White Paper

LOCATING PINS AND HOW THEY ARE USED

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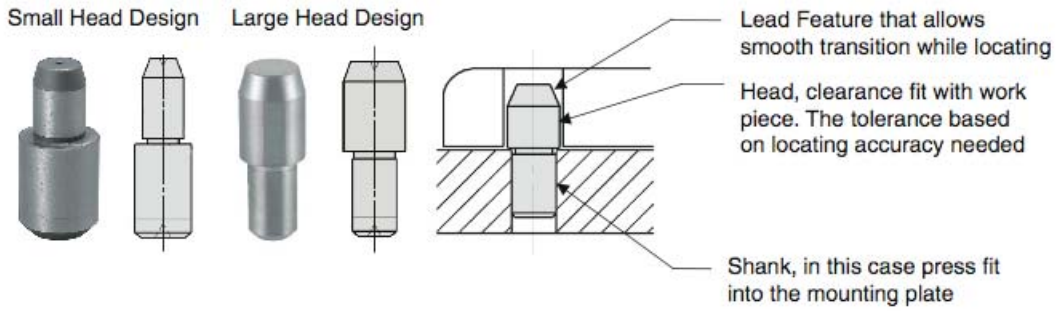
This white paper reviews the various types of locating pins available for machine designers and offers insights into the proper application of such locating pins.

Typically, the locating pins are used for controlled, fine tolerance positioning of a work piece. For example, a pallet that is moved along one axis, where the drive mechanism is not accurate and stable enough to place it in a position sufficiently accurate to execute a particular process, the use of locating pins may be the best solution.

Usually two locating pins are enough to properly locate the work piece on one plane.

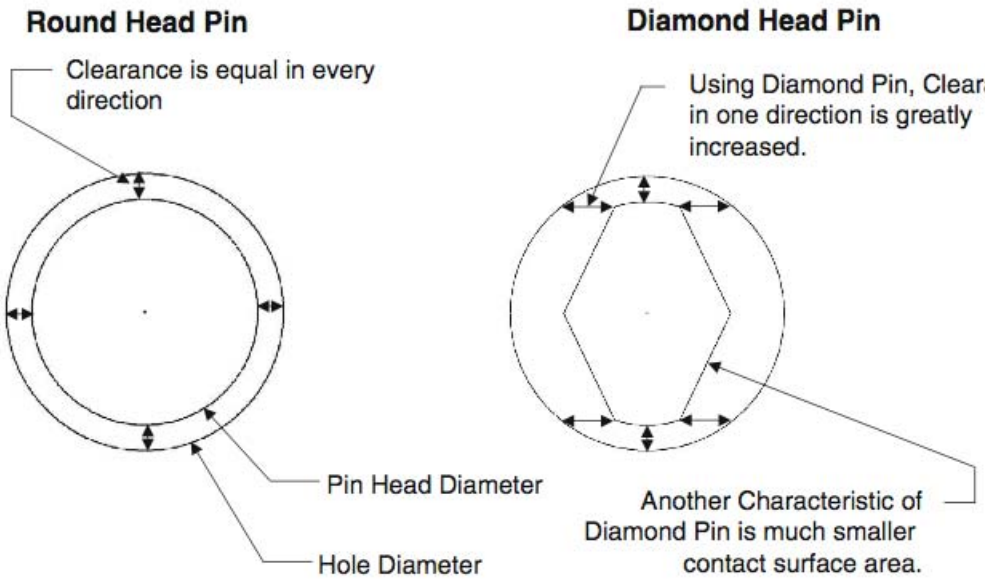
There are dozens of styles of locating pins that can be utilized in a design. We will explain the structure and show an example of how each style can be applied.

