Workholding Clamps and Systems Overview

Do you know the basics of clamping systems and how to use them to properly hold a workpiece in your machining systems?

Once properly located in the industrial machining process a clamping system must hold a workpiece firmly against the locating elements and the cutting forces developed during an operation without causing damage to it.

Proper clamping in a jig or fixture directly influences the accuracy and quality of the product produced and the production cycle time of the machining process.

Although workholding methods have advanced considerably, the basic principles of locating and clamping a workpiece remain the same.

In this article we will take a closer look at:

Manual Toggle Clamps

Toggle clamps consist of a handle to operate, a clamping arm to reach the workpiece, a linkage system to increase the applied force and a base for mounting to a workbench or fixture. Toggle clamps include:

> **Hold-down clamps**
> **Push-pull clamps**
> **Plier clamps**
> **Hook-and-latch**

Power Clamps

Like manual clamps, *power clamps* are used to position and hold workpieces. But unlike hand-operated manual clamps, power clamps are controlled by air pressure or fluid pressure.

If you want to make your process repeatable with no loss of quality, pneumatic and hydraulic power clamps can perform a range of motions including:

> **Hold-downs**
> **Swings**
> **Linear strokes**

Adjustable Clamps

There is a variety of *adjustable clamps* for workholding applications which include:

> Adjustable stroke plunger clamps
> C-clamps
> Bar clamps
> **Cantilever clamps**

Vises

Commonly used on drill presses, milling machines and grinding machines, *industrial vises* function as a large clamp to securely hold a workpiece. By preventing slippage, these vises help ensure the safety and accuracy of your work. Typical industrial machining vises include:

> **Screw action vises**
> **Screwless vises**
> **Quick action speed vises**

Magnets and Electromagnets

Commonly used in cutting, milling, grinding, and welding operations, *workholding magnets* help increase production efficiency and precision. Compared to manual clamps, magnets require minimal clamping time, resulting in faster set-up and feed rates. Plus, they eliminate vibration or chatter and allow for more consistent clamping.

Permanent magnets are available in a broad range of holding forces, shapes, and materials such as alnico, ceramic, neodymium, and rare earth.

Electromagnets are also known as temporary magnets. They use a controlled electrical current to control the strength of the magnetic field and have an on-command release feature. With variable strength and on-off capability, electromagnets are ideal for industrial lifting applications. Magnetic welding squares and angles are also available to assist welders with fast set-up and accurate holding of steel sheet stock, plates and tubing.

Jig and Fixture Clamps

Jig and fixture clamps for machining and fixturing applications are available in many assorted sizes and configurations.

Compact Fixture Clamps

Allow fixturing of more parts on a machine table. These economical, low-profile clamps make programming easier because there are no clamps to jump over.

They are available in:

> Cam edge clamps
> Toe Clamps
> Wedge Clamps

ID Expansion Clamps

Are excellent clamps for palletized setups in secondary operations on lathe parts.

Hook Clamp Assemblies

Are ideal for set-ups where space is limited.

Swing Clamp Assemblies

Are ideal for set-ups where space is limited.

Strap Clamps

Are used to secure large or oddly shaped workpieces directly to the table.

Cam handles provide quick locking action and high holding pressure. Adjustable clamp rests are used to support and level a clamp on mills and other machining applications. Set-up wedges are used for leveling and to provide extra height to the workpiece or strap clamps. Triangular step blocks have long angled serrated edges that fit together so the top block is the same height as the workpiece to level a set-up clamp.

Summary

Since proper clamping in a jig or fixture directly influences the accuracy and quality of the product produced and the production cycle time of the machining process it is important to select clamping solutions that allow a machine to work at its full potential while efficiently and consistently producing quality parts.

Fortunately, there are many distinct types, configurations and sizes of clamps and clamping systems to choose from that allow manufacturing operations to maximize spindle usage time and minimize setup time while ensuring repeatability and accuracy of the products they produce.