CA28080, CA2440, CA28102 and CA28106

P/N CA28085 CA3052 CA28154 	 100° Flush with Slot		300 Series CRES.	Passivated per QQ-P-35 or Black Oxide
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For dimensions and full specifications please use the appropriate sales drawings available from Fairchild Fasteners.

Contact Fairchild Fasteners for information on other sizes and materials.

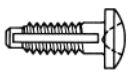

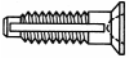

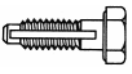

CAPTIVE SCREWS *(continued)*



These retaining ring type of captive screws bridge the gap between conventional designs and high performance structural panel fasteners. The elimination of housing allows direct transfer of shear and

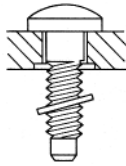
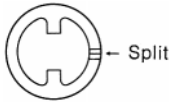
tensile loads through the screw without the usual compromise. The retaining ring retention allows for quick installation and removal with inexpensive hand tools minimizing maintainability problems.

RETAINING RING TYPE.

Configuration and Basic Part Number		Head Styles	Size	Material	Finish
P/N CA21062 Single Lead		 Pan Head with Phillips Recess	6-32 8-32 10-32	300 Series CRES.	Passivated per QQ-P-35.
P/N CA21063 Single Lead		 Flush Head with Phillips Recess	6-32 8-32 10-32	300 Series CRES.	Passivated per QQ-P-35.
P/N CA21088 Single Lead		 Hex Head with Phillips Recess	6-32 8-32 10-32 1/4-28	300 Series CRES.	Passivated per QQ-P-35.

Retaining Ring (Split). CA21062R

(To be used with Part Nos. CA21062, CA21063 and CA21088.)



Typical 21062 Screw Installation with retaining ring and top panel with counterbore to provide retaining ring cavity.*

Material: 17-7 PH CRES
Finish: Passivated per QQ-P-35

*P/N CA21062R Retaining Ring is used to captivate screw to panel. Washer (CA21062W) or spacer (CA21062S) shown below may be used as an alternate to counterbore in the top panel or substructure to form the retaining ring cavity.

Installation Tool.

(For splitting retaining ring)

P/N CA21062T10



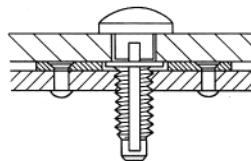
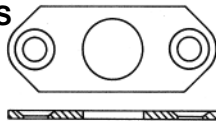
Material: 17-4 CRES.
Finish: Glass Bead Blasted and Passivated per QQ-P-35

OPTIONAL:

Spacer.

(Forms retaining ring cavity)

P/N CA21062S



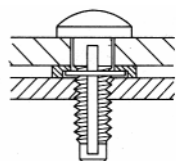
Use of optional washer or spacer provides necessary cavity for retaining ring without counterboring top or bottom panel. Convenient to use with gaskets.

Material: 6061-T6 Aluminum Alloy
Finish: Clear Iridite

Washer.

(Forms retaining ring cavity)

P/N CA21062W



Use of optional washer or spacer provides necessary cavity for retaining ring without counterboring top or bottom panel. Convenient to use with gaskets.

Material: 6061-T6 Aluminum Alloy
Finish: Clear Iridite

For dimensions and full specifications please use the appropriate sales drawings available from Fairchild Fasteners.

Contact Fairchild Fasteners for information on other sizes and materials.

FLOATING NUT PLACE ASSEMBLY.

4-Lead Self-locking.

These nut plates are specifically designed for use with Tridair® quad (4) lead captive screws. They are available in two styles: a conventional configuration is for use with the fully retractable module fasteners and a deep counterbore

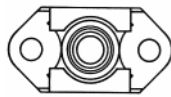
style for the plus flush captive screws. Counterbore allows for thread disengagement before the captive screw begins to jack outer panel away from the structure. Minimum total float is 0.040.

P/N CA3440

4-lead

0.040 minimum total float.