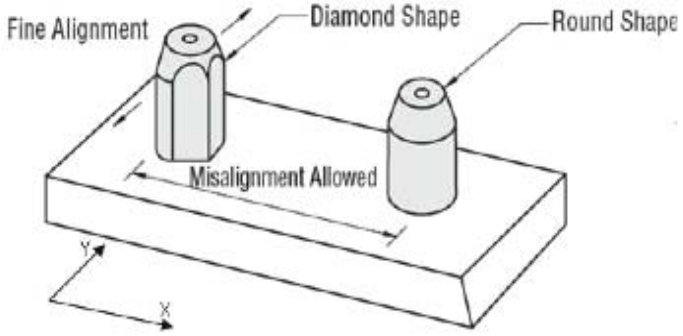
One of the most common pins is a stepped pin with either small or large head.

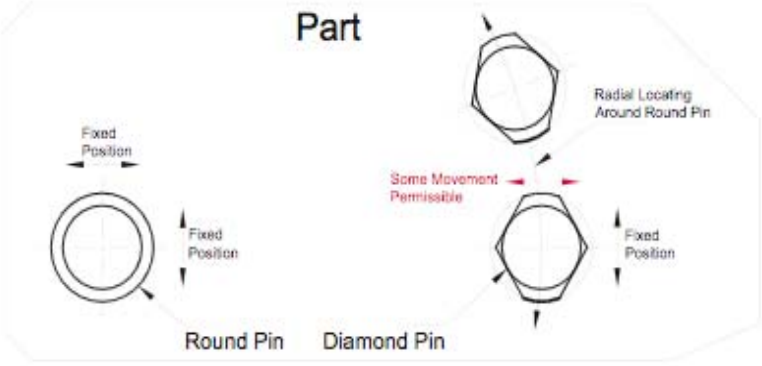


Diamond Shaped Pin

The Diamond Shape is a critical feature that helps with machining inaccuracies and smoother locating operation. When two round head pins are installed onto one plate, the distance between two mounting holes must be extremely precise and even then, the work piece will not be placed on the base as easily as it would with the use of a diamond shape pin.

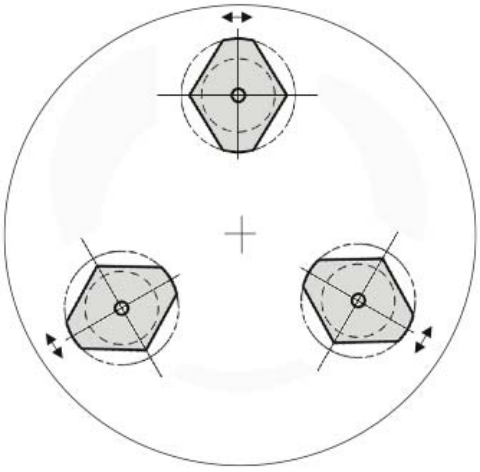






Please, see figure 2. The round pin is the datum pin that is located on the base and fixed in both X and Y direction. The Diamond pin oriented properly allows minimal misalignment in the X axis, but prevents the work piece to move in the Y direction. This way you eliminate small inaccuracies in respect to mounting hole distance and even if it's manufactured with high precision, the operation will improve since there is less work surface area.

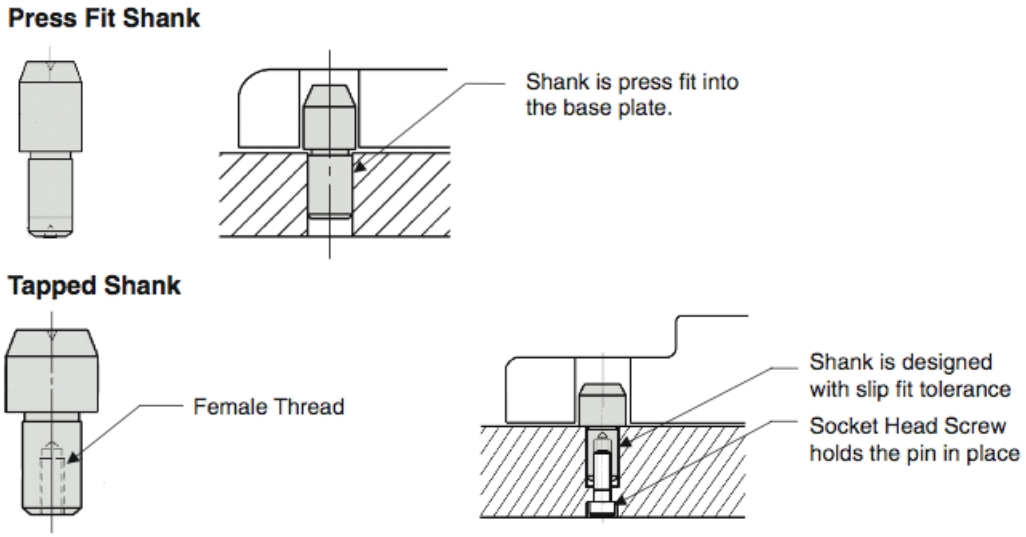
There are other ways of utilizing diamond locating pins. This is one example, where you need to perfectly align the center of the part, but the angular orientation is not critical.



