

Special-purpose fasteners

Specials have capabilities beyond those of standard fasteners either in the mechanical properties they offer or in their ability to perform multiple functions. Special fasteners therefore can cut assembly costs or reduce the total number of parts required for a product.

Specials include threaded and non-threaded fasteners as well as fastening elements such as clamps and latches. They are made from a variety of metal and plastic materials to meet the needs of a specific design. The only common criterion among specials is that they all perform a fastening function.

Stamped spring-steel fasteners

STAMPED spring-steel fasteners, another major type of special, can range in size from a few pounds down to a microminiature precision stamping used in the aerospace industry. Cost per fastener can range from a fraction of a penny to several dollars. But cost is not a function of size alone. Material, design, and production must be considered.

Most common materials are high carbon spring. Phosphor-bronze, beryllium copper, and also stainless steel are the most commonly used for special applications.

Some guidelines to consider when selecting a stamped spring-steel fastener:

Communication: Get the supplier's engineers involved early in the design process. This will guarantee sufficient lead time to design the fastener, conduct tests, and make any necessary alterations.

Under Engineering: Don't buy based on price alone. The fastener received may be improper for the particular application or too frail for the job. Don't specify a single thread fastener where a multiple thread is necessary. Don't use an existing fastener for an application that requires a new, specially designed fastener.

Over Engineering: Don't request metal which is too heavy for an application, critical tolerances where they are not needed, or oversized nut and bolt combinations.

Remember that a demand for fastener simplicity increases production costs. And,

conversely, oversized fasteners should not be requested when a simpler fastener, possibly even one of the standard fasteners, can be used.

Finish Selection: Choose the finish after the supplier's engineers study the problem. Finish hardness should be based on fastener application.

Material Selection: Match the grade of steel

of the application. Be particularly aware of gage thickness.

Fastener Function: Clearly specify what the fastener is to do when ordering. Be aware of what the fastener limitations are.

Servicing: Before ordering, know if the fastener is to be removed. If so, also determine how often it will be removed and if any special tools will be required.

Dart-type clips



Thin-metal clip is designed for light loads and delicate items.



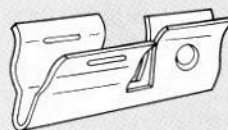
Heavier gage metal gives clip more holding strength.



C-clip retains a D-shaped shaft in a knob. Clip provides multipoint contact within the knob hub and a long-wearing surface.



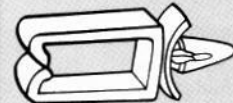
Lips on clips allow easy fastener removal with screw-driver blade or pliers.



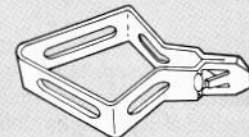
U-clip links a circular shaft to a flat shaft.



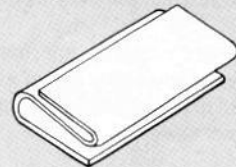
Reusable plastic dart is used where insulating properties are needed or to accommodate panel thickness variations.



Wire retainer has a top-loading feature, and dart-type retainer.



Clip with dart retainer holds ceramic insulator for heating coil.



S-clips, available in a number of variations, are used to clamp panel to panel attachments.



Head of clip is designed to retain miniature lamps.

Assembly Techniques: Be sure the fastener requested is compatible with existing automatic assembly equipment. Don't compromise fastener reliability for fastener assembly speed.

Be sure the assembly workers are properly instructed in the use of the fastener and that the fastener is not so complicated that it results in a high error rate.

Marketing: Consider the possibility of delays when ordering fasteners made of exotic or hard to get materials.

Evaluate order size carefully. Once an order is placed, some suppliers may not be set up to handle high quantity runs on short notice.

Spring clips

Generally, spring clips are self-retaining, one-piece fasteners that slip into a mounting hole or onto a flange or panel edge. They need no secondary fastening devices such as rivets, studs, or screws. Because spring clips are held by spring tension they do not loosen easily through vibration and compensate for tolerance buildup and misalignment.

Materials and finishes

The basic material for the spring clip fastener is steel with 0.50 to 0.80% carbon. Generally, fasteners are hardened to Rockwell C 45-50. Varied spring tensions are obtained by controlling the steel's width and thickness.

Other metals are used, but to a lesser degree, because they cannot match the spring properties of high-carbon steel. Plastic fasteners have replaced metal spring clips in many applications. Plastic designs are limited by their holding capabilities and by some environmental conditions.


Many plastic clamps and fasteners are self-retained to panels by an integral dart shape, an expandable leg, or high-strength contact adhesive.

Coatings can be used to meet special requirements. For example, on metal parts neoprene and vinyl dips provide a soft cushion to prevent chafing and damage. Zinc mechanical plating also provides an attractive finish without danger of hydrogen embrittlement.


Dart-type spring clips

Dart-shaped, panel-retaining elements have "hips" to engage within panel or component holes. They are commonly used for securing two panel surfaces together, as in

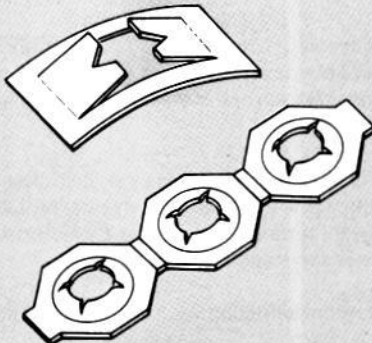
Stud receivers




Thin-wall stud receiver used for 0.05 to 0.625-in. diameter studs in limited access applications.



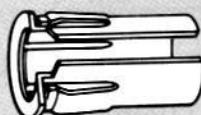
Cap-type receiver, available in metal or plastic, can decorate and protect as well as secure.



Push-on receiver is also available in strip form for automatic assembly.



Fingers on receiver are squeezed together to remove the clip.



Flange and spring-loaded fingers bite on stud to hold tubular clip in place.

refrigerator door liners. Other configurations are used to fasten cables, molding trim, gaskets, and fabrics. Most dart-type clips are easily removable and require a mounting hole and space behind the mounting panel to accommodate the dart.

Dart-type clips can be designed to be installed with finger pressure for light duty or with power tools for heavy applications.

Stud receivers

The three basic types of stud receivers—push-ons, tubular, and self-threading, attach to unthreaded studs, rivets, pins, rods of metal or plastic, or wood. Stud receivers are most commonly made of hardened and tempered high-carbon spring steel.

Push-on stud receivers are made in flat or round styles with two or more prongs that allow the fastener to be forced down on a stud and locked in place. Back pressure against the fasteners causes the prongs to bite deeper into the stud. They can be designed to be either removable or permanent and are available in shapes that receive D, square, or other stud forms. Some types are covered with a metal or plastic cap for protection or decoration.

Tubular spring clips have a split tubular sleeve for securing unthreaded assembly

members. They are used where only one side of an assembly is accessible and a stud member can be incorporated. Examples are nameplates, decorative trim, and knobs.

Most tubular clips require panel mounting-holes or cavities within the mounting panel. Pressed into position as an assembly, the tubular clip is self-retained and permits front mounting of the stud member.

Self-threading stud fasteners form their own thread as they are turned down on the unthreaded studs of diecast zinc, aluminum, or plastic. The spring action of the nut body, plus the interference fit produced by the thread-forming flutes or teeth, provides strong prevailing torque to hold the nut firmly.

Cable and tube retainers

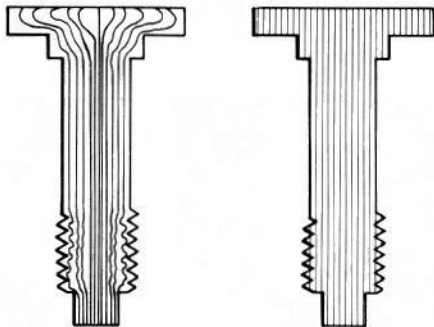
Retaining elements to hold wires or tubing are incorporated into these fasteners that engage panel holes, mounting flanges or panel edges.

These fasteners are front mounting, and require no access to the back of the panel. One spring clip often replaces several loose parts. Because they fasten through spring tension, they compensate for normal tolerance variations and misalignment, and will not vibrate loose.

Cold-heading for strength and economy

Custom-designed fasteners often can be made economically by cold-heading. With this process, details such as washers, shoulders, sleeves, and collars can be formed as one piece instead of being made separately and then assembled. An additional cost advantage of cold-headed parts is the increased strength that permits the use of fewer fasteners or lower-grade metal.

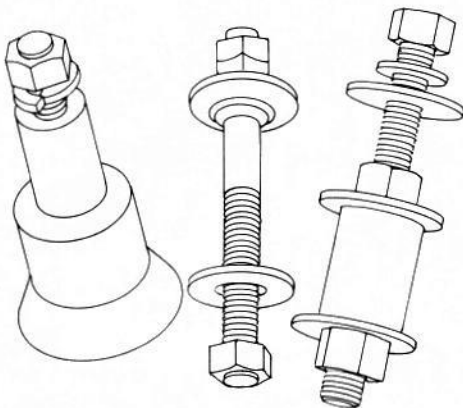
During cold-heading, the metal flows smoothly along the axis of the blank, arranging grain structure to follow the contours of the part. This grain flow eliminates high stress concentrations in corners and increases strength. In contrast, when a fastener is made by machining, metal is cut away, and the grain structure is broken, producing potentially weak areas.



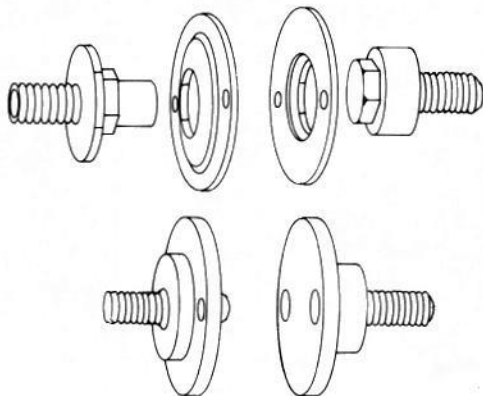
COLD-HEADED

MACHINED

Grain structure of a cold-headed fastener follows part contours rather than being cut as in a machined fastener. The resulting increase in strength can permit cost-saving design savings.