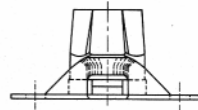
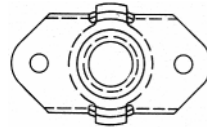
Self-locking.



Sizes
6-32
8-32
10-32
1/4-28

Material and Finishes:
Cage: 18-8 Type 300 Series
CRES., Passivated per QQ-P-35
Nut: 17-4 PH CRES., 190,000 psi min., Dry film lube.

FlatBeam™ Locknuts



Tridair® FlatBeam Locknuts represent one of the latest innovations in precision fastening technology. The patented flexible beam locking elements realize the inherent possibilities of beam fixture while totally eliminating the thread cutting action which plagues first and second generation designs.

Typically more than 250 installations are possible utilizing a single nut. Snap-out feature allows nut element replacement without time consuming cage removal. FlatBeam Locknuts are available from Fairchild Fasteners in a variety of materials and finishes. Contact Fairchild Fasteners for additional information.

4-Lead KEENSERTS Inserts

P/N TR 24265

Internal Thread

Lock



Size:
6-32
8-32
10-32
1/4-28

Material:
300 Series
CRES

Finish:
Insert: Dry
Film Lube
Kees: Passivated
per QQ-P-35.

For dimensions and full specifications please use the appropriate sales drawings available from Fairchild Fasteners.

Contact Fairchild Fasteners for information on other sizes and materials.

Custom Designs.

One or more of the standard Captive Screw designs on the preceding pages will prove suitable for most applications. Some applications, however, will require special configurations or performance. *Fairchild Fasteners' Field and Product Engineers specialize in working directly with customers to resolve unique design requirements.*

A variety of successful custom designs are described in this section which were developed in response to particular user requirements. While these demonstrate a range of design alternatives, no attempt has been made to be all-inclusive. Creative innovation applied to changing situations continually results in new solutions.

No Tools Needed.

These captive screws were designed to allow manual application of seating torque for those situations where normal wrenching tools can not be used. Figure 1 is a fixed position wing. Figure 2 is a sliding T handle, which permits application of considerable torque.

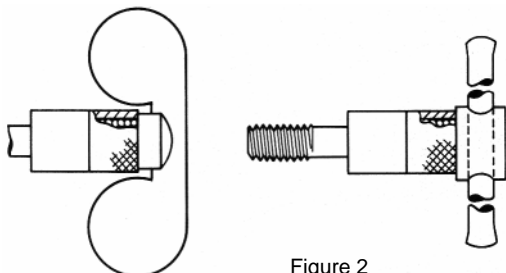


Figure 1

Figure 2

Knob Head Style.

Figure 3 illustrates a knob head style. The linear knurl allows a good grip. Installation and removal can be accomplished by hand with relatively high seating and unseating torque applied with a tool through the screwdriver slot.

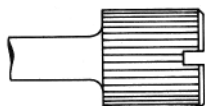


Figure 3

Front Panel Use.

Figure 4 illustrates decorative Plus Flush style for front panel application.

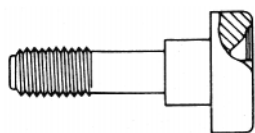


Figure 4

Tamper Proof.

Tamper Proof head style prevent unauthorized access. A rounded head frustrate attempt to jimmy the screw loose; a pin in the center of the hex socket prevents wrenching with a standard hex key.

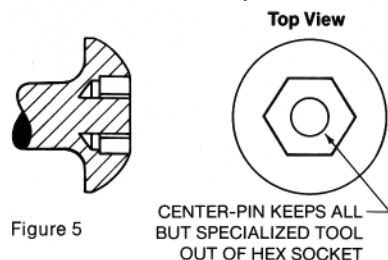


Figure 5

Overcoming Vibration Problems.

Captive screws are frequently used in areas which experience significant vibration and provision must be made to prevent loosening. Captivating a lock washer under the screw head is often an effective approach. Lock wires are avoided which degrade maintainability; reusability is high relative to the normal fifteen cycle limit for self locking threads.