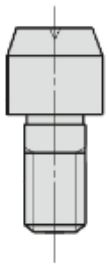
Shank mounting styles

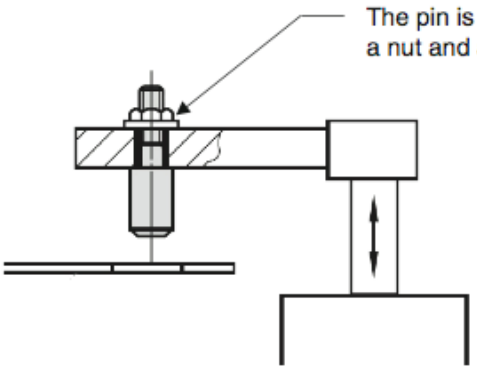
One of the locating pin features is a shank- the part of the pin that is installed in the mounting fixture and does not come in contact with the work piece. There are several different shank mounting configurations.

The press fit shank is used, when you have access to the bottom of the mounting plate. This way it can be knocked out when replacement is needed.



Threaded Shank

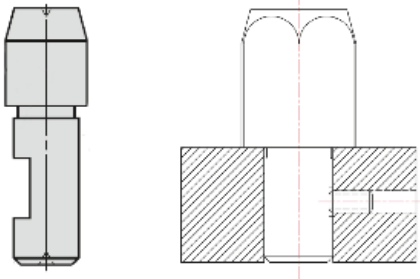




Not all designs will allow you access the back of the mounting plate, so there are other shank designs that are appropriate.

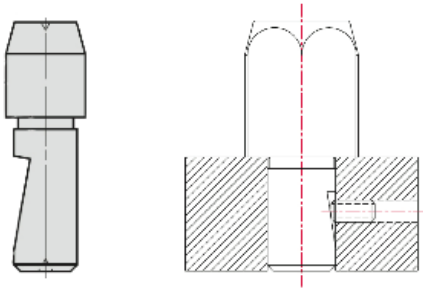
Side Mounting Styles

Set Screw Flat



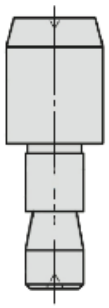
The flat feature allows the pin to be mounted and at the same time it will help set the orientation of the Diamond Head.

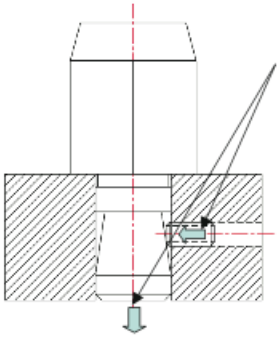
Shank With Locating Notch



The Notch feature works the same way as the flat, but while driving the set screw in, you push the back of the head against the mounting surface.

Shank With Circumference Groove



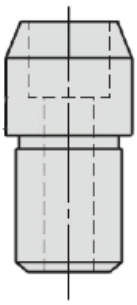


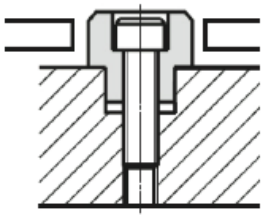
Circumference notch is typically used for pins with a Round Head since they do not let you control the orientation.

