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WHITE PAPER

# Solid Pin Retention Features

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Solid Pins are commonly used as permanent fasteners in a wide range of applications. They are retained by the harder Solid Pin displacing material in the softer host component(s). There are two primary methods of accomplishing this:

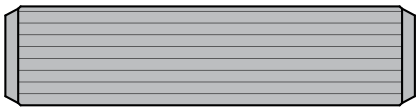
1. **Press-fit:** Press-fit dowels and straight pins are typically retained in the assembly by being pressed into holes that are smaller than the pin diameter. The pins are retained by compressing the host material.

2. **Retention features:** Retention features (i.e. knurls and barbs) are often preferred over press-fit dowels because they allow for wider hole tolerances and lower insertion forces during assembly. Knurls and barbs carve into the softer host component, and displace the host material into the valleys of the knurls and barbs. This results in more frictional contact area between the pin and hole, and thus higher retention as compared to simple press-fit doweling.

This White Paper describes the common types of retention features and can serve as a reference tool when designing a new product. There are several types of Solid Pin retention features, and it's beneficial for designers to take advantage of the characteristics associated with each retention feature. The four most common retention features are described below.

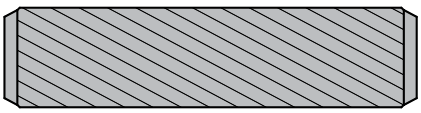
## Straight Knurls

Straight knurls provide strong resistance to rotational forces but minimal resistance to axial loads. Therefore, straight knurls are often recommended when the pin is used to transmit torque, such as when used as an axle to rotate a wheel. In this type of application, the pin would have a partial knurl equivalent (or shorter) to the thickness of the retaining component. The mating component could then rotate about the pin's "blank" (non-knurled) section.



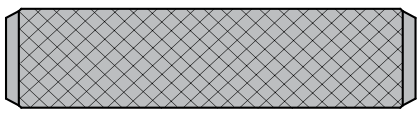
## Helical Knurls

Like a screw, Solid Pins with helical knurls rotate as they enter the hole and cut into the host component. The helical knurls provide greater surface contact than straight knurls, therefore providing greater resistance to back out. Helical knurls provide resistance to both axial loads and rotational forces. In dynamic applications with solely rotational loads (like the wheel and axle mentioned above), straight knurls are preferred because helical knurls subjected to torque have a propensity to rotate further into or out of the hole - depending on the direction of rotation. In general, helical knurls are the most versatile among the Solid Pin retention features.



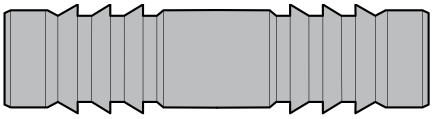
## Diamond Knurls

Although they are very common, diamond knurls provide little value compared to the other retention features. Diamond knurls shred the host apart during installation and introduce a risk of particles escaping the hole. While they do provide some retention, it is minimal. Diamond knurls should be avoided.

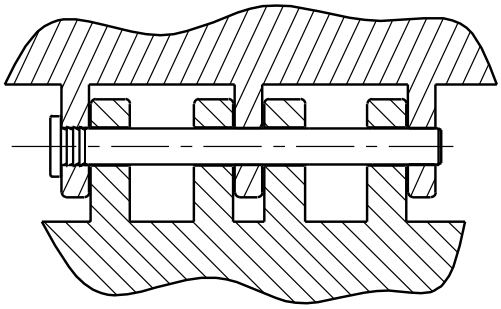


## Barbs

Barbs were designed specifically for use in plastic assemblies. The raised barbs are angled backwards, opposite the direction of insertion. The plastic of the host component naturally backfills around the metal barb after installation permanently joining the components together. Barbs provide the greatest retention among the retention features discussed in this White Paper.



*Application example:*
**SPIROL LP500 Latch Pin in Automotive Door Handle**



## Solid Pin Retention Features in Comparison

| | Straight Knurls | Helical Knurls | Diamond Knurls | Barbs |
|---|---|---|---|---|
| **Resistance to axial loads** | **Limited** | **Good** | **Limited** | **Great** |
| **Resistance to rotational forces** | **Great** | **Good** | **Limited** | |
| **Use in plastic assemblies** | ✓ | ✓ | ✓ | ✓ |
| **Use in non-plastic assemblies** | ✓ | ✓ | ✓ | |

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