

From one-offs to medium series

Automated ultra-precise grinding



Final touches: All bare metal areas on this housing for a driven tool pre-machined by the customer were finished to the tightest tolerances at TSchmid
(Photo: Klaus Vollrath)

When it comes to machining mechanical components to the highest level of accuracy, the demands not only on the equipment but also on the workforce increase considerably. For many companies such as machine manufacturers and toolmakers, however, such requirements are not mandatory across the entire value chain. They often have to be met for just a handful of their products. What equipment is recommendable for such tasks, and when might it make more sense to have such services carried out externally? A discussion with a specialist focusing on such services.

"Many of our customers already provide us with largely finished parts that just need the proverbial last finishing touches in terms of a few key features," says Thomas Schmid, owner of TSchmid Präzisionsschleiftechnik in Ebersbach near Stuttgart (Germany). The company specializes in grinding technology with jig grinding as its core competence. In this field, he focuses on the machining of components with high demands in terms of accuracy and/or surface quality, such as cutting punches and dies for aluminium foils, for example. These particularly demanding parts have to be finished with tolerances down to 2 µm. Other examples are guide elements or setting masters for automotive components whose hardness often exceeds 60 HRC in some cases. For almost every

command, the tolerance requirements are extremely tight. Individual parts and series are machined for sectors such as toolmaking, mould-making, mechanical engineering and aero-



Ownership pride: Thomas Schmid at the controls of his Röders RXU 1200, purchased second-hand in 2013, which works with the same high precision as on the first day (Photo: Klaus Vollrath)

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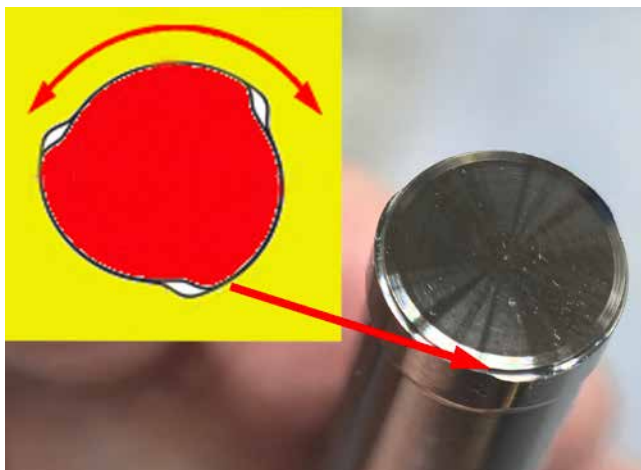


View into the air-conditioned workshop. The RXU 1200 at front left
(Photo: Klaus Vollrath)

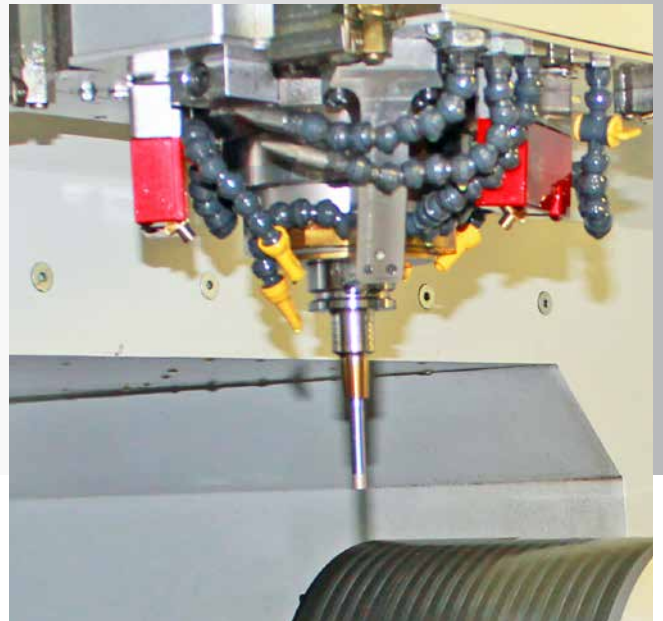
space. Although these customers are usually highly qualified themselves, they often shy away from the challenges involved in maintaining or economically utilising the necessary machine and personnel capacities for particularly high precision requirements. In such cases, he is ready to serve them as a competent partner. Relying on his long-term experience, he responds flexibly to customer-specific requirements and finds optimum solutions in terms of technology, quality and cost-effectiveness. This enables him to offer his customers the desired combination of precision work, adherence to deadlines and consistently high quality.