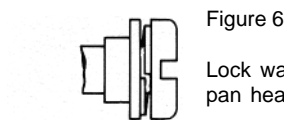


Figure 6

Lock washer captivated on low profile pan head with swage-in type housing.



Figure 7

Fully retracting module type with captivated lock washer and flat washer.

Moisture Seals.

Moisture seals can be provided as an integral part of the captive screw assembly as shown in figures 8, 9 and 10. Sealing is possible under the screw head, along the screw shank, and at the panel housing interface. If needed, seals can be placed at several locations on the same screw as shown in figure 10.

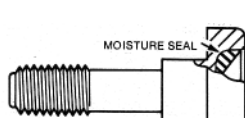


Figure 8

Plus flush style with moisture seal under head.

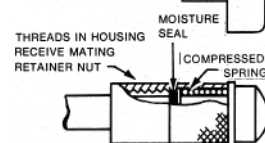


Figure 9

Fully retracting module style with moisture seal along the screw shank.

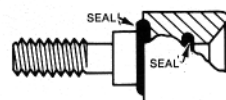


Figure 10

Special configuration utilizing seal on screw shank and at the housing panel interface.

Custom Designs. *(continued)*

Coping with Misalignment.

It is sometimes necessary to cope with misalignment between mating threads. Some captive screw assemblies offer float capability. Another approach is to use oversize holes, washers, and a large retaining ring. The design as shown in figure 11 permitted a large minimum total float of eighty thousandths of an inch (0.080).

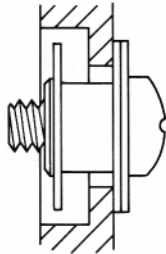


Figure 11

Space Vehicle Application.

Figure 12 illustrates a completely custom design used on a space vehicle. Shown in the installed position, the screw is spring loaded for automatic retraction. An external wrenching hex configuration allows the use of box wrenches on both the head and the housing. The heavy duty retainer nut was provided with a patch lock to prevent loosening under vibration. High performance materials were specified for guaranteed high tensile and shear capability

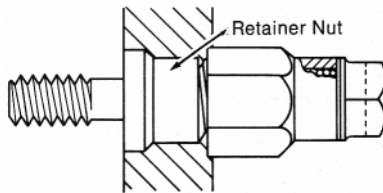


Figure 12

Multiple Lead Threads.

Special thread and point configurations may also be employed to achieve various design objectives. Multiple lead threads have been commonly specified where rapid installation and removal are required. For a more detailed discussion, please refer to page 10.

Figure 13  Standard screw thread.



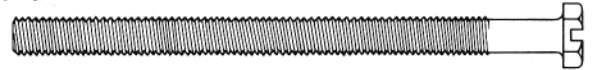
Figure 14  Dual (2) lead thread.

Figure 15  Quad (4) lead thread.

Longer and Shorter than Normal Thread Lengths.

Figure 16 is a design with 10-32 UNF-2A threads. An unusually long thread, equal to approximately 14 diameters was specified. Normally captive screws are designed with thread lengths about 1 1/2 times the nominal major diameter. Wide variations from this norm are possible.

Figure 16



Probing.

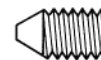
Captive screws are often used in situations where blind probing is required to locate the mating thread. This often frustrating operation can be eased by using an appropriate point style, several of which are shown in figures 17, 18 and 19.

Figure 17



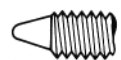
Half-dog point.

Figure 18



Semi-cone point.

Figure 19



Modified cone point, rounded point.

A word of Caution.

When initiating a special design, the user is advised to consider typical purchase quantities. The “economic order quantity” for captive screws is approximately 2500 pieces. Unit prices can rise quite rapidly for smaller quantities.

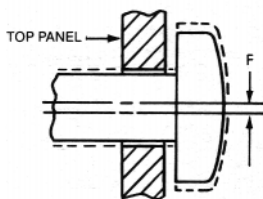
NOTE: Most captive screws, whether “standards” or “specials” are manufactured to custom order. Care should be taken to check lead times with Fairchild Fasteners well in advance of the required date.

