The quickest path to the perfect bore

For precision machining of small bores with a diameter of less than 16 mm in terms of shape, surface and dimensional accuracy, a special honing process is available. The process is both **ROBUST** and **EFFICIENT** and no separate measurement control is necessary.

Figure 1. Microcut's new generation of honing machines is designed for bores with a diameter of 0.25 to 16 mm and high quality demands

Micricrocut, based in Lengnau, Switzerland, specialises in the high-precision finishing of small bores using special honing machines. The company develops machines and tools for the efficient finishing of bores ranging from 0.015 to 16 mm in diameter to high quality standards. The company also offers contract honing services.

The new ›UniBore 942s-C-R‹ generation of honing machines can be configured with one to four honing spindles **(Figure 1)**. In addition, a full part handling robot can be integrated directly into the machine compartment to save space. The machine can also be loaded manually or by means of an external handling system. The manufacturer continues to offer the already proven, slightly smaller UniBore 800 machines, which can also be equipped with one to four spindles.

The company describes the Microcut Honing System as an easy-to-control and robust process that guarantees minimal variation in shape accuracy, surface quality and dimensional accuracy **(Figure 2)**. According to the manufacturer, the system, which has been developed specifically for small bores, has technical and economic advantages over established processes such as internal cylindrical grinding and conventional honing. The addition of sonic-honing technology achieves higher surface quality and productivity **(Figure 3)**. The company reports that this latest stage of development has quadrupled cutting performance, improved surface roughness and extended tool life.

For low or high volumes

Other advantages include low tooling costs per bore and low space and energy requirements for the systems. The process is suitable for small batches, for instance in tool and mould making, but also for large series in the automotive industry. The machines are modular and scalable.

Thanks to the easily reproducible, exceptionally good shape and dimensional accuracy of the honed bores, the manufacturer has noticed increased

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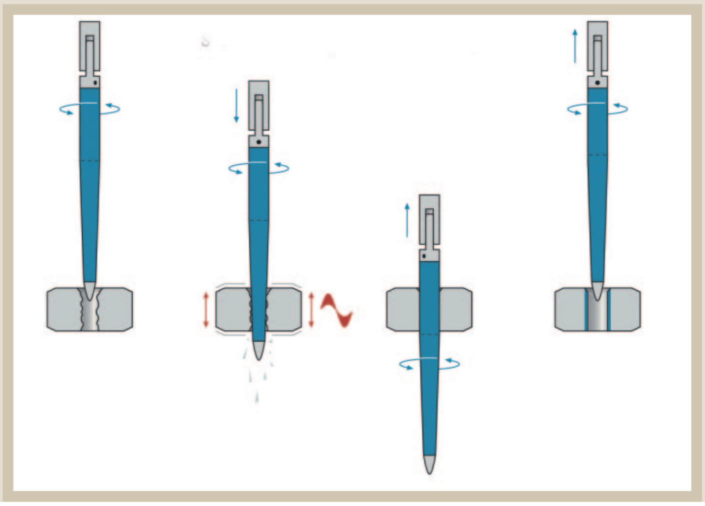

Figure 2. Sonic honing focuses on quality and productivity

demand for machines for larger diameters. The advantages are particularly pronounced in interrupted main bores with cut-outs and cross holes, as is the case with hydraulic control components, for example **(Figure 4)**.

Process and tool

According to the manufacturer, the shape accuracy (cylinder shape) is automatically given by the honing process itself, without the need for measurement control. The one-piece tools, which offer maximum rigidity with precisely honed dimensions, define the final diameter virtually independently of environmental conditions, such as temperature. The system can also be used to remove a relatively large allowance along the tapered tool section. Wear on the cylindrical section of the tool is minimal for each part. The single layer coating of the tool prevents spontaneous changes, such as grain break-out.

The sonic-honing technology is based on the Microcut Honing System and is suitable for specific applications. The adaptive feed control of the tool is combined with a fast stroke of the workpiece in the sonic range. The feed is controlled in relation to the torque applied. This results in significantly reduced cycle times, longer tool life and finer surfaces for the same grain size. When it comes to difficult components, such as thin-walled and ▶

