

# Quick change-overs bring benefits

For the manufacturing of gears for automatic transmissions, German drive-train systems specialist Voith Turbo relies on an automated manufacturing cell with clamping devices from Hainbuch. In this regard, the new quick change-over interface capteX B ensures that even small lot sizes can be rationally produced.

The trend towards just-in-time production with minimal amounts of stock presents new challenges for the businesses such developments affect. In the past, systems were required that always processed the same workpiece in high quantities with the fewest possible interruptions, over a long period of time. Today, however, the trend is clearly in the direction of extremely flexible systems that can manufacture different workpieces in small lot sizes.

An essential factor for economic success in this regard is the possibility to quickly change over the manufacturing system from one workpiece to the next. In addition to changing the required tooling, the change-over time for very special fixtures is often time-consuming as well.

Founded in 1867, the Voith group today is one of Europe's largest family-owned enterprises, boasting more than 40,000 employees, a turnover of €5.6bn and locations in more than 40 countries around the world. The company's products are widely used in the energy, oil and gas, paper, raw materials, and transport and automotive sectors.

Voith Turbo is the specialist division for hydrodynamic drive, clutch, and brake

systems for use on road and rail, in industry, and for marine propulsion. Voith Turbo had a turnover of approximately €1.52bn in 2010-2011 and has approx. 5900 employees, of which 530 work at its facility in Garching, near Munich, where great emphasis is put on gear cutting competence.

"Everything in this category, if possible, we manufacture on site", stresses Michael Dirrigl of Voith's industrial engineering, machine procurement and tool management arm. "We have set up a manufacturing cell to manufacture planetary gears for gearboxes in different designs and dimensions. We turn the blanks on an Emag VSC 250, mill the oil pockets and drill a 3mm bore, then we transfer to the second machine, an Emag VSC400WF, where the gear-cutting takes place. A third machine in the system does the deburring of the parts. Overall we manufacture four different part sizes."

As a rule, the gears are produced in manageable lot sizes. The outer diameter of the cast blanks is between 50 and 105mm, while the weight is always less than 1000g.

"Our goal is to cover a three-day requirement for assembly," explains Dirrigl. "On average we are required to change over the system once a day."

When Voith began searching for a new system that could effectively replace four of its existing machines, Emag Koepfer brought Marbach-based workholding specialist Hainbuch into play. The system that was procured has been running at Voith since December 2010.

"Our specification for the machine manufacturer at that time was also to offer a change-over friendly clamping system for the gear hobbing machine," explains Dirrigl. "For us it was clear that the set-up time would be an essential factor for the profitability of the system."

### Rigid clamping guaranteed

The capteX machine interface from Hainbuch can be joined and parted quite easily thanks to its ingenious design. Steel balls that are vulcanised into a rubber shell bear the only point load. With the interface, which rivals a bolted solution in terms of flexural rigidity, numerous clamping solutions can be realised with the modular system. The mandrels used at Voith are special solutions derived from existing modules – due to the gear hobbing they are built somewhat narrower than their standard counterparts, ensuring ensure the necessary levels of freedom for this machining.



The planetary gears are manufactured in manageable lot sizes.

With the capteX interface, Hainbuch has provided a connection that could withstand the centrifugal forces when turning, as well as the transverse forces of milling operations, without any problems. The radial holding power is 80 to 150kN, the axial holding power is between 25 and 30kN. The pull-back effect ensures that the component is clamped against a fixed stop, ensuring that extremely rigid clamping is guaranteed. The quick change-over system does not restrict turning jobs in any way at Voith.

"With the Hainbuch interface we were able to turn up to 7,000rpm – we never get close to that limit," notes Dirrigl. "There are certainly clamping systems that are cheaper than those from Hainbuch. However, we are also using Hainbuch systems in another area of the plant and are very satisfied – consequently, we know that a system that may be more expensive to acquire can quickly pay off."

The machines of the cell are connected with a conveyor for workpiece transportation.

"Set-up of the VSC400WF proved to be a particular challenge", explains Dirrigl. "On this machine the workpieces are picked up via the clamping device in a pick-up station – the procedure is fully automated. At first we thought it obvious to only replace the clamping bushing for each diameter. However, in light of the capabilities offered by the capteX interface, we quickly abandoned this approach – if we keep a separate mandrel with quick change-over interface on hand for each size, the procurement costs are higher, but with extremely precise concentricities required, changing the entire mandrel ensures greater accuracy."

