Clamping Tools
The most effective clamping tool for individual applications – an overview.

By Thomas Oertli

There is no ‘best’ clamping tool. However, we have developed the most effective and therefore the best clamping tool for every application, for every type of tool and for any type of machining. For this reason, we do not focus on a single type of clamping tool; rather, we approach matters on a case-by-case basis to determine which clamping tool will yield the best results for the respective application.

Numerous factors influence the selection of the most effective clamping tool: milling capacity, dimensional accuracy, surface quality, setup times, tool wear and finally the quality of the finished component and the costs involved in producing it. The clamping tool also plays a decisive role in influencing the operating life of tools and the conditions to which the machine spindle is subjected.

Collet Chucks

Collet chucks are used far and wide in the woodworking industry. The advantage of a collet chuck is that it is highly flexible, because it means that various collets can be used. The fact that it can be utilised in many fields is further augmented by the variable chuck capacity of the collet.

Function and Handling
When clamping the collet nut, the collet encloses itself around the tool shank, which is thereby friction-locked into place in the collet chuck. As the collet elastically deforms itself during clamping, shanks with larger tolerance deviations can also be clamped. Nevertheless, the large potential chuck capacity (up to 1 mm) leads to relatively poor concentricity, therefore resulting in low balancing quality. For this reason, we recommend that the potential chuck capacity of a collet should only be used in the 0.1 mm range. In all other cases, the appropriate collet should be selected for each shank diameter.

Conclusion
The collet chuck is a good chuck for simple tools which do not have any special requirements placed upon them with regard to their concentricity and milling capacity. Should requirements regarding capacity and accuracy increase, the limits of the collet chuck’s clamping system will be reached due to its mechanical restraints. In terms of clamping force, the tool is neither the most effective nor clamped in a highly precise manner. As a result, strong forces are exerted
upon the tool and the chuck during machining. The tool is inaccurate in its operation, leading to the chuck and tool being subjected to a significant amount of stress and therefore increased wear. The quality of the finished work is also adversely affected.

Handling:

Performance:

Investment:

Expansion Chucks: SINO and Hydraulic

Excellent damping properties
A result of the machining process, vibrations affect the operating life of tools and machine spindles. Thanks to the special design of the SINO and hydraulic clamping chucks, these vibrations are reduced. The vibration damping effect does not just lead to a reduction in micro-blowouts along the tool’s cutting edge and less wear and tear; it also improves the smooth running of the tool at the same time. This extends the operating life of the tool, protects the machine spindle and clearly improves the surfaces of the component.

Concentric accuracy
The concentric and repeat accuracy is an excellent < 0.005 mm for the hydraulic chuck and SINO chuck.

Comparing the SINO and hydraulic chucks
The SINO and hydraulic clamping chucks offer a comparably high performance for the same price. The differences lie in the technical design and handling. The SINO clamping chuck requires a mounting fixture in order to mount the milling cutter on the clamping chuck. In contrast, a simple T-handle wrench is sufficient for installing the hydraulic clamping chuck.

SINO Clamping Chuck
The SINO clamping chuck consists of an interface on the machine (normally the HSK 63F) and an extension sleeve integrated into the chuck. The chamber for the extension sleeve is filled with an elastic material which serves as a pressurising medium.

Function and handling
In order to mount the tool, it must be fixed in a clamping block; the clamping tool is then released using a hook wrench, and the tool shank is inserted. By axially tightening the flare nut, the necessary pressure is exerted upon the extension sleeve, and the tool is clamped. During the clamping process, the flare nut is tightened until it reaches the shaft inset (and therefore a planar contact area). The whole system is further reinforced thanks to the flare nut’s contact with this area, and the stability of the system increases accordingly. This results in a strong clamping force and excellent concentric accuracy.

Conclusion
The SINO clamping chuck is suitable for directly clamping shank-type tools with cylindrical shafts which have a diameter of 12, 16, 20 or 25 mm. Adaptor sleeves can be used for intermediate dimensions
(i.e. shaft diameters of 3 to 20 mm). However, adaptor sleeves impair the clamping quality and reduce the high precision of the clamping chuck.

Handling: 👍 👍
Performance: ⭐ ⭐ ⭐
Investment: $ $

**Hydraulic Clamping Chuck**
The hydraulic clamping chuck is a universal clamping chuck for precisely clamping tools with cylindrical shafts. A hydraulic fluid is located inside the hydraulic clamping chuck, which is encased in an annular gap around the borehole.