FROM GRINDING TO HARD MILLING AS AN ADDITIONAL SERVICE

„For some workpieces, it is essential not only to grind but also to mill,” adds Production Manager Steffen Hummel. For specific



Sophisticated punch for the production of so-called circular wedge restraints for mechanical engineering and the automotive industry with a surface roughness Ra of just 0.05 µm (Photo: Klaus Vollrath)



Grinding pins are main tools: Like the other Röders systems, the RXU 1200 runs in grinding mode for around 80-90 % of the time. In the latter mode, high-speed stroke grinding accounts for around 30 % of the time
(Photo: Klaus Vollrath)

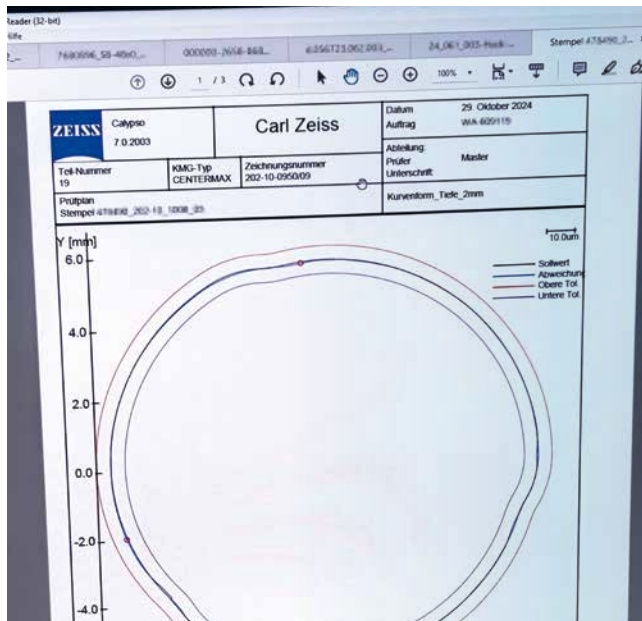
operations, milling is significantly more economical or opens up new possibilities thanks to its higher cutting performance. Due to the high precision requirements, this has to be done in the same clamping as grinding. This was not possible with the grinding centres he previously bought exclusively from a Swiss manufacturer. Ten years ago, the company therefore purchased a machine tool from Röders that was suitable for both jig grinding and hard milling. Originally, it was assumed that hydrostatic guideways were mandatory for these high accuracy requirements. It was feared that the long-term accuracy of linear roller guideways, with which the Röders machine under consideration was equipped, would not be sufficient for the high loads. Nevertheless, in 2013 the decision was made to purchase a four-year-old used Röders milling machining centre of the type RXU 1200. A rotary swivel table is installed in its particularly large working area for five-axis machining. This machine proved to be highly precise. „The experience we had with this system and the support from Röders was so positive that we decided to purchase another four-axis Röders RXP801 system in 2015,” confirms S. Hummel. This machine also runs just as smoothly as the first one and is used for jig grinding as well as HSC milling.

RELIABLY MASTERING QUALITY

„If one intends to produce quality, one has to be able to measure and document it,” explains T. Schmid. For him, this is all the more important as he usually works on parts that are already largely finished, so that only the final fine grinding needs to be carried out. This leaves him no wiggle room for trials, errors or mistakes, as even the smallest error could destroy the often very high added value already invested in the component due to previous machining. For this reason, „the first approach must be right”. Otherwise, not only will the expensive workpiece be ruined, but an important delivery date may be in jeopardy.

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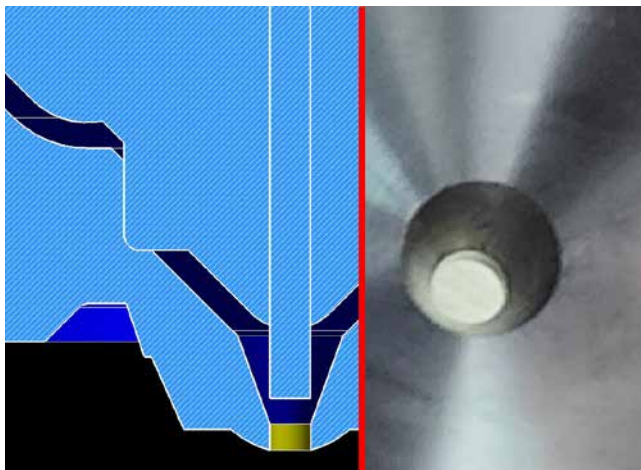
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Im 1- μ m-Bereich: Das Messprotokoll für den Kreiskeil-Stempel beweist die außerordentliche Präzision der Bearbeitung und damit auch die Qualität der Röders Anlage (Foto: Klaus Vollrath)