Bushing support for a potato harvester conveyor was originally a cut-to-fit casting that proved to be too time-consuming and costly to fabricate. An alternative welded part also was expensive. Most economical was a cold-headed version, fabricated as a single unit by Elco Industries Inc. The 4.6-in.-long part not only costs less, but also is stronger and lighter than the original component.



Mating detent studs for a self-adjusting truck mirror were originally made in two pieces and then welded together. With cold-heading, the parts were fabricated by Elco Industries Inc. as single units at a lower cost.

Shaped spring clips

Spring clips use compressive spring force to secure assembly components. They can be made in many shapes and sizes to accommodate a wide variety of plastic and diecast parts.

U-shaped clips are used to assemble cover panels, breaker trim, flange and channel assemblies, wire and cables, glass panels, armored cable, hinged components and rubber and fiber materials.

S-shaped clips fasten panel and flanges in line with each other, or at an angle with these clips. They are particularly useful in assembling plastics and other soft materials in blind or hard-to-reach areas.

C-shaped and compression-ring clips have compressive action to hold plastic knobs firmly on steel shafts and permit their ready removal and reuse.

Formed metal fasteners

MOST metal special fasteners made by hot or cold forming are more costly than standard fasteners. Their manufacture usually requires more precision, more manufacturing operations, more highly skilled workmen, and more initial engineering. The payoff is in performance and reduced cost.

Metal special fasteners can be divided into two general categories. First are the modified standards, or fasteners that look much like standards but have been changed slightly in shape or mechanical properties to meet a specific need. For example, a standard hex bolt may be specially hardened or lengthened or have a slot machined in its tip. The other type of special might be called a multiple-function fastener. These fasteners perform some function in addition to fastening. They are incorporated into gears, cams or levers, or contain some other machine element critical to the product.

Plastic fasteners

BOTH threaded and nonthreaded conventional plastic fasteners have the same dimensional, thread class and fit standards as those for metal fasteners. Sizes range from 00 to 3/4-in. diameter and in lengths up to 6 in.

Threaded plastic fasteners include bolts, screws, rods, studs and nuts.

Nonthreaded plastic fasteners generally classified by product families include rivets, washers, pin fasteners, quick-operating fasteners, retaining rings, inserts, spacers, clips, harnesses, clamps, wire bundlers and ties, snap-inserts, and grommets.

Plastic fasteners should be considered for applications where the environmental, thermal, optical, weight, chemical, and electrical properties are a significant consideration for end use.

Plastic materials can meet a broad spectrum of design requirements—strength, rigidity or flexibility, heat, low-temperature, chemical, and corrosion resistance, sealing, toughness, good electrical properties, and light weight.

Common plastic fastener materials are often less costly than their metal counterparts.

In addition to being available in standard fastener shapes, plastic fasteners can be designed to have special functions. Integral color, special undercuts, and molded-in metal inserts are a few of the possibilities.

Assembly can often be simplified when a single plastic fastener replaces several metal components.

A plastic fastener must be evaluated not only on the material to be used, but on the intended application as well. In selecting a plastic material for a fastener application the design should know:

- Physical, mechanical, thermal, environmental, and electrical properties required.

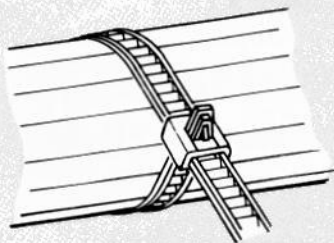
- Fastener plastic which meets the specified requirements.

- Materials, other than plastic, which are suitable for a fastener in the application.

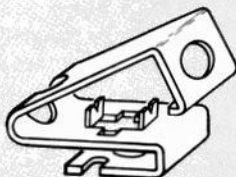
With this information it may be determined if the advantages of the best available plastic material outweigh those of the other candidate materials for the fastener.

In the evaluation of a plastic for use in a fastener the designer should also be aware that new forms of plastic for fasteners can be created by alloying, varying the processing techniques, or adding fillers, lubri-

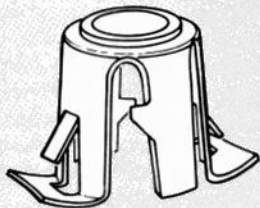
Cable and tube clips



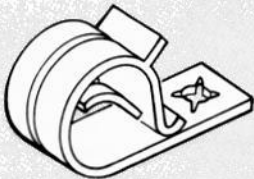
Adjustable binding strap with release tab is reusable.



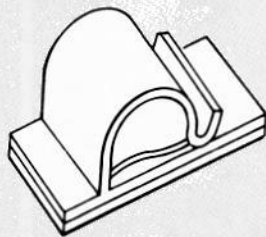
Grounding clip slips onto a panel edge and has barbs which pierce the electric line passing through it.



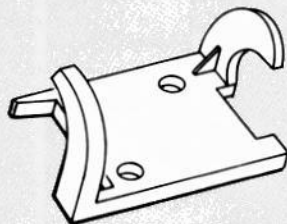
Flexible conduit clip provides low-cost junction-box attachment.



Plastic wire retainer grips stud end.



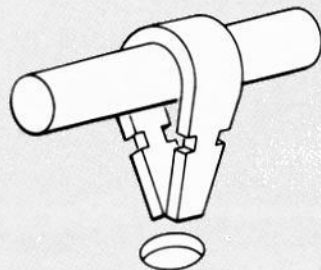
Adhesive backing on clip retains cables without the need for panel holes.



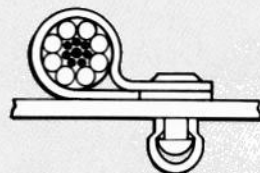
Reversed hooks retain cables or tubes. Installation and removal are fast.



Retainer on tube clip has a self-retaining catch design.



One-piece plastic clamp has notched tapered ends that index with mounting hole.



Various size wire bundles can be retained in flexible plastic clamp.



Purse-lock clips are interlocked to secure the wire bundle. Post clip tip snaps into a panel hole.

cants, or reinforcing materials.

Most of the plastic fastener materials can have a glass or metallic filler added to the base resin to improve strength, stiffness, useful temperature range, and specific gravity. Therefore, it is to the designer's benefit to consult his fastener supplier for assistance in selecting the best plastic material and plastic fastener for a specific application.

Quick-operating fasteners

WHEN repeated access to a component is necessary, the design should probably use quick operating fasteners. When selecting these fasteners, the factors to consider include strength of construction, smoothness of operation, and ease of installation. Speed may also be a consideration if many fasteners are involved. Simplicity of fastener design and operation can also be important. For example, a quick-release fastener with Phillips recess offers fast access only if an operator has the required screwdriver.

Six of the major quick-operating fastener types are: lever-actuated, turn-operated, slide action, push-pull, lift-and-turn, and magnetic catches.

Lever-actuated

Draw-pull catches have either a U-shaped wire bail or a flat spring-steel J-hook connected to a lever that pivots within a housing bracket mounted on one element of the closure assembly. Others have an engagement point built into a combined lever/cover that conceals all the catch assembly components in order to protect the lock and present a clean appearance.

The keeper, which is the element that engages the bail, is usually on the movable element of the closure assembly. These fasteners pull the two elements together tightly and lock by means of an over-center linkage.

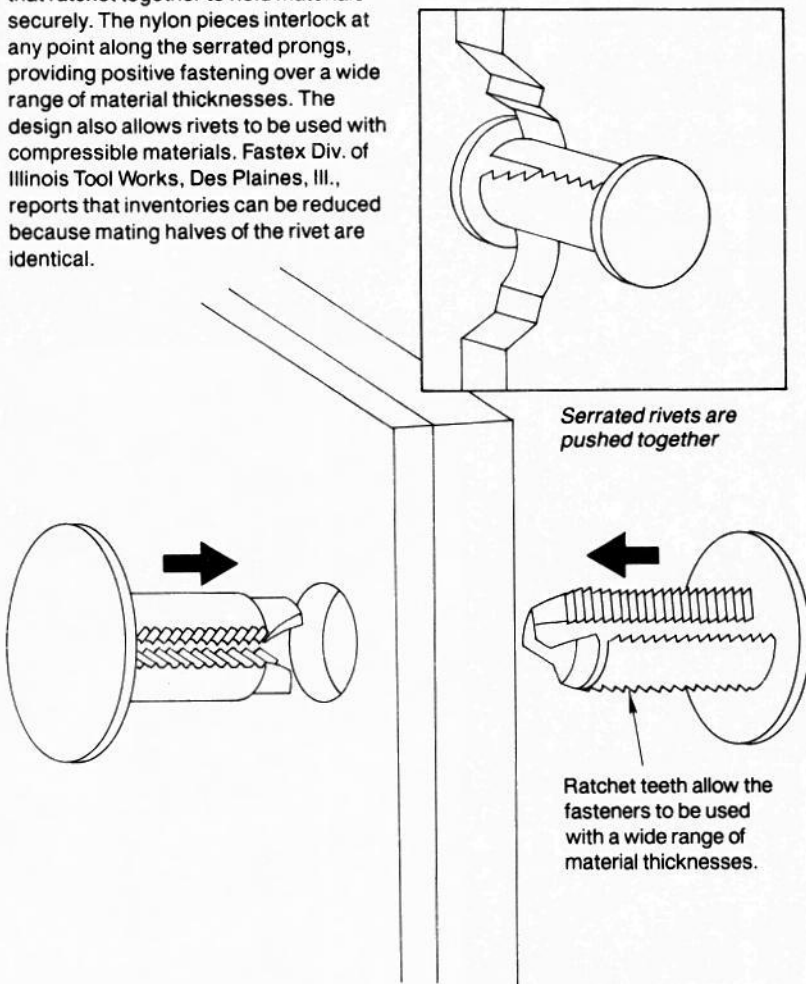
Some lever-actuated fasteners have coil springs or an adjustable threaded hook. These features compensate for installation inaccuracies, wear, gasket set, or damage.