Design Problems and Solutions.

Although it may be impossible to anticipate all design problems, certain dilemmas appear repeatedly. The purpose of this section is illustrated successful approaches used to resolve these "standard problems."

The terms "total float", "top panel" and "bottom panel" will be used frequently. "Total float" means the minimum difference in diameter between the captive screw shank and the circle inscribed in the shank surface as it rotates through 360° in the extreme off-center position. This is illustrated by figure 1. "Top panel" indicates the part of the assembly to which the screw is captived. "Bottom panel" means that part of the assembly distinct from the top panel to which the captive screw is joined in the fully installed condition.

Figure 1.

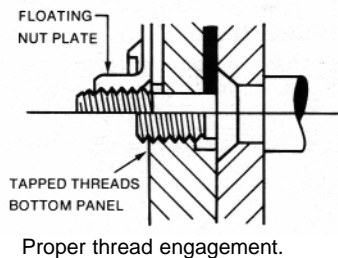


"F" dimension equals total float.

Selecting Correct Screw Lengths.

Determine the distance from the topside of the top panel to the first mating thread of the bottom panel. This is to be accomplished in the fully installed condition. If gasket material is used, all calculations must be done using the thickness of the gasket when compressed. Add to this the required length of thread engagement. Please note that it is standard practice to allow for engagement of at least two full threads past any internal thread lock. Depending upon the location of the lock, additional engagement may be required to insure that full strength is achieved.

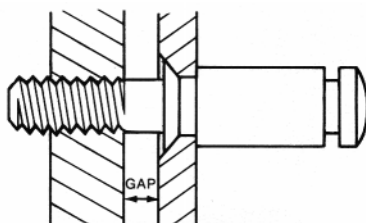
Figure 2.



Care should be taken to avoid the possibility of specifying a screw length/thread combination which could allow the screw shank to jam in the bottom panel threads as shown in figure 3.

Figure 3.

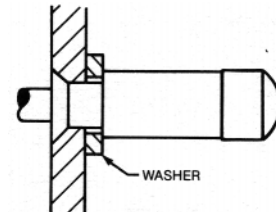
Screw shank jammed in bottom panel thread before clamp was achieved.



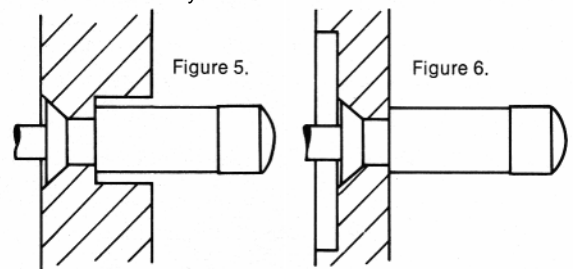
Selection of Correct Housing Swage Collar Length or Housing Retainer Nut.

Selection of the correct collar length or housing retainer nut is accomplished by specifying the dash number which corresponds to top panel thickness as tabulated on the sales drawings. If top panel thickness extends beyond the range of tabulated values, standard components may be utilized by adding spacers in the case of thin panels, or counterboring in the case of thick panels. Use of spacers may cause some degradation of ultimate shear. When counterboring is used, be sure to allow required clearances for installation tools. These conditions are illustrated in figures 4 through 6.

Figure 4.



Build up the panel thickness by using washers. This technique may not allow utilization of full shear strength capability provided by the captive screw assembly.

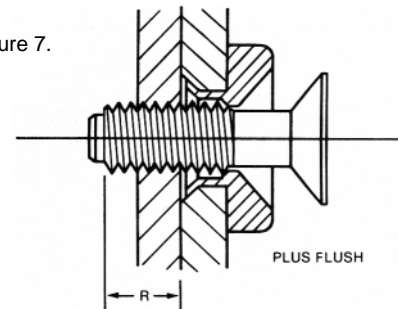


Counterbore used to compensate for thick panels. Note clearance allowed for swaging tool with bottom side counterbore.

Jack-Out Damage.

