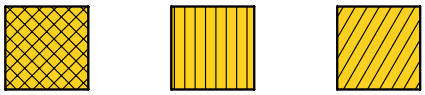
SPIROL® INSERT DESIGN

The objective is to design an Insert with sufficient torque resistance to accommodate the tightening torque necessary to achieve sufficient axial tension load on the threaded joint to keep it together and prevent loosening, while also achieving pull-out values necessary for the load conditions that the Insert will be exposed to while in service.

In general, resistance to torque is a function of diameter and resistance to pull-out is a function of length. These functions, however, are interactive and the challenge for the designer is to achieve the optimum combination of both.

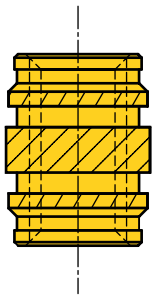
TYPES OF KNURLS



POST-MOULD INSTALLED WITH HEAT OR ULTRASONIC INSTALLATION

Knurls are used to increase resistance to torque. Straight knurls, as opposed to diamond knurls, are the preferred design. Coarser knurls increase resistance to torque but they also induce greater stress on the plastic. In addition, the circumference of the Insert determines the knurl pitch so there are practical limitations on knurl design. Helical knurls, in comparison to straight knurls, lower torque resistance but increase axial pull-out resistance. In practice, knurl angles between 30 and 45 degrees have a positive impact on pull-out resistance with a minimal loss of torque value. Several knurl bands with different helix angles can be combined on the same Insert to achieve an optimum combination of torque and pull-out resistance.

Some Inserts are designed with a slightly larger diameter knurl band between two slightly smaller diameter knurl bands on either side separated from the larger knurl band by grooves. With a properly designed Insert installed in a hole manufactured as recommended, the plastic will flow over the larger knurl band into the groove and knurls behind the larger knurl band in the opposite direction of installation, significantly increasing pull-out resistance. All the plastic above the larger knurl band in effect becomes a shear plane. A head facilitates plastic flow into the upper grooves of the Insert.



Finally for best performance, it is essential that the Insert is installed axially square to the hole. This can be facilitated with tapering the Insert or by providing a pilot. Pilots need to be of sufficient length and have a plain, unknurled diameter the same size or slightly smaller than the hole.

DETERMINING PROPER INSTALLATION

Retention within the hole is provided by the plastic conforming to the external features of the Insert. A sufficient volume of plastic must be displaced to entirely fill these external features so that the Insert achieves maximum performance when the plastic solidifies. An accurate way of determining sufficient plastic flow into the knurls, barbs and undercuts of the Insert is to take a cross section of the installed Insert and ensure that the features are mirrored in the plastic as shown in *Figures 1* and *2*. It is extremely important to ensure proper plastic flow into the features of the Insert as this dictates the torque and pull-out performance. In *Figure 2*, the plastic did not sufficiently flow into the retention features, which will result in low Insert performance.

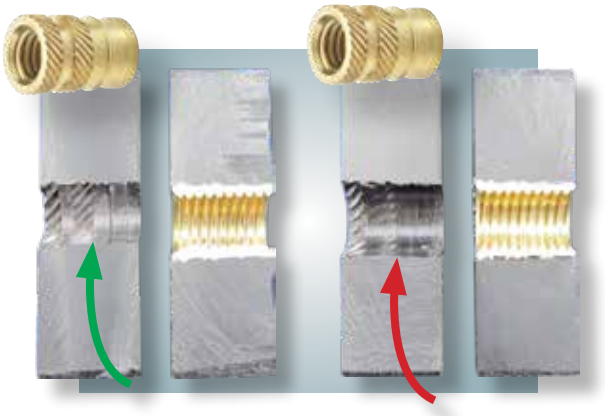
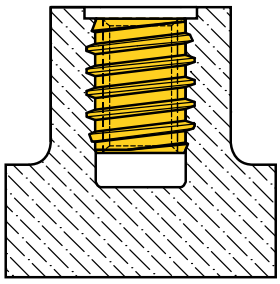