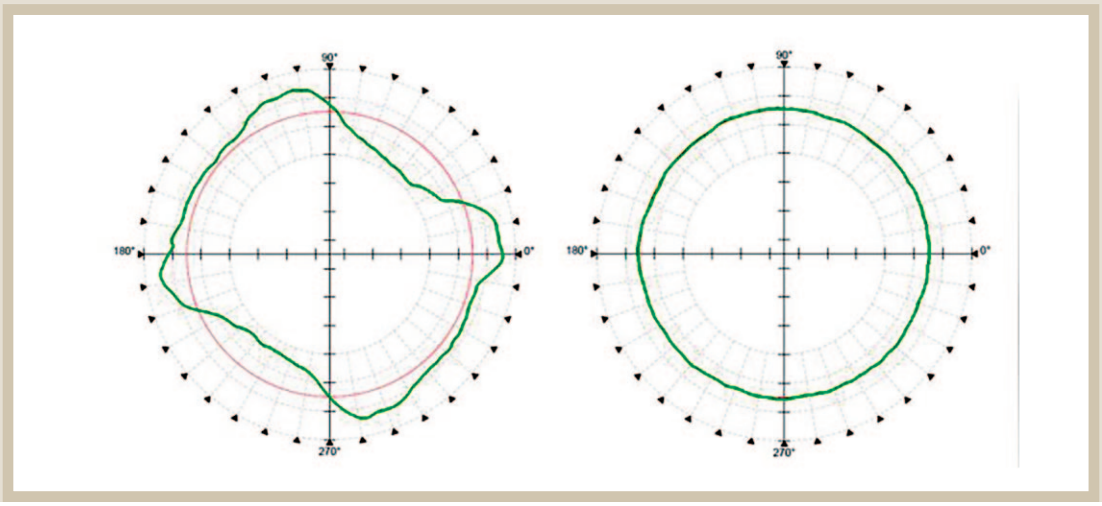

Figure 3. Left: Hard-milled or coordinate (jig) ground bore with a roundness of 2.31 µm; Right: After the Microcut honing process with a roundness of 0.12 µm

small components, a proper workpiece clamping approach is a key success factor for achieving high shape quality and automation. The company offers various systems for this purpose.

Advantages of hydraulic control valves

The honing system reveals its full potential with hydraulic control valves, for example. In various industries, such as aviation or automotive engineering, slider sleeves with cross bores place very high demands on the cylinder shape (roundness and straightness) of the bore and also on the surface. Take a machine capability study with 25 spool sleeves as an application example. Cpk values greater than 1.33 were achieved for all criteria.

As the honing tools are one-piece and coated along a length of 350 mm, the tool lies against the circumference of the bore and along its entire length. This enables optimum correction of the bore in terms of straightness. This advantage is also beneficial for the roundness, as the surface pressure between the tool and the bore wall is very evenly distributed. In the case of a tool used for conventional honing or internal grinding (short honing tool or grinding pin), which is shorter than the bore length, the forces vary much more due to the cross bore. This is ultimately reflected in the shape of the finished bore, specifically the straightness of the bore wall. The stroke position and length also have a significant influence on the cylinder shape for internal grinding and conventional honing. They must be constantly monitored and adjusted.

Bores with greater geometric accuracy

Needle valve gate nozzles in a hot runner system are another application example **(Figure 5)**. As all machining movements and force measurements are performed by the tool in Microcut honing technology, this means that even small, very short, stepped bores can be machined in relatively large inserts. The position of the bore in the workpiece is not changed. Needle valve gate nozzles are an important application in injection mould tool manufacturing. In this case, it is important that the needle seals precisely, which requires an optimum shape (roundness, cylindricity), surface and absolutely precise bore dimensions. In this way, burr formation on the injection part is kept to a minimum. Due to the fact that the bore is now much more precise geometrically, the diameter of the needle can be defined more accurately which minimises

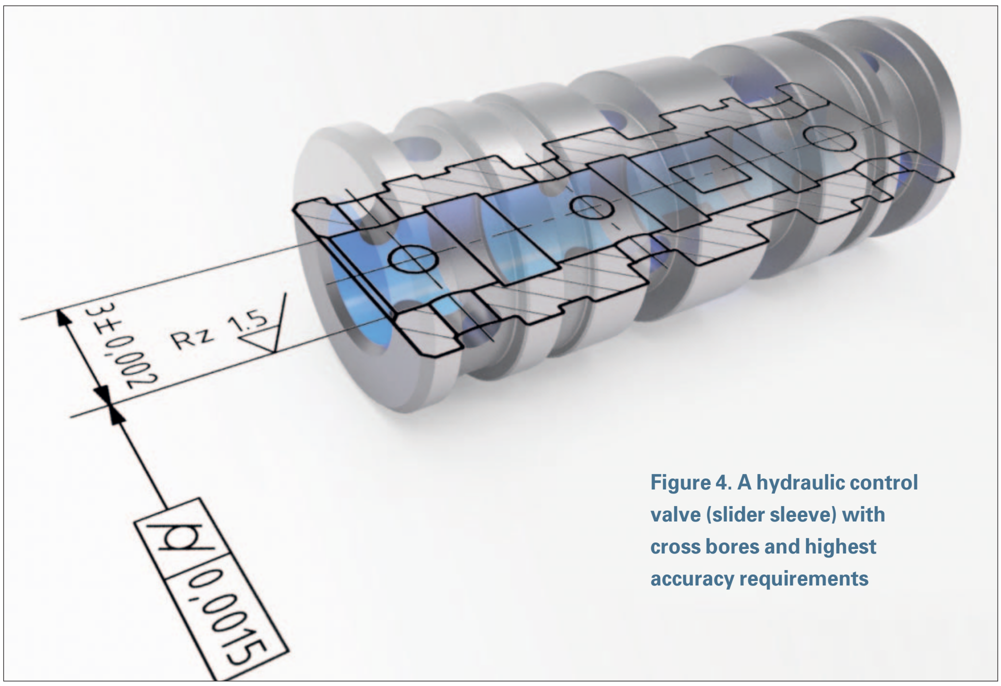

Figure 4. A hydraulic control valve (slider sleeve) with cross bores and highest accuracy requirements