In some cases, there is no easy access on the back or the side of the pin mounting plate. There are a couple of standard solutions.

Top Mounting Styles

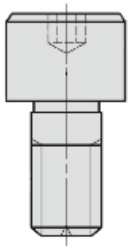
Counterbore of Hole Pin



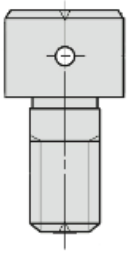


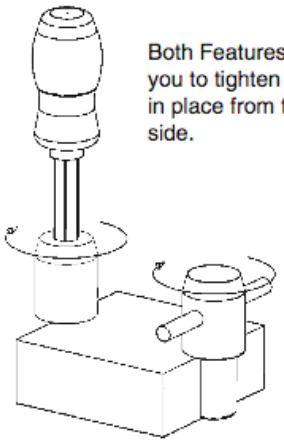
The Clearance Hole with the C-Bore feature lets you install the pin using S.H.C.S. when you have limited access to the back or side of the mounting plate. The disadvantage if this pin is its size. This design can not be used when small size pins are required due to the size of the mounting Socket Cap Screw.

Hexagonal Socket Head



Wrench Hole Head

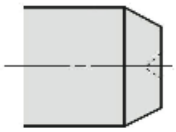




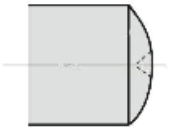
Both Features allow you to tighten the pin in place from the face side.

Different Pin Head Shapes

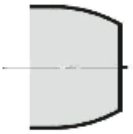
There are several styles of Pin Head shapes. They serve different purposes and can be utilized in a variety of applications.



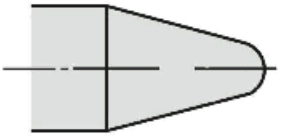
Head with Lead. The lead is usually between 15° and 30° and allows the pin head go into the mating hole even with small misalignment.



Round Nose. Similar to head with lead. This is often used in designs of printed board. application. Maximum nose diameter is equal to head diameter.



Rounded Lead. Similar to Head with straight lead, allowing smoother location. You can still enjoy small misalignment while decreasing the stroke in comparison to the round nose pin.

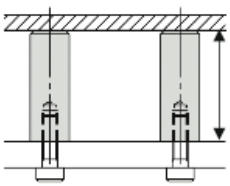


Radius tip with lead. This design is very common in automotive and welding applications.

Flat Face with Chamfer. This design is predominately used with short stroke applications or where the lead can be incorporated in the hole the pin goes into.

Height Adjustment Pins

Height adjustment Pins use the face of the pin for crating spacing between the product and the pin's mounting surface. The face of the pin usually needs to be hardened.

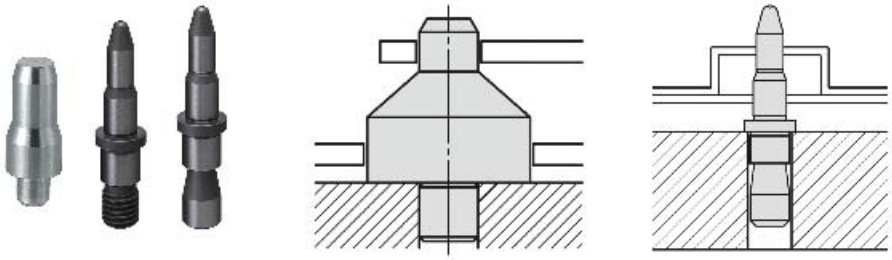


Locating Pins with Shoulder

Flanged pins are very popular due to their dual functionality. They provide both XY plane as well as Z height location.

Stepped Head Pins (Also known as Double Pilot Pins)

Stepped Head design allows you to position two layers of work pieces as once. Often used when working with multiple pieces of sheet metal.

