Flexibility for centreless grinding of small production runs

# An overall package that works

Wandfluh is a specialist in top-quality hydraulic components and electronic systems. In keeping with its production policy of high automation and low manning levels, Agathon introduced the company to cylindrical plunge grinding using a ›255 CL‹.

BY MICHAEL HOBOHM

→ Centreless grinding is often associated with the production of mass goods. After all, this type of mass production method is frequently used to manufacture simple rather than complex geometries. The example of Frutigen-based hydraulic component and electronic system manufacturer Wandfluh is the exception that proves the rule: mass production is not on the agenda for this Swiss precision manufacturer. Conversely, its aim is to implement individual solutions to the highest possible standard of quality. Such a policy naturally demands extreme flexibility from the production department. By combining highly automated machines with quality measurement as close to real time as possible, Wandfluh is able to ensure the efficiency of its production outfit with ever lower staffing levels. This principle was applied recently to a project involving cylindrical plunge grinding courtesy of an Agathon ›255 CL‹. (Fig. 1).


1 Hydraulic component and electronic system manufacturer Wandfluh integrated a ›255 CL‹ centreless cylindrical grinding machine from Agathon into its highly automatic production process including robot and post-process measurement

The Wandfluh group manufactures a broad-based portfolio of hydraulic components with wide-ranging different designs and functional characteristics. Alongside its Frutigen location, this family firm operates at a further five sister locations in Germany, the UK, France, America and China with a workforce of over 300.

## Top-quality products produced to a clearly defined strategy

Wandfluh is best known for products used in complex hydraulic applications. The focus of its activities is on spool and poppet valves, proportional hydraulic and electronic components, cartridge valve technology and miniature hydraulics. With a wide pool of experience in component and system construction and an ingeniously designed modular system, it produces individual solutions adjusted closely to user requirements. The company's wide application spectrum is due to this customer-oriented flexible market approach. The different industrial sectors in which hydraulic components and systems from Wandfluh are found in stationary and mobile application are many and varied: Whether in the paper, textile or plastics industry, in the construction, forestry and energy sector or in mechanical engineering and shipbuilding. Worldwide exports account for an impressive two-thirds of Wandfluh products, with Germany out in front.

To allow top-quality products to be manufactured competitively, Wandfluh pursues a number of clearly formulated production strategies. While it masters the whole range of cutting technologies, for instance, the company tends to focus on qua-

Figures: Agathon (4), Hanser (1, 2, 3, 5)

lity-enhancing machining operations. These include primarily grinding and honing processes which provide components with their final high-precision finish. The majority of turning and milling work as well as surface refinement, conversely, are outsourced to long-standing suppliers. This leaves predominantly parts requiring high levels of expertise to be produced in Frutigen. By concentrating in this way on core competences, Wandfluh achieves around a 50 per cent level of in-house manufacturing.

»The batch sizes we generally produce vary between 10 and 3,000 units«, explains Wandfluh's operations manager Marc Colijn. »The majority of our work is with free cutting steel and cast iron, supplemented by a small proportion of aluminium and stainless steel.« Machining what are often highly complex parts takes place using a fleet of some 20 state-of-the-art CNC machines, of which no fewer than six are grinding machines and hard lathes. »These machines are frequently automated and equipped with in-process or post-process measurement systems«, continues Colijn. »Our underlying strategy is aimed at ensuring 24-hour troublefree low-manned production with optimum process reliability wherever possible.«

Wandfluh broke new ground when it introduced the centreless 255 CL grinding machine from Agathon to its machine outfit at the end of 2007, with the intention of applying this same maximum automation strategy to the full. It achieved this with the simple integration of a handling system from a separate supplier and a post-process measuring unit provided by Wandfluh itself (Figs. 2 and 3). Before the introduction of the 255 CL to the production outfit, the only grinding work to be carried out in Frutigen had been between centres. »By introducing this new technology we were endeavouring to achieve shorter cycle times and higher output«, explains Colijn. »While grinding between centres frequently necessitated several reclamping operations, we were looking to manufacture some of the more complex profiles in a single clamping.«

