

Milling, penetration EDM, measuring and washing

Mold making: automated cell integrates multiple technologies



The core components of the cell include two Röders HSC milling centers of the RXP series as well as a handling robot on a linear rail (Photo: Klaus Vollrath)

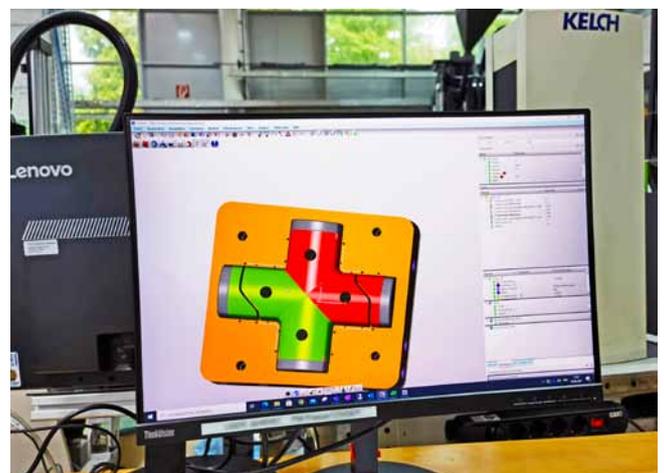
In mold and die making, a profound transition is taking place. The previously favored juxtaposition of individual machines requiring high labor intensity is gradually replaced by complex, fully automated cells with integrated handling combining

different types of equipment. The main advantage is a higher degree of utilization, as the systems can operate unmanned 24/7. The prerequisite for this is a more intensive digitization of the processes as envisioned by Industry 4.0, backed by a higher investment level. A further major success factor for such a project should be to foster the involvement of the workforce as the company's most important capital.

“With a total of around 25 employees, we are responsible for the production of die casting, injection molding and thermoset molds for the Festool Group,” says Jürgen Kopsieker, head of tool and mold making at Festool GmbH's Neidlingen plant in Germany. The department is organized as a profit center and has to keep up with market demands in terms of quality, technology and price. It does not receive its orders directly from the Group's plants, but from system suppliers that have been commissioned by the parent company to develop and manufacture new products. With these companies, Neidlinger Werkzeugbau must win the contract in each case in a direct price and performance comparison with the free market. On the other hand, the department can itself source in orders from the free market in order to utilize its capacities. In addition to the pure manufacture of tools, the range of services also includes design and engineering consulting. Modern CAD-CAM tools such as CREO-Parametrics or Hypermill are used for this purpose.



Tomislav Jurisa (left) and Jürgen Kopsieker at the control cabinet of the Röders RXP 601 DSH HSC milling machine (Photo: Klaus Vollrath)



Engineering and work preparation tasks are performed using modern CAD-CAM tools (Photo: Klaus Vollrath)

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The robot running on a linear rail operates three machine tools, the coordinate measuring machine and the washing system. Material, pallets and tools are lined up on shelves (Photo: Klaus Vollrath)

FROM A CLASSIC "GREEN MACHINE" SHOP ...

"About three and a half years ago, we were still an old-style toolmaking department with five individual machines in classic machine tool green," adds Tomislav Jurisa, Manufacturing Team Coordinator. The equipment consisted of one wire EDM machine, one penetration EDM plant and three milling machining centers. Only one milling center had five axes. These plants were constantly supervised in the traditional manner by employees who, in addition to monitoring the machining processes, performed tasks such as clamping and unclamping workpieces, loading and unloading the machines, and setting up and changing tools. In addition, the supervisors also took care of quality assurance. The utilization of the machines was therefore not satisfactory. At this point, the company decided to comprehensively upgrade the shop to the latest state of the art for strategic reasons at considerable expense.

... TO A FULLY AUTOMATED CELL BASED ON THE MODEL OF INDUSTRY 4.0

"We wanted an automated manufacturing cell in which a wide variety of technologies such as five-axis milling, penetration EDM,



Tools lined up at the sides of the cell, ready to hand, as well as clamped blanks for graphite electrodes; behind them, the airlock for loading and unloading (Photo: Klaus Vollrath)



Setting down a pallet on the zero-point clamping system of the penetration EDM system from Exeron (Photo: Klaus Vollrath)

coordinate measuring and, in addition, professional wet cleaning were fully integrated," reveals J. Kopsieker, "so that we could operate all of our key technologies in an automated and linked manner." Added to this were storage facilities for milling tools and electrodes, as well as for workpieces mounted on Erowa pallets. All transport tasks are performed by a handling robot running on a linear rail. Within this cell, all processes are completely unmanned. The task of the employees is to supply the cell with the workpieces to be processed and the necessary tools. They are also responsible for creating the NC programs for all integrated production processes. The cell is fully controlled by the RMSMain job manager from Röders. RMSMain itself is linked upwards to the company's IT hierarchy based on the ERP system IK Office.