The cam-actuated fastener has a cam which engages, pulls in, and locks a pin mounted in a separate keeper. The cam can be an inherent part of the lever, or it may be a separate component interconnected by a housing.

The draw-pull catch is designed for use on boxes or chests with coplanar surfaces

Ratcheting rivet takes up slack

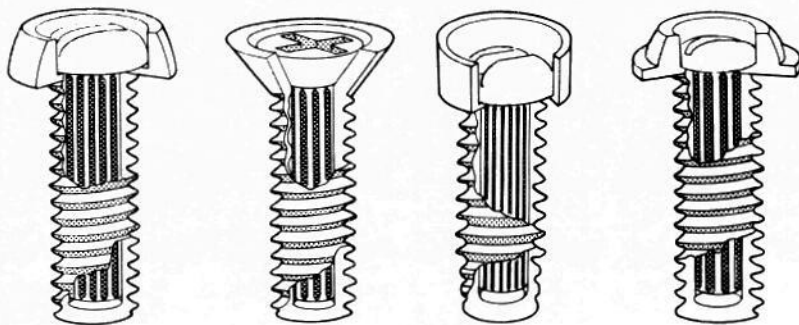
Rivet consists of two identical mating parts with internally serrated prongs that ratchet together to hold materials securely. The nylon pieces interlock at any point along the serrated prongs, providing positive fastening over a wide range of material thicknesses. The design also allows rivets to be used with compressible materials. Fastex Div. of Illinois Tool Works, Des Plaines, Ill., reports that inventories can be reduced because mating halves of the rivet are identical.



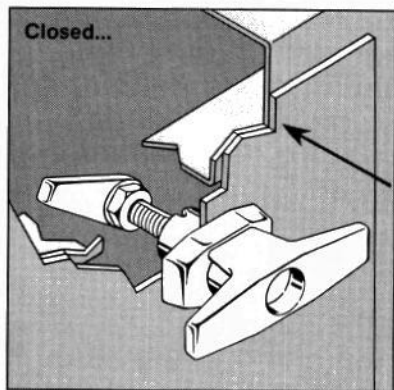
Metal core screws

Where extra strength is required, nylon screws with metal cores can be used. Cores are typically heat-treated high-carbon steel, which may be zinc or cadmium plated. Plastic exteriors are

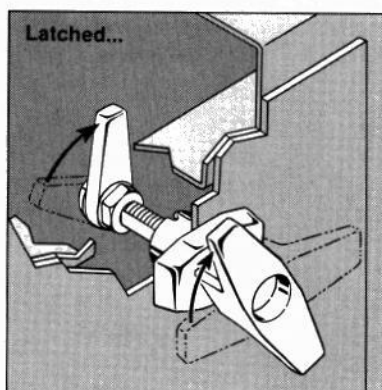
usually molded of Nylon 6/6. The combination is said to provide four times the shear strength of solid nylon screws. Round, flat, fillister, and round-washer heads are available.



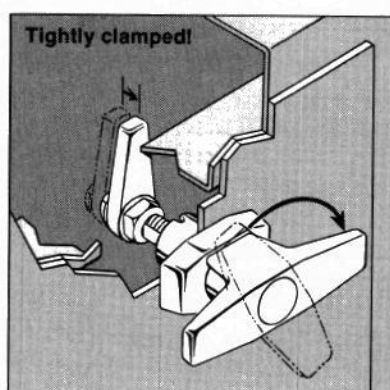
New latch. One quick turn. First, it latches the door. Then it applies compression!



With a single half-turn, Southco's Vise-action Latch completes two sequential motions — it latches the door, then pulls it up tight.

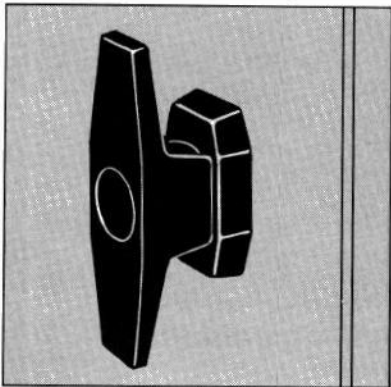


First — start the turn. *Click.* The latching pawl swings smoothly into place behind the door frame. The door is now lightly secured against opening.

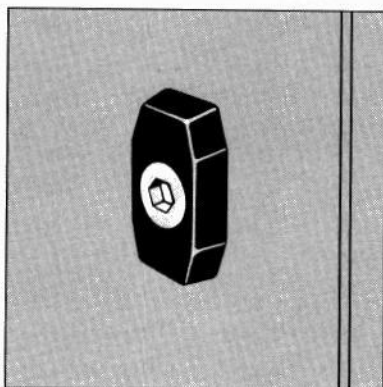


Then — finish the turn. *Click.* The latching pawl now moves toward the door, pulls up tightly against the frame, applies a quarter-inch of vise-like compression to RFI and EMI gasketing material.

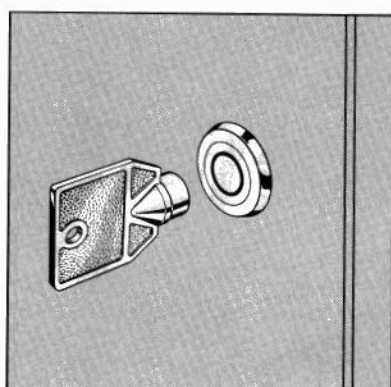
3 versions:



Hand operated —
Durable, 3-hole mount handle has retractable center button. Recessed position indicates partially complete latching; flush position (shown) indicates fully compressed latching.



Tool operated, weather-sealed —
This version of the E3 latch mounts in three round holes, has gasketing for outdoor applications. 1/4" hex-key operation.



Key operated, single-hole mount —
One inch diameter round escutcheon is slightly lower in profile. This E3 latch mounts in one double-D hole.

Use reader service card to request more information. Write on your letterhead to receive a full-line catalog.



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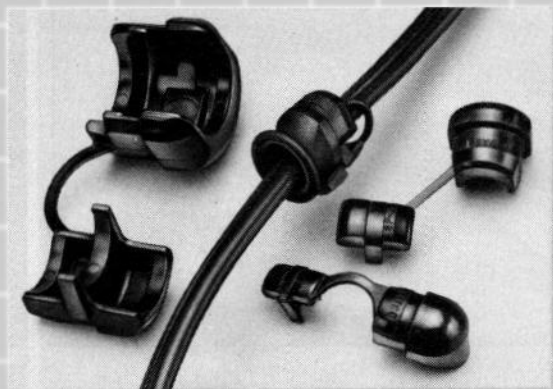
CIRCLE 82

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For relieving strain...

Heyco® Nylon Strain Relief Bushings anchor, insulate and flex-protect cables. They protect the lifeline of your electric/electronic products by absorbing the forces of pull, push, flex and twist on those all-important power supply cables. 63 sizes for all flat and round cable.

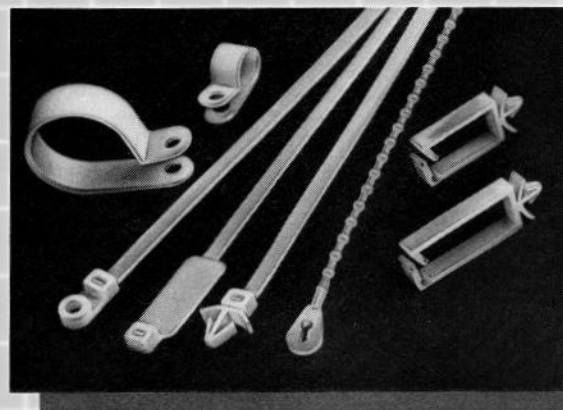
- Bell-mouth type.
- Straight-thru type.
- Right angle type.
- International types.



For insulating cables...

Heyco Nylon Insulating Bushings smooth raw-edged chassis holes, protect, insulate, position and hold cables, tubing, hoses and shafts through chassis walls. Easily assemble with fingertip pressure. 73 sizes for all commonly specified chassis holes.

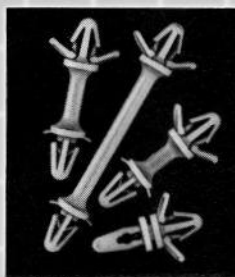
- Snap Bushing.
- Shorty Bushing.
- Double Insulated Bushing.
- Open-closed Bushing.
- Universal Bushing.
- Snub Bushing.



For gathering and tying cables...

Heyco Nylon Cable Ties, Holders and Cable Clamps bundle, tie, anchor and hold cables exactly right. Low cost ways to make sure cables, tubing and hoses are always properly positioned, anchored and "dressed" the way they should be. Both standard and heavy-duty types available in many sizes.

- Nytye® Cable Tie.
- Wire & Cable Holder.
- Beaded Wire Tie.
- Cable Clamp.



For spacing printed circuit boards...

Heyco Nylon Spacer Supports for providing needed spacing between printed circuit boards and chassis. Easy to install, low cost and releasable. Wide ribbed wings plus a barbed chassis lock provide extra stability and a secure fit. Two styles: locking or tension barb at board end. Two materials: 6/6 nylon or fire retardant nylon.

- Spacer Support.

