Many industries, such as renewable energy, require large parts, so machine shops should review their workholding equipment to make sure they’re up to the task.
Increased demand for large-size parts such as gears and turbine blades, mostly coming from the energy sector, requires machine shops to reinvestigate their clamping methods. Machine tool development kept up with the demand, but the clamping technology is still mostly manual, which is time consuming and requires a lot of maintenance.

**CHUCKS FOR PRECISION**

During the turning of clamping diameters of up to 2,000 mm (79") there is a tendency to choose more flexible and efficient three- or six-jaw chucks. The reason for that is simple: Even large components need to be very precise, which can only be achieved by using corresponding precision lathe chucks. In the past large precision chucks were too expensive. Due to standardization of large-size chucks, SCHUNK can now offer very competitively priced solutions for this industry.

Extra-large precision chucks are used wherever workpieces with large diameters have to be clamped safely and machined precisely, such as tube ends for the oil industry, thread drill bits, graphite blocks, rail wheels, pump and valve housings, gearwheels, and many other precision parts. The lathe chucks for large components from SCHUNK can be used on every known lathe. They are suitable for vertical and horizontal applications, and help to reach any high precision requirement.

The three-jaw power chucks achieve high clamping forces of up to 50 kN (120 000 lbs) and a repeat accuracy of less than 0.003 mm (0.0001"). Highly deformable components such as bearing rings, gear components or rail wheels can be machined on six-jaw compensation chucks, which considerably improve the roundness of these workpieces. These chucks can be switched from self-centering mode to compensating mode. On request, many large chucks can be modified according to the customer’s specifications. Some customers order lathe chucks surface ground, provided with tapped and drilled holes to use them as a faceplate.

These large-size chucks deliver the highest accuracies, even in the heaviest applications. Besides, these chucks are much better sealed than conventional mechanical devices so that even very small chips, dust, or tremendous amounts of coolant cannot penetrate the chucks. Especially in the case of large clamping equipments, a safe installation is extremely important. Ideally customer service should train the staff on how to handle the chuck. This will guarantee a worry-free operation for many years.

**MAGNETIC TECHNOLOGY**

An alternative to the high-precision chucks are those with magnetic clamping technology. For machining ring components, the radial pole plates...
Fig. 2: ROTA NCR for huge gear units, rings, and other deformation-sensitive workpieces.

Large component mandrels from HAINBUCH:

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offer many advantages. Large turned parts can be clamped quickly, safely, and without deformation. With a multilevel holding force adjustment, workpieces can be easily aligned on the magnetic chuck. The so-called hybrid chucks work even more efficiently. Here the technology of a conventional three- or six-jaw centering chuck merge together with the technology of radial pole magnet. With these chucks, workpieces are automatically centered for fast ID or OD clamping. Hybrid chucks that are used on lathes with pneumatic or hydraulic actuation can reduce the set-up times up to 80 percent and thus contribute to a considerable boost in productivity.

In order to achieve optimal results, the radial pole magnet up to diameter 4000 mm (158") should be made out of one piece. This assures extreme stability during the clamping operation. SCHUNK offers a full line of supporting product such as demagnetizers to ensure that the parts do not have any residual magnetism after machining.

**CLAMPING LARGE COMPONENTS**

Although high-precision jaw and magnetic chucks have become more important in the past few years, large or asymmetrical parts are mostly clamped on faceplates. This applies all the more for large components with diameters of about five meters, as they are used for marine engines, wind power stations, power station turbines, or in the engineering plant. Normally vertical lathes are used for components of this size, where the faceplates serve as a workpiece support. This way, gigantic diameters of up to 75 ft are feasible.

Faceplates from 1.000 mm (40") and larger faceplates with a diameter of more than 3.000 mm (9 ft) are mostly equipped with parallel running T-slots. Screws and T-nuts can be mounted into the T-slot guidances and provide stability to the jaw boxes. In order to increase safety, they are additionally form-fit connected with faceplates using a cross bar. Normally large faceplates are provided with at least four double T-nuts for four jaw boxes. If very large and complex or heavy workpieces should be machined, sometimes six, eight, or more jaw boxes can be used.

Conventional jaw boxes consist of a cast housing, an adjustment spindle, and hard stepped jaws. By offsetting the double T-nuts manually they can be individually adjusted to the workpiece. That way it is possible to clamp various differently dimensioned workpieces safely. The jaw boxes are mounted next to the workpiece, and the jaw boxes are then offset as far as necessary by the spindles, until the workpiece is safely clamped.

**JAW BOX EFFICIENCY**

Enormous efficiency potentials are hidden in conventional clamping tools and devices, and it is proven that the modern steel jaw boxes, where the spindle drive is completely encapsulated, offer a huge advantage over their cast iron predecessor. An integrated lubrication system, a maintenance-free design, and all-sided hardened functional parts minimize wear, assure a permanently high accuracy, and assure long life of the drive spindle. In contrast to the conventional versions, modern jaw boxes have a lower profile, which allows for better use of the machine’s working area.

The users should pay special attention to the jaw interfaces. If the base jaws are equipped with tongue and groove and standard jaw connections, conventional standard jaws can be used, which reduces expenses considerably. Operators gain additional flexibility by clamping, if using the clamping surface on the face of the base jaw. Such additional interfaces allow stable setups close to the surface of the faceplate.

The dimension of the development potential of jaw boxes is shown by the trend-setting SPK jaw boxes from SCHUNK, which fulfill every requirement for a highly efficient workpiece clamping. The large jaw stroke of up to 100 mm, and the enormous clamping force of up to 180,000 lbs.
using low tightening torques provide a safe ID or OD clamping. During the clamping operation, the jaw stroke can be read from a clearly visible scale, which increases the safety of clamping. Since the distance of the gauge is variable, these jaw boxes can be used for every face plate with parallel running T-slots.

In order to expand capabilities and meet new market requirements, machine shops should reinvestigate their clamping methods. Upgrading to handle clamping the large parts required by industries such as renewable energy will expand both capabilities and a company’s customer base.

Fig. 5: Jaw boxes of the future: the sophisticated SPK assures efficiency during the machining of large turned parts.

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