Destructive jack-out forces may be encountered when removing a panel which uses a number of captive screws. This occurs when a screw reaches the limit of retraction permitted by its housing before its threads are fully disengaged from the mating threads of the bottom panel. The condition is illustrated by figure 7.

Figure 7.



Typical jack-out condition. Screw has reached full retraction. Continued application of torque will result in damage. "R" equals screw protrusion at full retraction.

Design Problems and Solutions. *(continued)*

Jack-Out Damage. *(continued)*

Damage can occur to the threads, the housing, and/or the top panel, requiring substantial repair. See figure 8, views A and B.

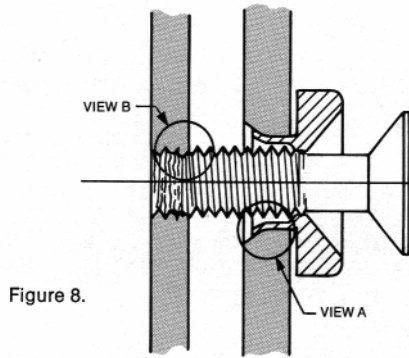
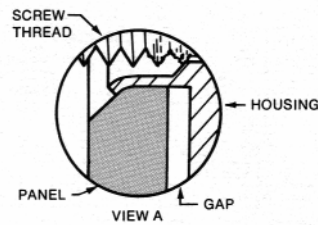
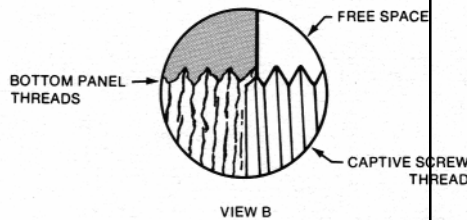


Figure 8.

Areas subject to jack-out damage.



Housing has separated from panel.

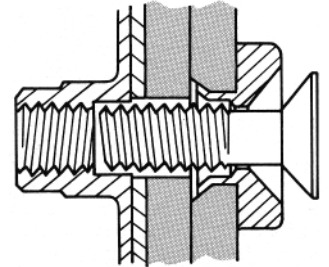


Internal and/or external screw threads can be deformed.

An easy solution is achieved through the use of captive screw designs which accommodate the full thread within the screw housing. The fully retracting styles are described on page 2 & 3. When other screw styles are used, adequate provision should be made for full thread disengagement well before maximum retraction occurs. This may be achieved through relative spacing of the top and bottom panels, and/or counterbores in the top and bottom panels. Counterbores are also available in nut plates and KEENSERTS Inserts. Whatever approach or combination of approaches is employed, the free space achieved must at least equal the length of screw thread protruding below the top panel at maximum retraction. See figure 9.

Figure 9.

Proper design avoids jack-out. Counterbore in nut plate and spacing between panels combine to allow full disengagement of threads before maximum retraction occurs.



Cycle Life Problems:

Captive screws are usually subject to numerous installation and removal cycles, often using a socket wrench. Both cause unusual demands on the wrenching recess. Slotted and Philip's recesses are especially vulnerable to cam-out through slippage or the use of an inappropriate tool as opposed to the correct bit. For these reasons, a hex socket recess is recommended whenever possible. Provided the proper depth and diameter socket is specified relative to the thread size, the hex recess gives superior trouble-free service. Numerous installation and removal cycles can also impose severe wear problems on screw threads. This can become critical when using few threads tapped in a thin bottom panel, or when threads are tapped in soft materials such as aluminum. Tridair® inserts are available for use in these situations. They provide wear-resistant threads capable of developing the full strength potential of the captive screw assembly. Refer to pages 5 and 11. Self-locking threads are often specified in order to prevent loosening in vibration environments. In such cases the cycle life is usually limited to 15 guaranteed installations and removals per MIL-N-25027, provided appropriate materials, surface finishes, and lubricants are specified. Special designs, such as Fairchild Fasteners' new patented high cycle nut plate described on page 5 are available if your application requires self-locking and high cycle life. Contact Fairchild Fasteners for further information. It should be noted that use of a captive lock washer under the screw head is often sufficient to provide adequate vibration resistance. This approach eliminates the 15-cycle limit of typical self-locking thread designs.