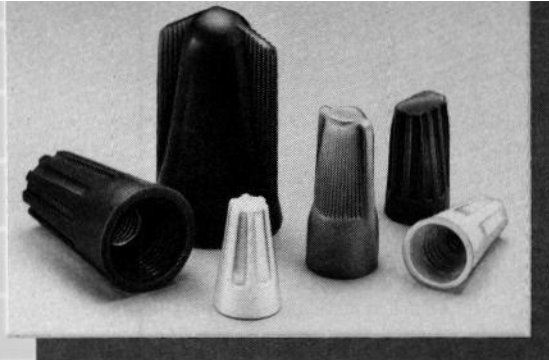
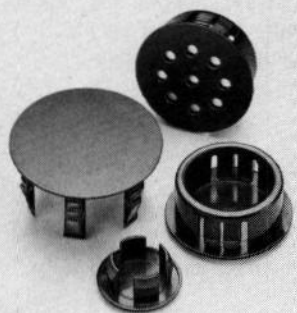


NYLON

For plugging holes...

Heyco Nylon Hole, Vent and Snap Out Plugs perform two key jobs in your products: (1) Hole Plugs for neat, low-cost closures of factory adjustment holes, wiring outlets and unnecessary openings; (2) Vent Plugs that permit passage of air for ventilation and heat dissipation. In either case you get fast, easy fingertip assembly.

- Hole Plug.
- Vent Plug.
- Snap Out Plug.



For connecting wires...

Heyco Turn-on and Crimp-on Wire Connectors are integrally threaded, spring insert loaded or ferruled for quick, easy and secure connection of stranded and solid conductor combinations ranging from #6 to #22AWG.

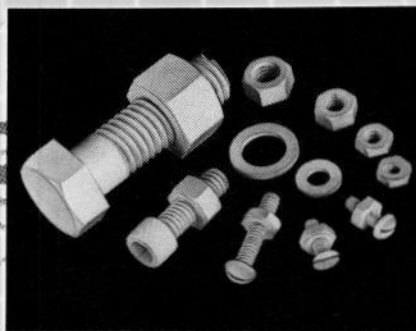
- Polypropylene & Phenolic Turn-on Wire Connector.
- Nylon Turn-on Wire Connector.
- Nylon Crimp-on Wire Connector.
- Urea All-Plastic Turn-on Connector.



For low-cost fastening and assembly...

Heyco Nylon Screws, Nuts and Washers are an inexpensive, reliable alternative to more expensive metal parts. They are tough, resistant to corrosion, lightweight, excellent electrical insulators and they dampen vibration.

- Nylon Screws, Nuts & Washers.



For sealing out liquids...

Heyco Liquid Tight Fittings provide liquid tight seal for cables, tubing, etc., running through clearance or threaded holes. Ten sizes for cable and tubing diameters from 3/32" (2.3mm) to 1" (25.4mm). V.D.E. & SEV accepted. Seven sizes of flex units provide flexible extender to prevent sharp bends and extend life of cable.

- Flex Liquid Tight Fitting.
- Liquid Tight Fitting.



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at the parting line of lid and body. It provides moderate strength across the parting line. The spring-loaded type also has good vibration and impact resistance and requires less care to install, but costs more.

The adjustable catch tolerates even greater errors at installation, permits future readjustments, and provides a solid high-strength pull down across the parting line because it has no springs. This fastener is not intended to carry loads in the planes of motion perpendicular to the parting line or along it because the lids of boxes and chests usually are fitted over mating edges. The draw-pull catch is an excellent fastener for gasket compression on container lids, hinged covers, dust-collector units, and for use on electrical control boxes where specifications will not permit fastener components to extend into the box.

Turn-operated

Stud-type fasteners consist of a stud member and a retaining device, such as a

nut, to keep the stud member within its panel. This fastener may use a system of multiple threads, a single fast-lead thread, or a projecting lug arrangement. They accomplish the three-fold function of engagement, compression, and hold down.

Pawl-type fasteners have a rotatable stud or shaft with a radially projecting pawl. The shaft is mounted through the removable panel, and the pawl engages behind the frame or supporting member. The fastener can compensate for a range of material thickness by using a threaded shaft on which the pawl moves axially when the shaft is rotated, or it may have a fixed adjustment, in which the pawl slides along the shaft and is locked in place with a nut or set screw. The first type provides more compressibility or

pull-up and is intended for use with gaskets or where very tight lock-down is desirable. The second type operates faster.

The quarter-turn panel fastener is designed for access panels, hinged doors and plates, removable signs, large structural panels, and other applications whenever the movable (or removable) panel overlaps the supporting member, and where very rapid removal or frequent access is necessary.

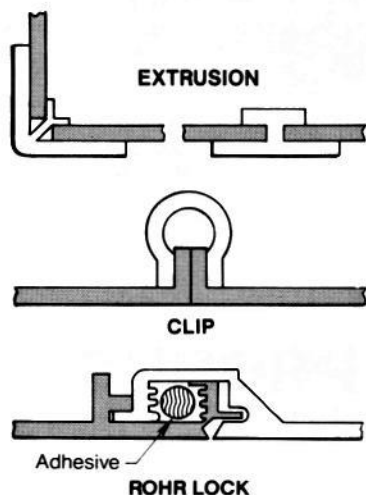
Although they usually provide excellent ultimate tensile strength, these fasteners characteristically are spring-loaded to engage and lock in a quarter turn. For this reason they have low plate-separation load characteristics up to the distance required

Properties of typical plastic fastener materials

Properties	ABS—Thermoplastic offering the best balance of properties of common rigid thermoplastic material — good impact strength, good heat resistance, good low-temperature properties, excellent electrical properties, and fair-to-good chemical resistance. Plateable grades available.	Acetal—An engineering thermoplastic that offers strength, rigidity, and good moisture, heat, and chemical resistance. Excellent abrasion resistance.	Fluorocarbon (TFE)—Used where extreme corrosion resistance is required. Also unusually stable at high temperatures. Has low dielectric loss and constant. Disadvantage is low tensile strength—1/10th that of nylon.
General			
Specific gravity	1.02	1.42	2.12
Water absorption 24 hr @ 73 F (% gained)	0.20	0.25	0.00
Mechanical			
Tensile strength (psi)	3,500-6,200	10,000	2,000-5,000
Elongation (%)	5.0-60.0	25 injection molded	200-400
Flexural strength (psi)	6,000-10,000	14,100	
Hardness Rockwell R	R-75-105	R120	R84
Electrical			
Volume resistivity, Ohms/cm (50% RH and 23 C)	1.0×10^{15}	$1.0-4.8 \times 10^{16}$	2.5×10^{18}
Dielectric strength, Short time 1/8 in. thickness (v/Mil)	350-500	380	495
Thermal			
Thermal conductivity (Btu-ft/hr sq ft-° F)	0.11	0.13	0.15
Specific heat (Btu/lb-° F)	0.41	0.35	0.22
Thermal expansion (10^5 in./in.-° F)	5.8	4.5	4.8
Environmental resistance			
Effect of weak acids	None	Resists some	None
Effect of strong acids	Attacked by concentrated oxidizing acids	Attacked	None
Effect of weak alkalis	None	Resists some	None
Effect of strong alkalis	None	Not recommended	None
Effect of organic solvents	Soluble in ketones, esters, some chlorinated hydrocarbons	Excellent resistance	None

Extrusions and clips

Aluminum extrusions and plastic moldings retain a component, such as a window, or fasten sections together. Spring-steel clips, usually in long lengths, are used to secure large, thin, metal sections. Aluminum extrusions are available in a variety of standard shapes or specially designed configurations to perform a combination of fastening and other structural functions. Moldings, clips, and extrusions may rely totally on friction for their holding power or be used in conjunction with a sealant, or adhesive. For example, the patented "Rohr Lock" (shown) is secured with an adhesive.



to fully compress the spring. If rigid, bolt-like characteristics of plate separation (sometimes called yield or initial tension) are necessary, a threaded screw fastener with fast-lead thread or an adjustable-pawl fastener should be used.

Slide-action

This family of fasteners has a laterally movable bolt-like member, usually attached to or enclosed in a housing bracket. The bolt member is moved across the edge of the closure to engage within, or under, a keeper element mounted to the frame or body of the structure. In some cases, no keeper is used, and the bolt engages directly into the surface of the frame or panel. Some types are

mounted entirely on the outside of the panel-frame structure.

Some slide-action fasteners are manually operated with a push, turn, or pull action. Others are spring biased to latch when the panel closes.

The slide-action fastener converts loads on the panel to shear within the fastener and can be used to restrict motion in at least two directions. Some types have an additional take-up feature that can be used to compress the panel tightly against a frame member or sealing gasket. The draw-pull catch is used where panel movement is along the line of engagement, while the slide-action fastener is used to resist panel movement perpendicular to it. When all components

are externally mounted, this fastener also meets the requirements for control boxes.

Push-pull

The push or pull fastener usually consists of an actuating button or knob that is linked to a locking device on the opposite side of the panel. The locking device may engage a receiver component on the frame member, a hole in the frame member, a lip of the frame, or a shaped striker. The latching action is usually accomplished by pressure engagement, pushing either upon the panel or the latch button.

Variations of these fasteners are numerous, but most employ the following combinations of manual operations: push to

Nylon 6/6—Most common material for standard plastic fasteners. Structurally strongest of all nylons, 6/6 features low coefficient of friction, good insulating properties, self-extinguishing, resistance to heat, shock, vibration, and chemical solvents. It is light, elastic, and has superior torque strength.

Polycarbonate—Most desirable balance of properties of any thermoplastic material available—excellent high and low temperature strength, good heat resistance (up to 250° F under load), high impact strength (in -275 to +250° F range), excellent dimensional stability, nontoxic, and excellent electrical insulation.

Polyethylene—Low-cost, medium-strength material. Good insulator and has "rubber-like" characteristics. Can be used for temperature applications to 190° F.

Polypropylene—Lightest of the thermoplastics. Excellent chemical, heat, and electrical resistance properties; is original "living" hinge material. Main disadvantage is low-temperature brittleness. Plateable grades available.