### High repeatability

With a conventional bolted clamping set-up the change-over process is often measured in hours. Moreover, the threaded unions are often not easily accessible to the operator. This is different with the capteX system: with just one screw which is easily accessible from the outside, the entire interface of the mandrel can be detached – including the draw mechanism of the clamping device.

In the process a high level of repeatability is provided. Small, high-precision balls that are vulcanised into a rubber shell assure mandrel positioning with repeatable precision of 3µm. A system check that measures the air pressure in the spindle ensures that the workpiece is precisely mounted. Consequently, high accuracy is guaranteed for the gear cutting relative to the turned part.

For changing, the spindle is moved into a specified position. A simple changing device that is inserted into the turret of the machine accommodates the mandrel. The operator has both hands free to loosen the screw. The mandrel can then be conveniently removed, and set-up of the new mandrel functions the same way.

"All in all this procedure takes less than five minutes," adds Dirrigl. "With this solution we were able to significantly increase machine runtimes. Throughput times of our planetary gears have been drastically reduced with the new system – from what used to be three to four days, to what is now less than one day. The Hainbuch system guarantees the necessary flexibility in this regard." **AMT**

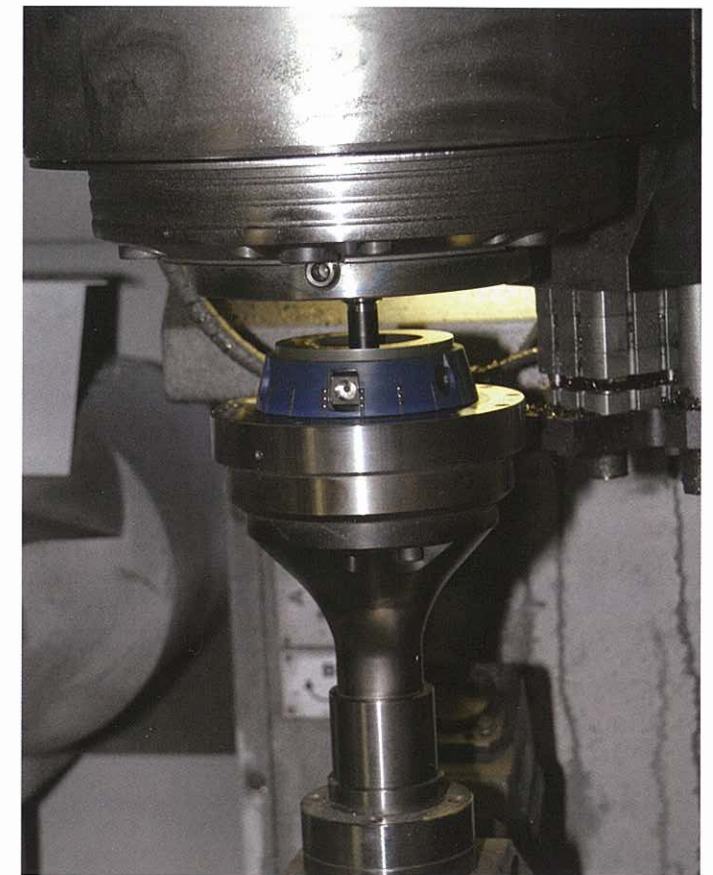
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Gear cutting in progress at Voith's Garching facility.



The capteX interface.

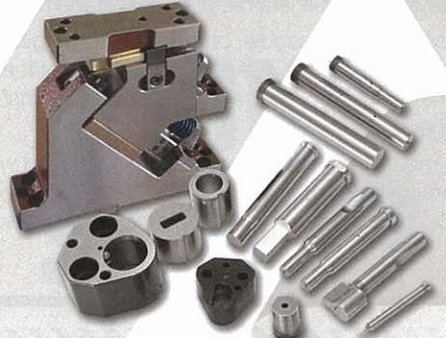


A simple changing device that is inserted into the turret facilitates the exchange. With a single, easily accessible screw the interface can be quickly detached, without problems.



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