Design Problems and Solutions. *(continued)*

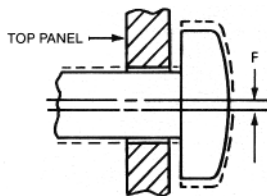
Misalignment.

Potential for misalignment of the top and bottom panel is aggravated when the design dictates use of a number of screws in a given panel. The problem may be minimized through careful use of manufacturing techniques such as clamping the top and bottom panels together and drilling all holes in one continuous operation. Such methods, however, are not always logistically and/or economically possible. In addition, when gasket material is used, misalignment becomes a significant factor regardless of manufacturing method.

Compensation for misalignment may be achieved by specifying a captive screw assembly which allows the screw to float within its housing as shown in figure 10. Screws of this type achieve full float only after the screw threads are extended beyond the confines of the housing. Therefore, it is important to allow adequate free space so that this condition is achieved.

An alternate is to use floating nut plates on the underside of the bottom panel, or floating KEENSERTS Inserts installed within the bottom panel. KEENSERTS Inserts and quad (4) lead nut plates used for this purpose are described on page 5.

Various terms are in use to describe the magnitude of available float. These can be seriously misleading. Please see the introduction to this section for a precise definition of the term "total float" as used here.



Captive screw assembly designed to allow screw to float with in housing.

Vibration Induced Problems.

Captive screws can become loosened and/or disengaged in high vibration environments. Use of a self-locking thread in mating parts is recommended. A wide variety of fasteners are available with this feature, some of which are described on pages 5 and 11.

Use of a lock washer under the screw head can provide a viable alternative approach. For example, see CA29041, page 2.

The screw housing itself may become loosened or disassembled from the top panel. The use of swage type housings will prevent this occurrence. If maintainability requirements dictate use of a retainer nut type design, the nut retainers should be orderd with a patch type lock applied per MIL-F-18240. If this is your application, please contact Rexnord for further information.

For comments regarding the use of multiple lead threads in vibration environments, please see below.

Multiple Lead Threads.

Multiple lead threads have greater helix angles which cause large amounts of axial movement per revolution. For example, a standard 1/4-20 single lead thread screw will advance only 0.050 of an inch in one revolution. The same size screw with quad (4) lead thread will advance 0.200 inch, a four fold increase. Multiple lead threads allow significant time savings over numerous installations and removals in order to meet stringent military maintainability requirements. A variety of quad lead captive screws are illustrated on pages 1 and 3. Mating quad lean nut plates and KEENSERTS Inserts are available as shown on page 5.

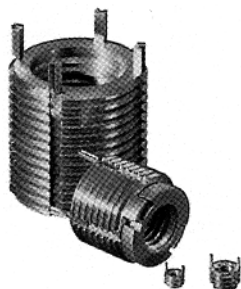
It is important to remember that multiple lead threads are prone to loosening. This condition is aggravated by the use of gasket materials. Standard practice should be to specify mating, self-locking nut plates or inserts; or a captive lock washer under the screw head (see CA29041, page 2). Even with these precautions, quad lead thread are not recommended for use in severe vibration environments.

Multiple lead threads are also sensitive to misalignment problems. Since gasket materials allow significant misalignment during installation, provisions should be made to incorporate float. Please see discussion of misalignment on this page for examples of how to incorporate float in your design.

Contact Fairchild Fasteners for information on their sizes and materials.

***Tridair* inserts**

For use with Captive Screws



Standard KEENSERTS® Inserts.

These inserts feature a solid bushing for maximum strength and high reliability. Built-in exclusive 'kees' assure positive lock against torsional rotation or vibration. The inserts are installed with standard drills and taps.

Lightweight standard and heavy duty types as well as blind end and floating configurations are available. Either free-running or locking internal threads can be specified. For complete information, call or write for Catalog No. 200.

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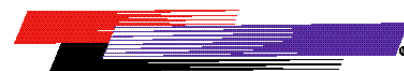
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