Rigid PVC—Used for many special fastener applications. Exceptional resistance to acids, alkalies, and alcohols. Excellent in corrosive applications. Self-extinguishing. Will not impart taste or color to materials handled. Good abrasion resistance.

1.14	1.2	0.940-0.965	0.90-0.91	1.35 to 1.49
1.5	0.15-0.18	≤0.01	0.30	0.10
9,000-12,000	8,000-9,500	3,100-5,500	4,300-5,500	5,000-9,000
60-300	100-130	20-1,000	200-7,000	2-40
no break	12,200-12,700		6,000-8,000	10,000-16,000
R108	R118	D63	R95	R113
4.5×10^{13}	2.1×10^{16}	$\geq 10^{15}$	10^{17}	$\geq 10^{16}$
385	400	450	500	1,413
0.14	0.11	0.15	0.08	—
0.3-0.5	0.30	0.55	0.46	—
5.0	3.9	9.0	6.0	3.5
	UL Class I & II			
None	None	None	None	None
Attacked	Slowly attacked	Slowly attacked by oxidizing acids	Slowly attacked by oxidizing acids	None to slight
None	Limited resistance	None	None	None
None	Attacked	None	None	None
Resists common solvents, but dissolved by phenols and formic acid	Resistant to paraffinics, soluble in aromatic and chlorinated hydrocarbons	Resistant (below 80 C)	Resistant (below 80 C)	Resists alcohols, aliphatic hydrocarbon, and oils; soluble or swells in ketones and esters; swells in aromatic hydrocarbons

lock—push to release; lock on closing—push to release; push to lock—pull to release; and pull to lock—pull to release.

The push-pull fasteners perform a basic

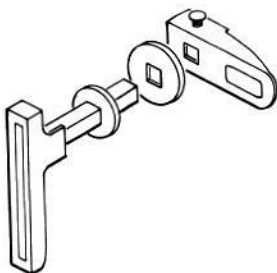
latching function. Some play or clearance must usually be permitted between attached panel and frame in the latched position, since these fasteners do not pull up or compress the panel to the frame or against

a seal. The types requiring a receiver component or a hole in the frame will not tolerate much misalignment.

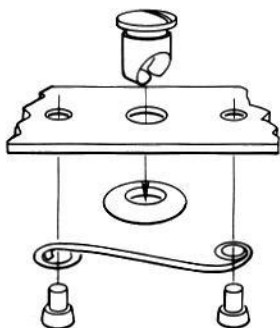
Push-pull fasteners are used where quick

Quick-operating fasteners

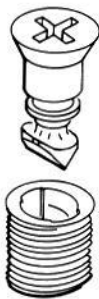
TURN OPERATED



Pawl-type fastener is used for door and frame applications. Easily installed, the fastener can be set to fit various door thicknesses.

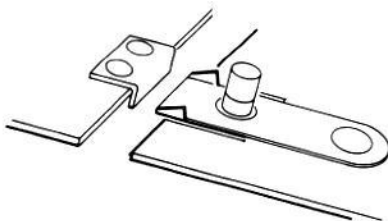


Quarter-turn fastener engages locking spring in panel. Retainer must be riveted or welded in place. A variety of fastener heads are available.

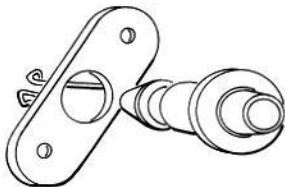


Threaded-receptacle, quarter-turn fastener is used for covers or panels. Receptacle is threaded into a blind or through hole.

PUSH-PULL

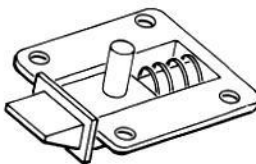


Button latch has hooked lever which engages a lip on the fixed panel. It is used for quick latching in light-load applications.

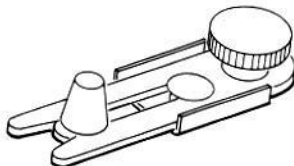


Pin-spring latch engages when the conical pin on the movable panel engages spring fingers on the fixed section. Finger pressure on the pin unlatches the fastener by spreading the retainer-spring finger.

SLIDE ACTION

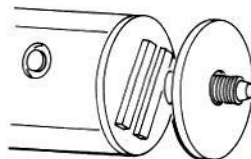


Spring-loaded bolt is usually mounted internally. Fastener does not compress panel or cover against the frame.



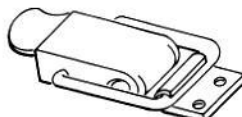
Snap-action latch has a slide on the removable section which engages a stud on the fixed section. Fastener has good shock and vibration resistance.

MAGNETIC

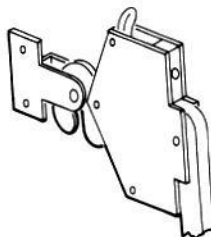


Fastener offers the advantages of no moving parts to wear. It is used where loads are light and no positive mechanical frame to panel connection is required.

LEVER ACTUATED

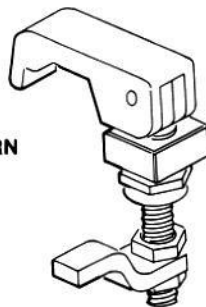


Draw-pull, bail-type fastener has good leverage for pulling adjoining sections together. Used for edge-to-edge applications, it has no parts within the assembly.



Cam-action fastener has good resistance to shock and vibration. Quick disconnect feature can also be used to make or break a circuit.

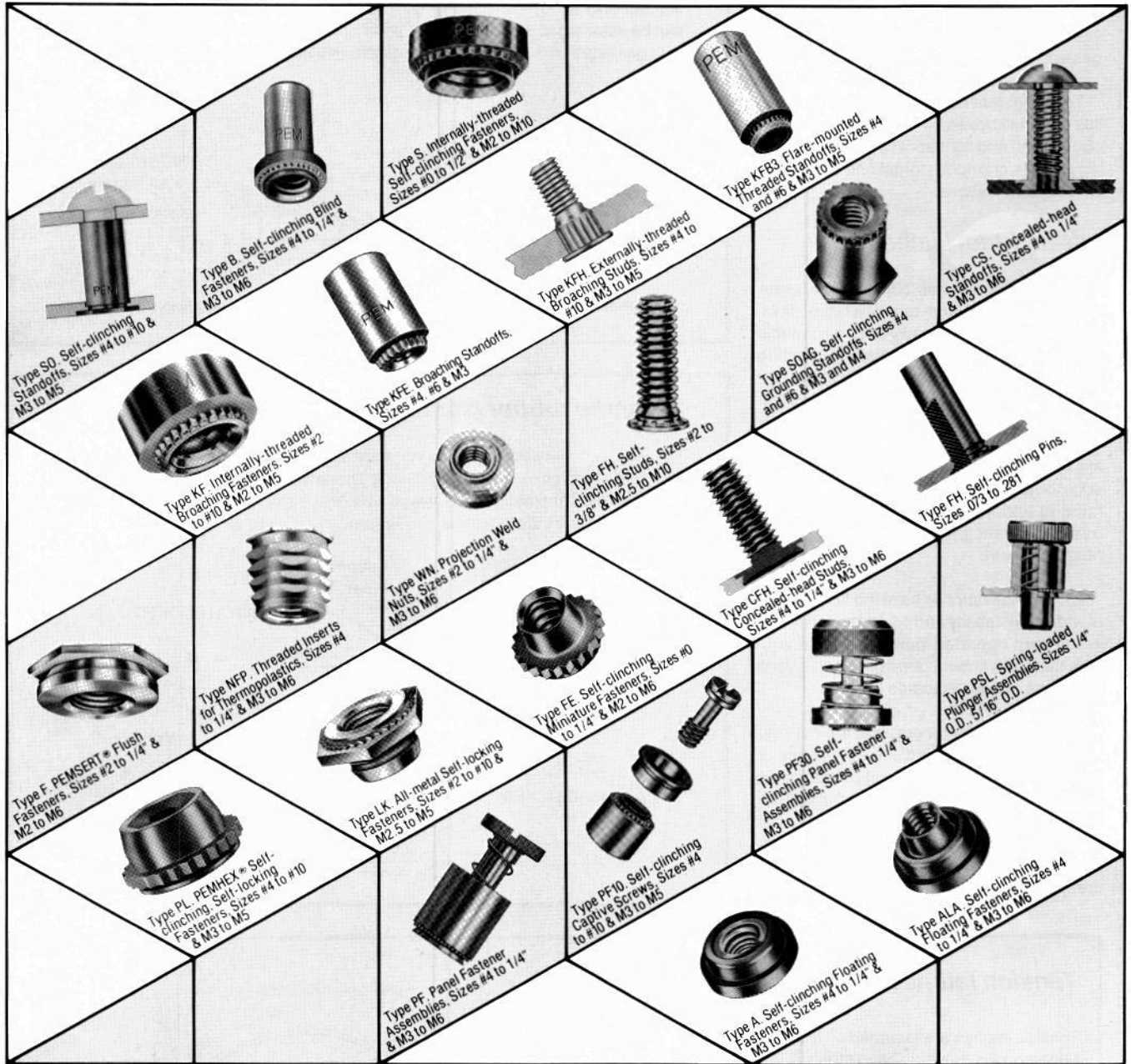
LIFT AND TURN



Compression of the panel to the frame is possible with this fastener. Lever, as opposed to knob, actuation gives a quick visual indication of a locked or unlocked condition.



Provide strong permanent threads in thin sheets.



PEM brand fasteners provide strong, permanent threads in metal and plastic sheets too thin to be tapped. PEM brand fasteners are easily installed by inserting them into punched or drilled holes and applying parallel squeezing forces above and below the fastener. In ductile materials, as the installation force is applied, part of the material cold flows into an undercut beneath the head of the fastener, thereby making the fastener an integral part of the sheet. A clinching ring prevents the fastener from rotating once installed.

