Editor Note: This article reviews the various types of locating pins available for machine designers and offers insights into the proper application of such locating pins.

Typically, 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.
Round Head Pin

- Clearance is equal in every direction

Diamond Head Pin

- Using Diamond Pin, Clearance in one direction is greatly increased.

- Another Characteristic of Diamond Pin is much smaller contact surface area.

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.
Press Fit Shank

Shank is press fit into the base plate.

Tapped Shank

Female Thread

Shank is designed with slip fit tolerance
Socket Head Screw holds the pin in place
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

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
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.
Height Adjustment Pins

Height adjustment Pins use the face of the pin for creating 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 the 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.

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 surface treatment that provides great insulation and prevents weld build-up between the work piece and the surface of the pin.