Figure 1. Proper Plastic Flow Figure 2. Improper Plastic Flow

SELF-TAPPING INSERTS

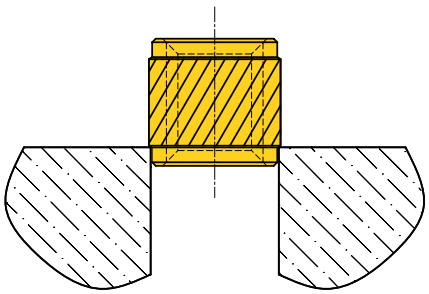


Provide the best pull-out resistance for a post-mould installed Insert. The threads are designed with a thin profile to minimise inducing stress into the plastic and a relative coarse pitch to provide the maximum plastic shear surface to resist pull-out.

Installation torque is not a problem in that tightening increases the friction between the plastic and threads, and the larger diameter of the external Insert thread increases the frictional surface. Back-out torque performance relies totally on the greater surface area of the external Insert thread and the tension between the threads and plastic.

Again, to facilitate installation square to the hole, a good pilot is essential.

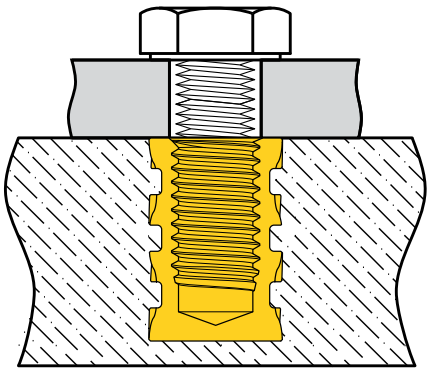
PRESS-IN INSERTS



These Inserts are designed to reduce installation cost at a sacrifice of torque and pull-out performance.

Helical knurls are used to provide both torque and pull-out resistance and to ensure good plastic flow as the Insert rotates into the hole. Installation torque to achieve sufficient tension between the threads is not a problem in that the helical knurls are designed so that the direction of the installation torque will have the tendency to drive the Insert into the hole — which of course is not possible — as the threaded joint is tightened.

A pilot only slightly smaller than the hole and of sufficient length is designed to assure straight Insertion into the hole.



Blind-end Inserts provide an additional alternative to prevent plastic from flowing into the inside of the Insert.

MOULDED-IN INSERTS

This process, although generally more costly in getting the Insert into place than the post-mould installation process, provides the best performance.

Both length and diameter have an impact on pull-out resistance and torque. The challenge is to find the most cost-effective solution that provides/meets the installation torque requirements to achieve a good threaded joint, and the pull-out values that meet the application load requirements.

Helical knurls are the designer's choice to maximise the torque resistance for a given diameter. The volume of these knurls must be such that sufficient plastic is encapsulated in the voids to meet the installation torque requirements for the given bolt.

The amount of plastic trapped in the undercuts of the Insert must be sufficient to achieve the pull-out resistance to which the Insert is subjected while in service.

In order to facilitate insertion into the mould squarely on the core pin, the tolerance of the minor thread diameter is reduced for a good fit between the Insert and these mold core pins. Countersinks are designed to simplify the placing of the Insert on the pin.

SPIROL

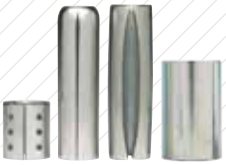
Innovative fastening solutions. Lower assembly costs.

Coiled Spring Pins

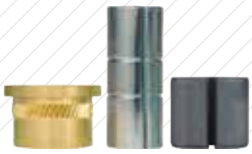
Slotted Spring Pins

Solid Pins

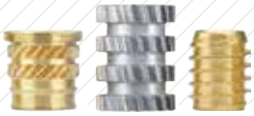
Alignment Dowels / Bushings



Spacers & Rolled Tubular Components



Compression Limiters



Threaded Inserts for Plastics

Railroad Nuts

Disc Springs

Precision Shims & Thin Metal Stampings

Precision Washers

Parts Feeding Technology

Pin Installation Technology

Insert Installation Technology

Compression Limiter Installation Technology

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