PEM brand fasteners are available in many variations. Selections of fasteners include free-running, self-locking, floating, and blind hole types meeting MIL

Specs and ISO standards. They are available in carbon steel, stainless steel and aluminum.

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access without use of special tools is required and where space limitations or other factors make lift, turn, or slide action undesirable. They should be used on lightly loaded panels and where the panel is not intended to be clamped against a frame or gasket.

These fasteners are often used to retain lids on small boxes or with removable panels, covers, and light access doors, particularly under cramped conditions or in poor visibility applications.

Lift-and-turn latches

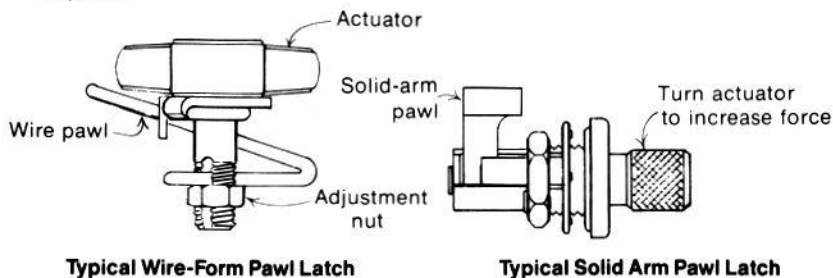
Lift-and-turn latches combine the lever-actuated latches and turn-operated pawl-type fasteners. This family uses a rotatable threaded shaft with a radially projecting pawl that can be positioned along the shaft to accommodate a range of panel thicknesses. The shaft and pawl move axially when the lever is lifted or depressed, causing the pawl to move to or from the inner edge of a frame member. The pawl is rotated to and from engagement behind the frame by rotating the lever while it is in the raised position.

Lift-and-turn latches have the advantages of wide adjustability and compression found in the turn-operated pawl-type fasteners, plus the quick action, good grip, and styling variations of lever-actuated latches.

Lift-and-turn fasteners are usually selected where elongated levers instead of round knobs are better suited to the styling requirements of the application or where the better grip and mechanical advantage of the lever allow tighter panel-to-frame compression. They are also chosen for compression or sealing applications where

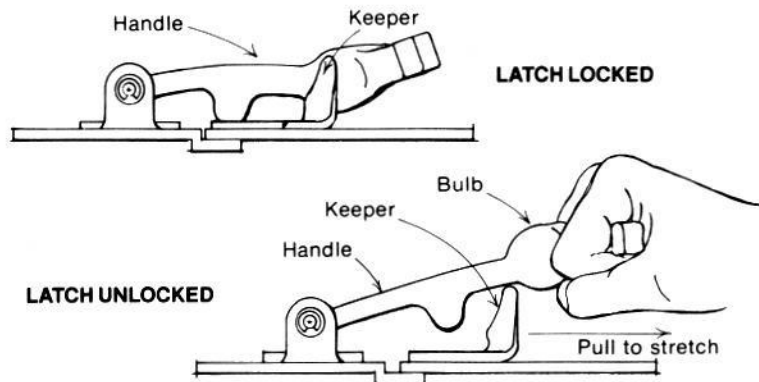
Pawl latches

Pawl latches are used to secure hinged panels. These latches have a rotatable actuator on which a radially projecting pawl is connected. The latch shaft extends through the panel. The pawl engages a frame member. Two pawl styles are generally available. The wire-form pawl is present, by means of an adjustment nut, for a specific latching force. The solid-arm pawl clamping force can be adjusted at each operation. Solid-arm pawl latches are generally used with gaskets and in other applications where high compression loads are required.



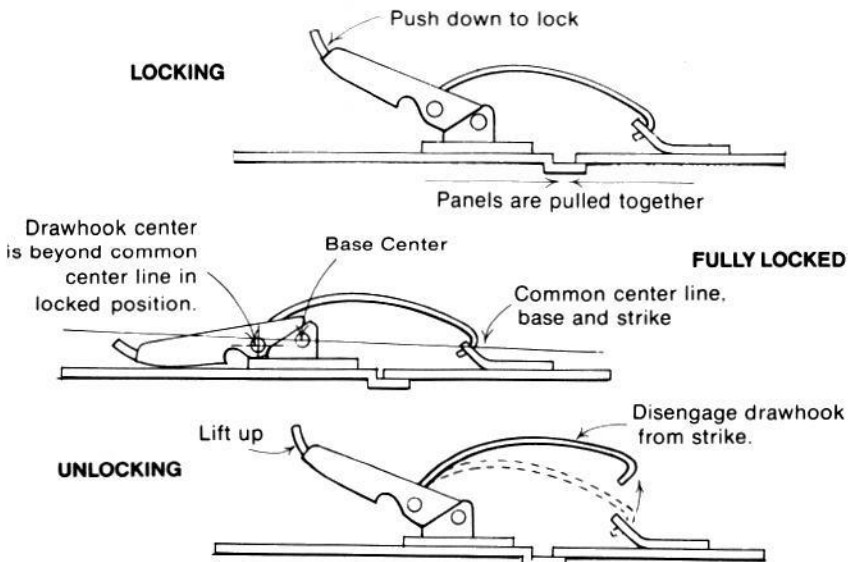
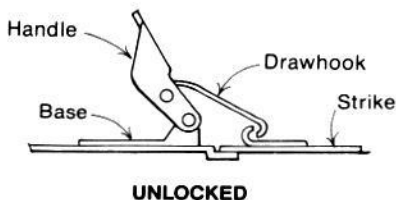
T-handle rubber latches

T-Handle rubber latches provide vibration and sound dampening and compensation for severe misalignment. These latch handles are generally made of ozone resistant material. Base and keeper are steel. To operate, pull on handle and slide bulb of handle into keeper.



Tension latches

Tension latches are fastened by first engaging the drawhook and strike. A downward force applied to the handle pulls panel parts together. A positive lock is obtained when the drawhook center is beyond the common centerline of the base and strike. Panels are held together with tension load on latch. To unlock, lift up on handle.



quick fastener operation is desirable and because the lever position allow a quick visual check on the status of an application where a number of such latches are used together.

Such latches are available with raised handles or with "flush" handles that lie close to the panel. Flush latches are operated by pushing in at one end of the lever, grasping the other end, and turning. Keylock styles are also available.

Magnetic catches

The basic element of a magnetic catch is a magnetic core piece sandwiched between two steel pole pieces. The magnet and its pole pieces are contained within a plastic or nonferrous housing that also provides a way to install or attach the magnetic catch. A small flat steel plate of "armature" is also provided which is installed on the mating component of the closure. The holding force usually does not exceed 15 lb, and 4 to 10 lb is most common.

Magnetic catches are a good choice where quick access is desirable where the forces required to keep the door closed are low and a positive mechanical door-to-frame connection is not required for safety. The outer surface of the door or panel need show no evidence of fastener attachment and, if an edge is accessible to pull upon, no other knob or finger hold is needed.

In addition, magnetic catches have no moving parts to wear out, and are otherwise reliable, trouble free, and little affected by normal environments. The only maintenance required is to occasionally wipe off the contacting surfaces. Installation is quick and economical.

Hose clamps

Hose clamps are made in a wide variety to match load, assembly and cost specifications. Although there are many modifications within each type, the four major types are worm-gear-drive, latch, ear, and quick-connect straps.

Worm-gear metal hose clamps are available in a wide range of sizes for many load conditions. Most have a smooth internal face to avoid damage to hose surfaces.



WORM-GEAR DRIVE

Latch clamps often have a ratchet tooth-locking action to retain clamping load. Typically used for light loads, the clamps are tightened in place with pliers.



LATCH CLAMP

Types of worm-drive clamps

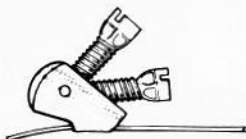
Worm-drive clamps are used primarily to seal fluid or air connections on hoses. When the clamp screw is turned, the screw threads engage the notches in the band. This pulls the band through the housing, reducing the clamp diameter and squeezing the component together to seal the connection.

Clamps are typically made of 200, 300, or 400-grade stainless steel. The 300-grade provides maximum corrosion resistance because of its high nickel content and is usually specified for inground, marine, and other corrosive environments.



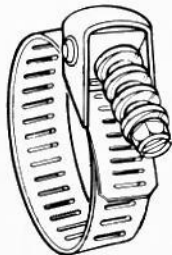
STANDARD

Recommended for general service on hose, pipe and tubing.



TWO PART

For permanent installations of the clamp with rivets or screws. Band lengths and clamp styles vary.



SWIVEL ACTION

Provides quick installation. For 'closed systems' where clamp must be opened to be applied.



MINIATURE

Suitable for installations in confined areas. For small diameter hose, pipe and tubing.



SAFETY COLLARED

Safety collared screw provides slip-proof fastening. Recommended for general service on hose pipe and tubing.



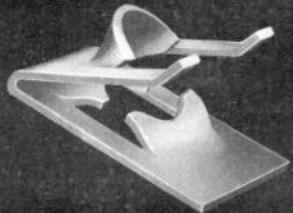
LINED CLAMP

Stainless steel liner prevents hose extrusion and shearing through the band notches. Recommended for use on silicone rubber hose and other applications where clamped surface must be protected.

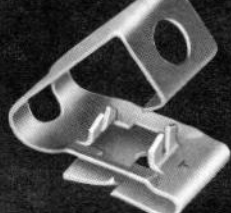
Material supplied by Ideal Div., Parker Hannifin Corp.