Figures: Microcut

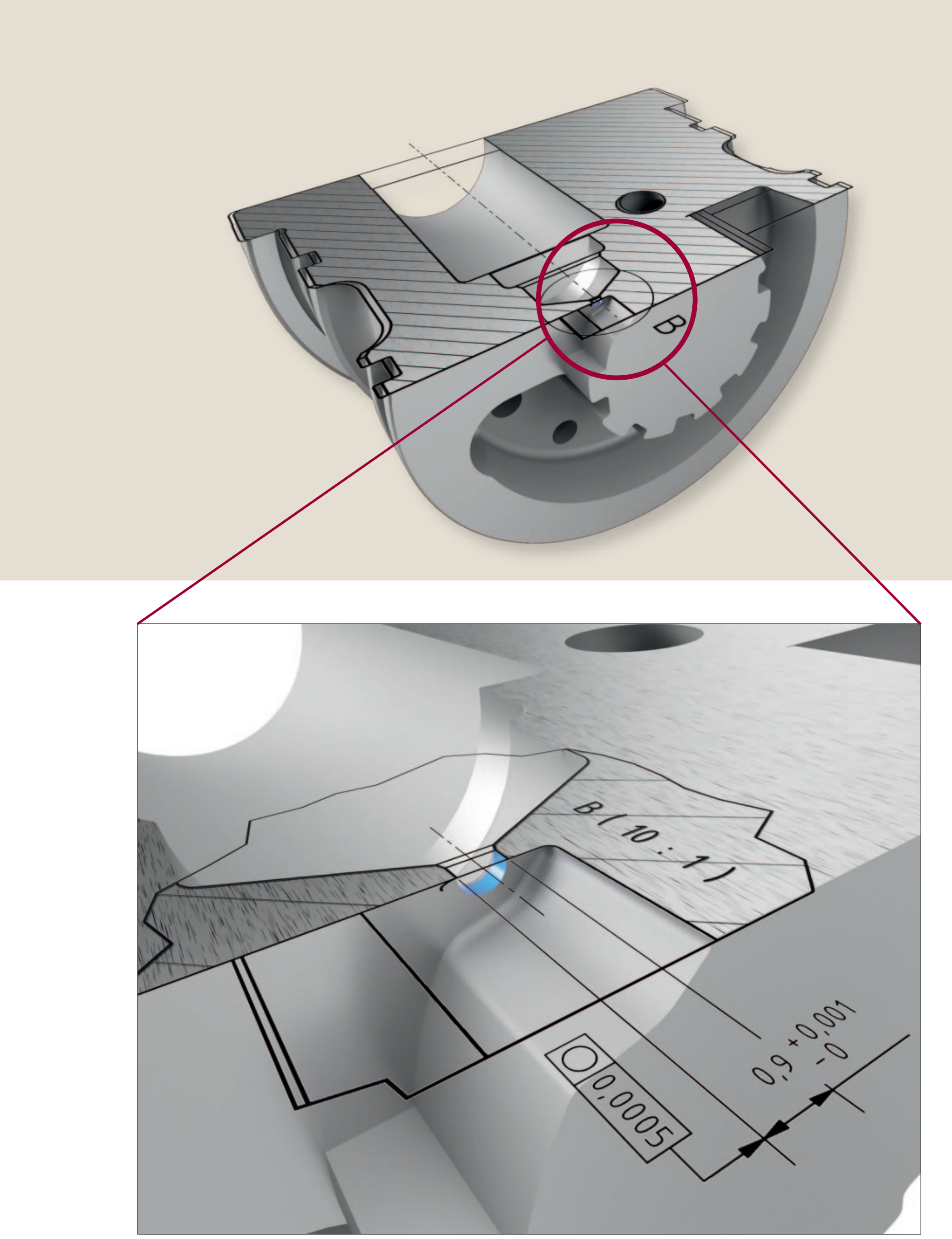

Figure 5. Needle valve gate nozzle (centre and right): even small, very short, stepped bores can be machined in relatively large inserts

mating play. This prevents burr formation on the injection part from the very first shot, as there is no material between the bore wall and the needle. Lengthy commissioning with corrections to the mould are no longer necessary.

Needle guides in a hot runner system

The advantages of a highly cylindrical bore with an optimised surface are particularly evident in needle guides during the production phase: the hot runner systems can be used on the machine for longer because there is significantly less wear on the needle and the needle guide, as well as on the needle and the valve gate nozzle. This results in increased machine and injection moulding tool availability and reduced maintenance work on the tool.

Using honing technology, bores with a diameter of less than 16 mm can be produced with high precision, efficiently and therefore economically. The process offers system-related advantages even for bores with cross holes or cut-outs. The systems can be configured for all series sizes. Despite the additional processing step, the benefits are considerable and the performance of e.g. the hot runner system is increased. ■