The RMSMain job manager coordinates all processes in the cell and communicates with the work preparation department and Festool's ERP system (Photo: Klaus Vollrath)



A palletized workpiece is introduced into the Mafac washing system
(Photo: Klaus Vollrath)

RÖDERS AS GENERAL CONTRACTOR WITH OVERALL RESPONSIBILITY

"There were basically two reasons for choosing Röders as our partner with overall responsibility for the complete cell," says T. Jurisa. Firstly, there were already many years of experience from other Röders installations within the Festool Group. The manufacturer thus already had a good reputation with respect to the performance, reliability and precision of their milling machining. Additionally, Röders presented credentials from a multitude of successful installations of complete solutions of fully automated manufacturing cells, including the integration of third-party products from a wide range of manufacturers. After completion of the installation, a total of four Röders systems – two five-axis milling machining centers of the RXP series, the handling robot and the RMSMain job manager – now form the backbone of Festool's mold and tool production. In addition, the storage room can accommodate 110 palletized workpieces and 258 tools. This is supplemented by the capacity of the tool changers in the milling machines themselves. The RXP 601 DSH is used primarily for machining graphite electrodes, while the larger RXP 950 DSH is used primarily for hard machining. The materials used there are mainly hot work tool steel 1.2343 and sometimes the cold work tool steel 1.2379. The blanks are rough machined in already hardened condition (54–60 HRC) and subsequently finished in the same fixture. Compared with the previous procedure – roughing in the soft state, then hardening and finally finishing – this significantly reduces both throughput times and costs. Cost savings are mainly the result of significant reductions of the extent of manual operations.

In addition to the two milling machines, the cell also includes a coordinate measuring machine from Hexagon, a penetration EDM plant from Exeron and an automatic washing system from Mafac. Tools and workpieces are supplied to and removed from the cell via an airlock. Here, blanks clamped on pallets are fed in and finished mold components are discharged. All other processes within the cell take place automatically, coordinated by the RMSMain job manager, without any need for the staff to intervene.



Feeding a palletized workpiece into the airlock of the cell
(Photo: Klaus Vollrath)

SMOOTH OPERATION

"I'm downright thrilled about how well the individual systems in the cell work together," says a pleased J. Kopsieker. The RMS-Main job manager is designed as an open system and has all the interfaces required for communication with the company's own IT as well as with external systems. The cooperation between the Röders experts and the specialists from Hexagon, Exeron and Mafac worked out excellently, so that all the systems in the cell worked together without any problems right from the start and the projected productivity and component quality could be reliably achieved.

The cell has been running since mid-2019 without any significant problems. Utilization in 24/7 operation is now very significantly higher than previously achieved levels. "We are very satisfied with the current utilization," says J. Kopsieker.

STAFF „FULLY ON BOARD“

„With such a far-reaching transformation of a department in a comparatively short time, it is crucial that the employees are behind it,“ explains T. Jurisa. In a highly technical company like Festool, qualified and committed personnel are the decisive operating capital. If you don't manage to “bring the workforce along” and convince them of the benefits of the redesign, even procuring the best possible technology won't get you very far. After all, it was a matter of replacing the entire previous mode of operation with fundamentally new work processes. Fortunately, a large part of the workforce are down to earth as well as technology-savvy breed of local people, who are known to have trouble only when asked to switch from their regional idiom to High German. They not only accepted the necessity and advantages of the changeover, but were actively committed to it, even in stressful situations when ongoing production had to be maintained in the midst of the changeover. The fact that the software developed by Röders was based on the Windows operating system, making it comparatively easy to learn, proved to be an advantage. The structure and handling of the programming for both the machine controls and the job manager were also well adapted to the typical shop-level processes. In total, only two training sessions were required, initially one week for the machines and later another three days for the job manager. If there were any problems during the startup phase, help was provided quickly and competently, partly with the help of remote maintenance from the headquarters in Soltau, and partly directly by Röders' local service personnel.

Klaus Vollrath, b2dcomm.ch

THE TTS GROUP

The TTS Group is a medium-sized, third-generation family business with more than 3,000 employees that sells its products internationally in 58 countries. With several subsidiaries under a common roof, the group of companies has successfully established itself in the international power tools market, especially with the Festool brand widely in use established among carpenters, painters, car painters and the renovation and refurbishment sector. The US subsidiaries SawStop and Shaper strengthen its competencies in the field of safety technology and digitalization. In 2019, the TTS Group generated consolidated sales of € 629 mln. The company is one of the largest employers in the Esslingen region and was recently awarded the titles of “Germany's Best Employer” and “Best Digital Champion”.

The toolmaking division Festool Tool and Mould Making is a manufacturer of highly complex, innovative injection molding, die casting and thermoset tools and thus contributes significantly to the outstanding quality of Festool power tools as well as of many products of its external customers in various industries. <<
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THE RÖDERS RXP MACHINES

The Röders HSC 5-axis milling machines of the RXP series have been designed for the highest accuracy requirements combined with high metal removal rates, especially when machining hard materials. They are equipped with frictionless linear direct drives that enable dynamic and high-precision machining. An essential prerequisite for this is high-precision optical scales in all axes - when it comes to precision, no compromises are made. Due to their accuracy and dynamics, the machines can also be used for coordinate grinding, if equipped accordingly. In addition, the Z-axis features a patented, frictionless vacuum weight compensation.

To ensure maximum thermal stability, the machines have a sophisticated temperature management system. The temperature of the medium flowing through all major system components is controlled with an accuracy of ± 0.1 K, or ± 0.02 K for certain applications. Another special feature is the proprietary RMS6 control system based on PC technology, whose functionalities are precisely tailored to the specific tasks of HSC high-precision milling or jig grinding. Since Röders has developed the control system itself on the basis of industrial PCs and the Windows operating system, updates of both the hardware and the software are available on request at any time, so that obsolescence of the machines on the part of their control system is virtually impossible. In the current expansion stage of the control with the Racecut function, the correction of deviations takes place with the exceptionally high sampling frequency of 32 kHz in each control loop. This enables significant reductions in machining time while at the same time ensuring optimum surface quality. <<