Front Mounting Nut Retainers



Special Flat Nuts



Light-Wire Grounding Clips



Quick Release Harness Clamps



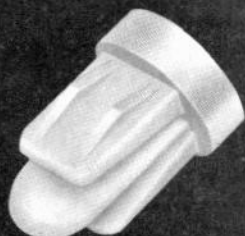
Special Tubular Clips



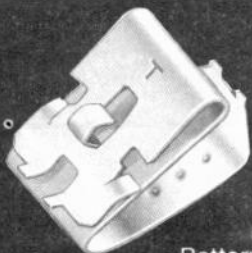
Pinch Grip Fasteners



Hooded J-Type Nuts



Nylon Stand-Off Nuts



Battery Clips



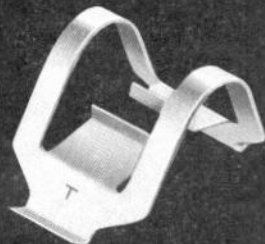
Self-Anchoring Type Nut Retainers



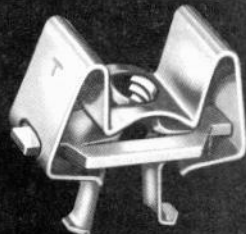
Knob-to-Control Cable Clips



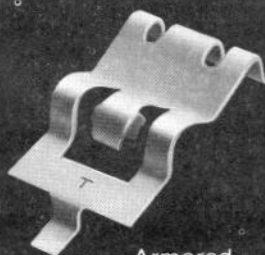
"PC" Mounting Clips



Grill Retainer Clips



Instrument Mounting Nuts



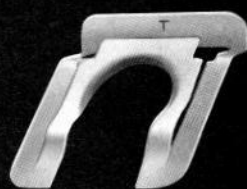
Armored Cable Clips



Wood Anchor Nuts



Strain Relief Clips



Horseshoe Clips

Tinnerman[®] brand fasteners

**one piece, self-locking, self-retaining,
lightweight, vibration resistant, low-cost.**

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Three strategically located plants, recently refitted to meet the *now* needs of industry, are **ready, revitalized, and rarin'** to go. Backed up by a National Network of Authorized Stocking Distributors who offer off-the-shelf delivery. Put these forces to work for you. They will bring new efficiency to your assembly line, new economy to your manufacturing costs, and protect your product's integrity.

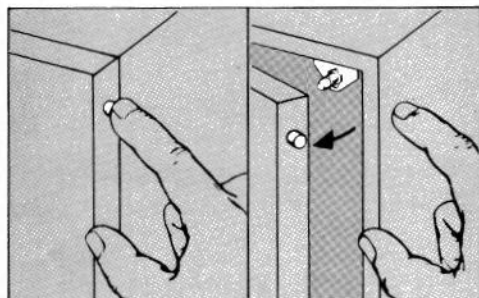
Your Authorized Distributor is listed in the National Yellow Pages under "**Tinnerman**" in the Fasteners-Industrial section. Or write: Eaton Corporation, **Engineered Fasteners Division**, Service Center, P.O. Box 6688, Cleveland, OH 44101.

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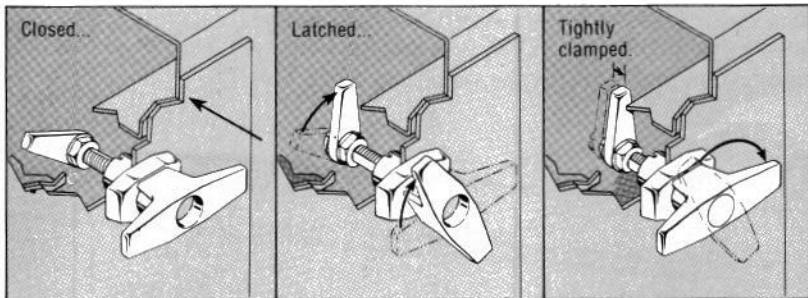
EATON

New

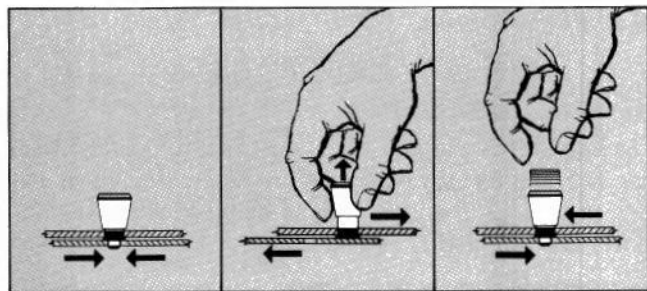
More latches, handles and fasteners ...from Southco.



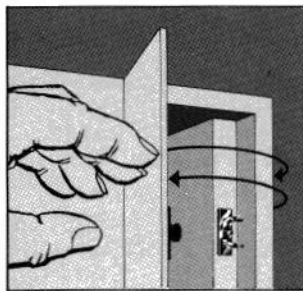
Hidden Panel Latch. Nothing shows on front. Mounts at top, bottom, or sides of hinged or hung doors. Pushbutton, recessed (hidden) pushbutton, or hex key operation. Available in two-point latching styles.



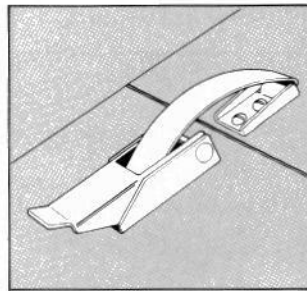
Vise-Action Latch. With a quick, easy half-turn, latch completes two sequential motions: it latches the door, then pulls it up tight and applies 1/4" of vise-like compression to shielding or gasketing material. Latch available with 3-hole mount T-handle plus two tool-operated styles (single-hole mount or weathersealed).



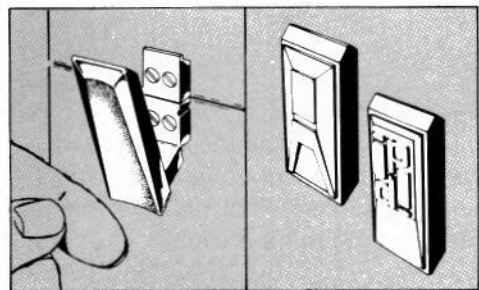
Spring-Loaded Plunger. Holds sliding panels, drawers, tubular products, etc. against lateral (sliding) movement. Pull to release locking stud from inner member hole; release to snap it back into alignment.



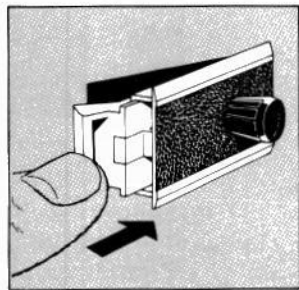
Tiny Touch Latch. Press to open...press again to close. Snaps into your door frame. Nothing shows outside.



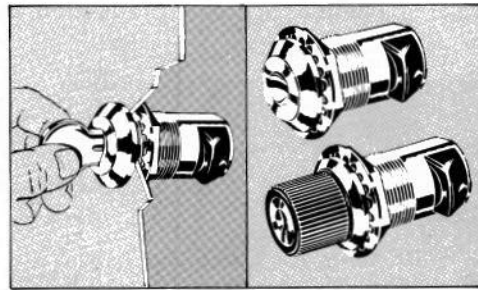
Over-Center Draw Latch. Simplifies latching of lids, covers, hoods, etc. Series 60 expands line to four sizes.



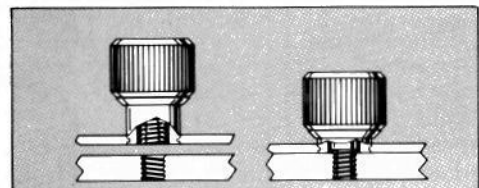
Draw Latches. Clean, decorative one-piece latches with integrally hinged sections (no pins). Flip open, snap shut. Custom designs and custom colors available.



Snap-In Slam Latch. Snap into opening and slam door —it's installed. Now available for hex key or knob operation.



Slam-Action Keylatch. Keylatch offers quick installation in standard 3/4" lock cylinder mounting holes. Dust and moisture shield available for low profile key-actuated style.



Press-In Retractable Screw Fasteners. For economical panel fastening. New hardened steel ferrules for installation in a variety of metals. Press-in installation. Metric sizes too.



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Single-use ear clamps are also usually applied in light-load situations. The clamp is slipped over a hose or duct and the ears are crimped with special tools.



EAR CLAMP

Quick-connect straps are suitable for large-diameter ducts and light loads. The strap is pulled to a loose fit, then adjusted tighter by turning the screw.



QUICK-CONNECT STRAP

Self-sealing fasteners

AN IMPORTANT auxiliary function of fasteners is preventing gases or liquids from leaking. When large areas or mating surfaces must be sealed, a gasket or chalking compound is used. In this case, the fastener provides clamping force but contributes little to the sealing action. If the fastener hole itself must be sealed, or the fastener acts as a plug, a separate element or compound may be added to the fastener. Fasteners with preassembled, or built-in, seals include screws, rivets, nuts and washers. Rubber, elastomers, plastic, soft metals, and interference fits are all used to maintain a seal.

In addition, certain thread-locking compositions can be used to coat the threads. When these materials cure a bond is formed.

As a side benefit, the insulating properties of some sealing fasteners prevent electrolysis, and reduce vibration and noise.

Design considerations

Cost is usually determined by type of sealing element. The designer should be particularly aware of the amount of time the fastener will have to perform the sealing function. Often a lower cost sealing fastener is satisfactory if the exposure to gas and liquid is not continuous.

Materials choice depends largely on ability to resist attack from the liquid or gas it is to seal. Common sealing materials are: Buna N, neoprenes, butyl rubber, silicones, natural rubber, fluoroethylene polymers, polyethylene, and nylons. The characteristics of these materials should be carefully matched to the design requirements.

Temperature can have both beneficial and detrimental effects on the initial seal. In low-pressure applications, moderate temperatures sometimes improve the initial seal. Prolonged exposure to higher-than-ambient temperature causes many seal materials to harden. Abnormally high temperatures can cause a complete breakdown in the seal.