THE CHALLENGE OF HOT RUNNER SPRAY NOZZLES

„The valve gate seats of hot runner systems for plastic injection moulding are among our particularly critical components,” says S. Hummel. The outlet of these nozzles is completely sealed by the closing rod. This technology ensures a clean surface on the injection moulded part without burrs or tear-off slugs. In view of the very high injection pressure, the fit between the needle and the outlet opening of the nozzle must be extremely good. Due to the customer requirements for the very small and comparatively short outlet openings, TSchmid has to measure both diameter and roundness at three different depths after production on its Röders machines and also determine and document their concentricity. To achieve this, the entire workshop area is fully air-conditioned. The equally air-conditioned measuring room is



The nozzle seats of hot runner injection moulding nozzles with valve gates have to be manufactured with exceptional precision (Graphic: TSchmid/ Steffen Hummel)

optimally equipped with a Zeiss CenterMax coordinate measuring machine (measuring accuracy of 1.33 μ m over 1,000 mm, 3D scanning deviation of 0.4 μ m). The other measuring systems used in the company, such as a Zeiss Calypso, also fulfil similar requirements. Measurements are taken with four digits after the decimal point. The company's philosophy requires that measuring protocols even for series parts always display the green marker signalling “100% within tolerance limits” before delivery to the customer.

OUTSTANDING LONG-TERM QUALITY OF RÖDERS MECHANISMS

„This measurement technology equipment also enables us to monitor the quality of our machine tools,” explains S. Hummel. This has shown that the original concerns regarding the durability of the roller guides were not justified, despite the fact that the systems are routinely subjected to hard use, especially when milling into fully hardened material. High forces are also exerted during fast-stroke grinding, which requires constant high acceleration of the Z-axis.

A further highlight comprises the linear direct drives providing for maximum acceleration and therefore stroke rates, which is essential for optimum grinding conditions. This is a prerequisite for achieving surface finishes with polishing quality. The proportion of high-speed stroke processing in the overall mix of the Röders systems in the shop is around 30 %. Nevertheless, the measurement results for a circular wedge punch, for example, show an outstandingly narrow spread. Such quality characteristics on the machined component can only be achieved if the machine tool used is in perfect condition. And this is despite the fact that his oldest Röders machine is already 15 years old.

ZEISS Calypso						
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	Hüll	0,9992	1,0000	0,0010	-0,0030	-0,0010
	Pferch	0,9988	1,0000	0,0010	-0,0030	-0,0012

The measurement data of the nozzle seat of a hot runner system determined on a Zeiss Calypso (Graphic: TSchmid)

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The automation of a first RXP501 with the RCE 1 workpiece storage unit proved to be so advantageous that another system was retrofitted with it shortly afterwards (Photo: Klaus Vollrath)



The RCE 1 workpiece pallet changer enables the automated processing of up to 240 components clamped on a total of eight pallets (Photo: Klaus Vollrath)

TSchmid now uses six Röders machine tools, four of which are three-axis models and one five-axis machine with a rotary swivelling table. Hydrostatic guides have long since ceased to be an issue for him.

FULLY AUTOMATED WORKPIECE PROCESSING WITH RCE1

„Due to the outstanding long-term stability of the Röders systems, we ventured into full automation as an essential further measure,” recalls T. Schmid. The most important prerequisite is the ability to measure both the workpiece and the tools with high accuracy during the machining process. This means that the position of each workpiece can be determined exactly before machining begins and the tool length and - particularly in the case of jig grinding - the tool diameter can be set precisely using a radius correction. When he realised that the Röders machines met all the requirements for high-precision series production without manual intervention, he purchased another Röders machine including the RCE1 automation system. On its eight pallets, the RCE1 can hold a total of 240 pieces of certain machine parts that have to be processed in medium quantities on a recurring basis. The automated RXP501 can process this stock fully automatically overnight or over the weekend. In view of the performance of this configuration, he had an existing RXP501 retrofitted with the same automation shortly afterwards. With these systems, he can now produce in three shifts instead of a single shift with the same number of employees and has thus been able to gain additional flexibility in personnel deployment. Of course, a lot had to be done beforehand to ensure the necessary process reliability, but now he can reap the rewards of his efforts.

Klaus Vollrath b2dcomm.ch

“In our assignments, there is no wiggle room for trials, errors or mistakes”

Thomas Schmid

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