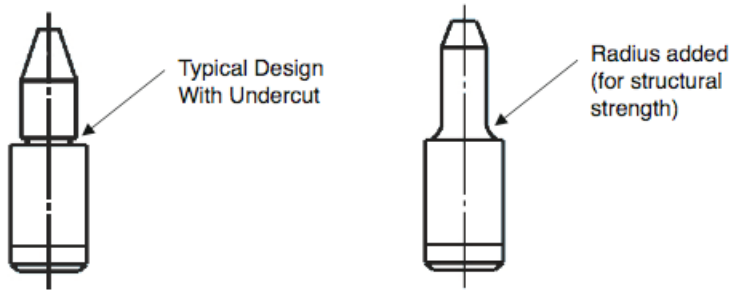


Head with Air Vent

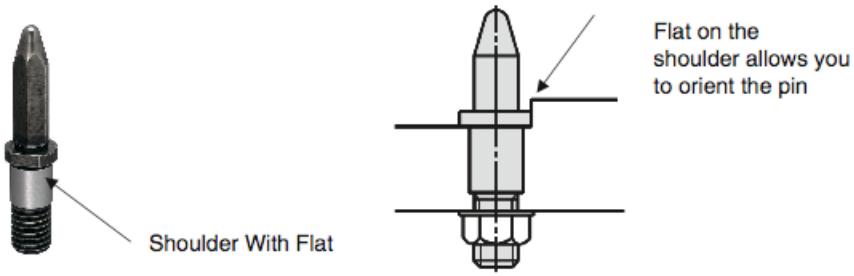
It is beneficial to add an air vent, often in form of a flat running along the side of pin's head in order to avoid air compression inside the hole, especially when dealing with blind positioning holes.

Additional useful features

Most of locating pins are machined with an undercut feature that allows for the work piece to rest on the base. Sometimes more structural strength is required and you can design the pin with a radius if the positioning hole can be produced with appropriate chamfer.



A flat feature on the flange can also be used for orientation of the diamond pin. Please see the example below how it can be utilized.

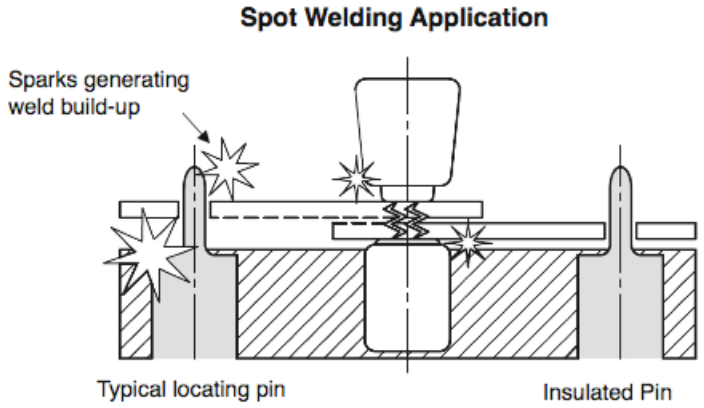


Materials

Typically, locating pins are manufactured from hardened tool steel such as O1 heat treated to 60-63Rc or from case hardened carbon steel (1045 with 45-50Rc). In some cases, soft 300 series or hardened 400 stainless is used in assemblies where no rust is accepted. Please, remember that pins made out of soft materials will wear out much faster than harden pins.

There is a variety of coatings that can be chosen based on your application. In corrosive environments, a hard chrome, Dicoat or TiCN coatings can help extend the life of the pin since they provide non-corrosive and hard layer that can be as hard as 3000 Vickers.

A variety of insulating coatings or materials can be used in case of welding applications. KCF stainless steel coat is one of surface treatments that provides great insulation and prevents weld build-up between the work piece and the surface of the pin.



As stated earlier, there are many different features that can be combined in the design of your locating pin. The photograph below represents only some of the combinations of features introduced in this article. Possibilities are virtually endless. To view a complete line of locating pins please consult the MISUMI Metric and Inch Factory Automation e-Catalog at: http://us.misumi-ec.com/