Pressure can cause mastic sealers or soft elastomer sealing compounds to flow. They are not recommended for pressures above 100 psi. But, when properly supported, the soft material will resist 2,000 psi. "Soft" sealing fasteners are not recommended for

critical applications where surface quality may vary.

Rubber and plastics can resist leakage in the full range of pressure from vacuum to more than 5,000 psi.

Corrosion may be resisted by many special formulations of rubbers and plastics. In some severe applications, stainless-steel fasteners are used with silicone or Viton rubber, or fluorocarbons.

In all cases the sealants should be tested to determine if they react with the mating surface or the fluid or gas being contained.

Life is directly affected by environmental conditions. If not subjected to extreme temperatures or severe corrosive conditions, rubbers and plastics give excellent service, typically 10 to 25 years. Reusability is an important design consideration because the sealer supports the load in most reusable fasteners. In nonreusable fasteners, the fastener element takes the load.

Self-sealing fasteners

Sealing techniques for fasteners and fastener elements include: resilient materials such as rubber; or nylon washers, collars, or inserts; flowed on sealants; nylon pellets, plastic coatings or jackets; soft metal collars or inserts and interference fits. Most thread locking compounds also perform a sealing function.

SELF-SEALING RIVETS



Molded rubber or O-ring



Interference fit



Aluminum or lead washer



Plastic jacket

SEALING WASHERS



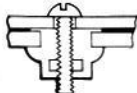
Nylon collar



Copper insert



Flowed-on sealant



Rubber body

SEALING SCREWS



Nylon collar



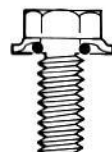
Metal washer with neoprene coating



Nylon strip



Lead or bronze washer

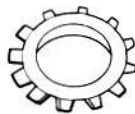


Molded rubber or O-ring

SEALING NUTS



Steel and neoprene



Lock washer with flowed-on sealant



Nylon ring

WHEN PERFORMANCE IS CRITICAL...SHUR-LOK.

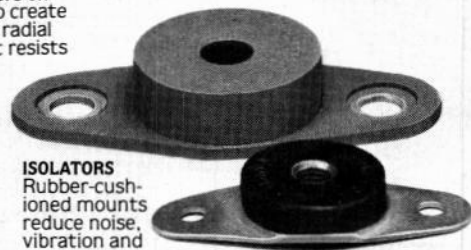


EXPANDABLE DIAMETER FASTENERS
Reusable fasteners expand to create a tight radial fit that resists shock.

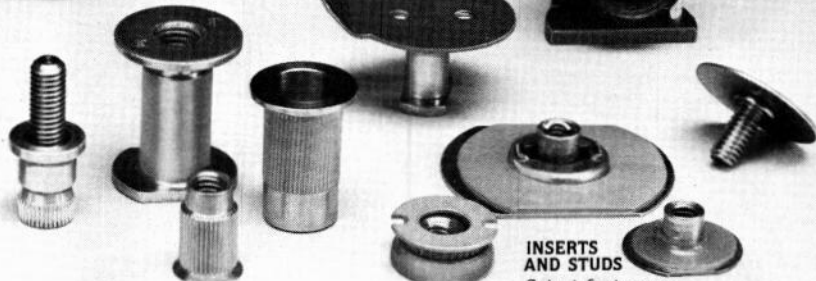
BEARING LOCKNUTS
Prevailing torque locknuts offer precise adjustment and Sta-Lok® Locknuts feature controlled tensile preload.



BARREL NUTS
Reduce weight with high tensile barrel nuts for primary structure applications.



ISOLATORS
Rubber-cushioned mounts reduce noise, vibration and heat transfer.



INSERTS AND STUDS
Select fasteners for composites or blind inserts for sheet metal applications.

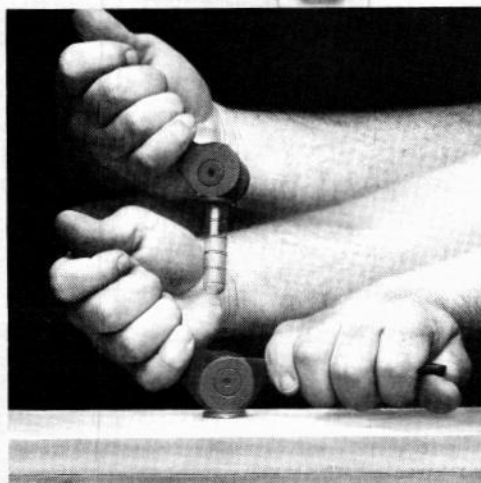


CLIP NUTS
Self-locking clip nuts install without rivets.

A Shur-Lok fastener is the best reliability insurance you can buy. Built to perform under the most rigorous conditions so you can design with confidence.

Industry demands superior performance, so we manufacture our fasteners and components with a dedication to product reliability - it's what our name stands for.

Extensive testing and rigid adherence to quality control standards assures you maximum performance. In the field, technical support personnel are ready to answer questions and



Quick-release Expandable Diameter Pins simplify service and maintenance.

solve any application problems.

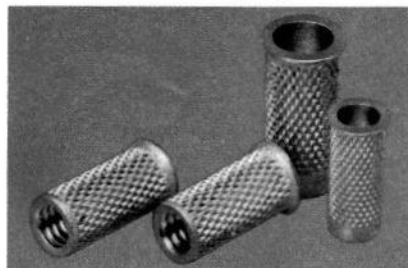
Whatever your component requirement, you will find Shur-Lok offers reliable products - designed and produced for superior performance. For more information call (714) 474-6000 or write Shur-Lok Corporation, 2541 White Road, Irvine, CA 92713.



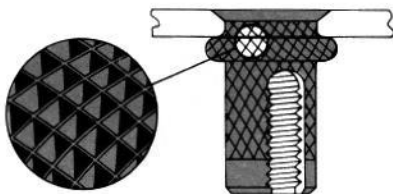
Camloc™ Fasteners for For Robotics to Radar

Inserts

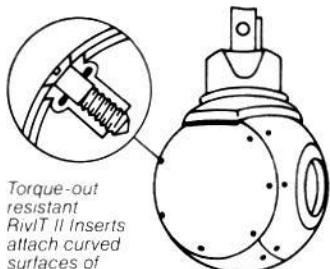
Camloc RiviT II™ Inserts



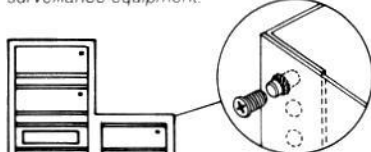
Updated version with improved design features. Now provides a more consistent pull-up capability with high torque-out values. No special hole configuration required. Readily available from sizes 4-40 through 3/8-24.



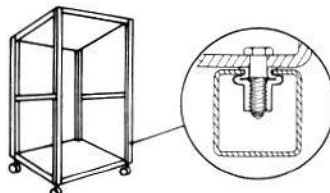
New diamond recess knurl provides high torque-out resistance. Its gripping action is far superior to similar style inserts. There's no special orientation required.



Torque-out resistant RiviT II Inserts attach curved surfaces of surveillance equipment.



Low installed cost RiviT II Inserts used in RETMA rails of telecommunication PBX cabinet.



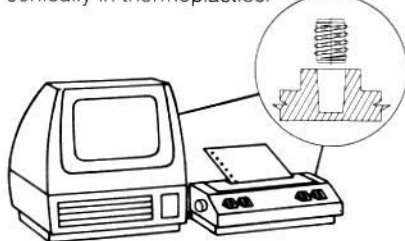
Blind-installed RiviT II Inserts secure square tubing on computer mainframes and cabinets.

Circle 180

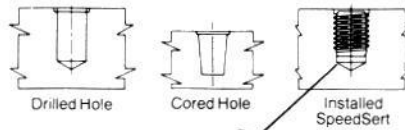
Camloc SpeedSerts® Inserts & Studs



Forms its own thread in plastics or light metal castings. Unique wave form threads assure chip-free installation. Stainless or brass. Bidirectional design eliminates need to orient each insert prior to installation. Also installs ultrasonically in thermoplastics.



High-speed installed SpeedSert Inserts used on plastic CPU and printer enclosures of small business computer.



Self-threading no-chip SpeedSert Inserts are used on plastic cover of word processor keyboard where long-lasting threads are required.

Circle 000

Knife Thread Inserts for Wood



Provide permanent steel threads in wood without crushing wood fibers. Can also be used in rubber and laminates. Available in inch and metric sizes.



Ideal for use on computer and office furniture, interior of aircraft or boats, wood accessories, hinge plates, shipping containers, etc.

Circle 181

Quick-Operating Fasteners

Camloc 1/4-Turn Fasteners

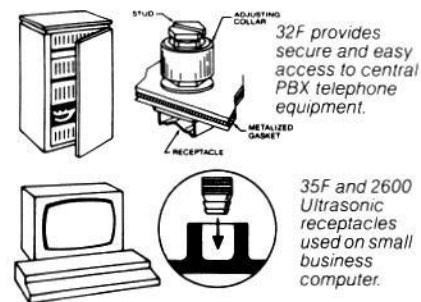


Versions Shown are Typical Only.

*Patented

Widest choice of quick operating, high performance fasteners for low installed cost. **35F Series.** Smallest 1/4-turn with snap-in stud assemblies; various head styles. Clip-in, press-in, and ultrasonic receptacles. **79F Series.** Snap-in studs and receptacles for low-cost installation. Push stud to close; open with 1/4-turn. **5F Series.** Miniature hand-installed fastener. Ideal for chassis rails with prepunched holes. **2600/2700 Series.** Widest selection of hand and tool-operated studs. Receptacles include ultrasonic and hand-installed types. **15F Series.** Push-to-open, push-to-close. Numerous stud actuators including adhesive mounted concealed version. **32F Series.** Positive compression of RFI/EMI gasketed panels. Provides the adjustability and clamping force of a threaded device with the convenience of a 1/4-turn fastener.

Typical 1/4-Turn Fastener Applications



Circle 182