**Function and handling**
The hydraulic fluid is condensed by means of a hydraulic clamping set (pressure screw, pressure pin and seal) and a hexagonal T-handle wrench. The resulting pressure causes a uniform deformation to occur within the extension sleeve. Through this, the tool shank is clamped with high concentric accuracy. Thanks to the closed construction, the hydraulic sleeve does not require maintenance and can be immediately used without the need for any auxiliary tools or tool mounting fixtures. By turning the T-handle wrench until it reaches a fixed shaft inset, pressure is built up via the valve, and the tool shank becomes centred and clamped within seconds. In order to remove the tool, the screw is turned back a couple of times. The pressure is reduced and the tool can be removed.

**Conclusion**
The hydraulic clamping chuck is suitable for precisely and directly clamping shank-type tools with cylindrical shafts which have a diameter of 12, 16, 20 or 25 mm. SINO clamping chuck adaptor sleeves can be used for intermediate dimensions (i.e. shaft diameters of 3 to 20 mm). However, adaptor sleeves impair the clamping quality and reduce the hydraulic clamping chuck's extremely high precision. As such, adaptor sleeves are not recommended.

As the tool can be clamped and released using a simple T-handle wrench without the need for any major manual effort, a mounting fixture is not necessary. As a result, a change of tools is easy to carry out and can be completed in seconds.

Handling: 👍 👍 👍
Performance: ⭐ ⭐ ⭐
Investment: $ $ $

**Shrinkage**
Shrink-fit chucks are especially slim and do not have any kind of mechanical or movable parts. Various clamping chuck contours can be modularly constructed with extensions and reducers,
thereby allowing cutting to be carried out in places on a component which are difficult to access.

**Thermal shrink-fit chuck**

The thermal shrink-fit chuck is highly convincing thanks to its very high concentric accuracy, optimum friction-locked connection between the tool and the holding fixture, extremely low weight, and slim design.

**Function and handling**

The chuck is heated up in the thermal shrink-fit device. The tool can be inserted by means of radial expansion. The tool then becomes securely clamped when the chuck cools and the radial shrinkage is at a normal level. As the material is only elastically deformed during the shrinking process and therefore always returns to its original form, in practice the shrinking process can be infinitely repeated.

**Conclusion**

The thermal shrink-fit chuck is suitable for clamping tools with cylindrical shafts in a highly precise manner. If you require the highest level of precision and performance and the modular use of extensions and/or reducers, and you are willing to allow the shrinking process to be carried out using an in-house shrink-fit tool or via your tool partner, this is the right clamping tool for you. OERTLI’s facility in Höri, Switzerland, is fitted with the most cutting edge equipment and will carry out the change of tools if required.

**Handling:**

👍

**Performance:**

🔍🔍🔍

**Investment:**

$ $

**Force shrinkage**

The TRIBOS clamping tool is based on the principle of force shrinkage. It provides effective conditions for machining tasks in or on areas of the component which are difficult to access, i.e. it is an application which conventional clamping systems can no longer be used for.

**Function and handling**

The TRIBOS clamping principle utilises the internal stress of the steel. This is cylindrical due to the specific deformation of the polygon-shaped mounting hole. In this state, the tool shank can be inserted. When the pressure is reduced, the tool is friction-locked via the internal stress of the steel. A special clamping fixture is required in order to mount the tool.

Cross-section of the TRIBOS clamping tool
Conclusion
The TRIBOS clamping tool is only offered by OERTLI on special request by the customer. The TRIBOS’s performance is less effective than that of the hydraulic clamping chuck and SINO clamping chuck, and offers very few advantages in comparison.

Handling: 👍

Performance: 💩

Investment: $ $

Minimum clamping length
For all OERTLI CNC tools, the minimum clamping length is labelled by the symbol K. Important: the minimum clamping length labelled on the shank corresponds to European safety requirements and is therefore not the most suitable clamping length – it only represents the minimum length! The shank should be clamped within the chuck as deeply as possible, and the degree to which the tool protrudes from the chuck should be kept to a minimum.

Figure 1: according to the standard (not ideal)
Figure 2: optimum clamping (ideal!)
Figure 3: shank clamped too deeply within the chuck (not ideal)