The production management was also looking for ways to save on the production of the centring mechanisms or drivers previously needed to locate workpieces, which sometimes have the added drawback of

**2** Using an existing interface, a robot from an external supplier was simply integrated into the automation concept

**3** Post-process measurement technology was used to verify adherence to quality criteria

interfering with the operation. »Because workpieces are completely supported during centreless grinding and consequently not subject to deflection«, explains Colijn, »we planned to combine higher stock removal output with a consistently high standard of quality.« Wandfluh's decision to opt for a 255 CL from Agathon was prompted – alongside the technological benefit of centreless grinding and the broad scope it offered for cohesive integration into the automation and measurement concept – by one primary motivation.

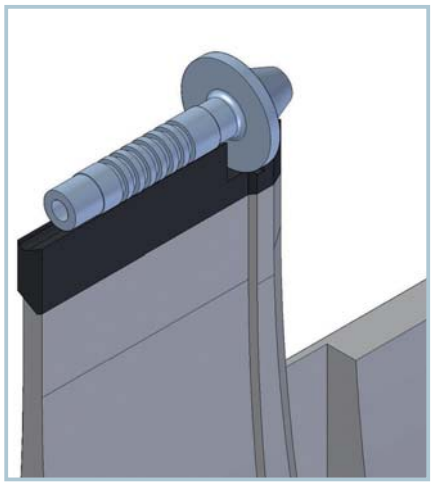
»The key lies in this tapered seal for hydraulic sealing of poppet valves«, announces Colijn, holding aloft a delicate component. »With a diameter of 3 mm and a length of less than 20 mm, getting this part exactly right poses an enormous challenge, not just in terms of the machining process but also when it comes to handling.« Previously, this tapered seal first had to be machined between centres before the subsequently grinding in of notches. »We aimed to combine these two work processes on the centreless machine and so reduce the overall machining time.« Depending on the component, this type of reduction can actually slash machining time in half. However, it was also evident that the stepped diameter would prevent throughfeed grinding of the tapered seal – which meant using the plunge grinding technique.

»Once the underlying concept had been established, we showed the tapered seal to various machine manufacturers in Switzerland and Germany with the remit to come up with a centreless grinding solution. All the grinding tests which followed were a failure«, recalls Colijn. »Except Agathon's. They were the only supplier to come up with the goods – and with the utmost process reliability: Not only for the specified batch sizes, but also beyond.« Alongside the potential offered by the machine itself, it was the expertise invested by the Solothurn-based machine specialist into a new workpiece support which made the decisive difference. It was only with the aid of this support that it was possible to integrate manufacture of the tapered seal into the automation concept. »Unlike our competitors, for reasons of stability we use a stationary workpiece support which cannot be traversed forward for loading«, explains Peter Roth, product group manager in charge of centreless machines at Agathon. »This prompted us to develop a special carbide tipped workpiece support produced in a type of Vee shape specifically for Wandfluh.« (Fig. 4).

However, for a manufacturer like Wandfluh which uses a robot, space at the machine can often be so tight as to impede or even prevent workpiece loading. »Consequently, in the 255 CL the regulating wheel traverses away from the support, allowing the tapered seal to be simply loaded into position. At the same time, the shape of the support prevents the workpiece from dropping down«, explains Holger Becker, regional sales manager for centreless grinding machines at Agathon. During the grinding process, the tapered seal is then pushed along the guiding edge against the grinding wheel by the regulating wheel, creating precisely the three-point support necessary for stable grinding with the utmost processing

reliability – a result Colijn is quick to confirm, adding that it was only the introduction of this special support that really brought the 255 CL's automation and measurement concept fully to bear. »This is why right from the start, we had stipulated a solution which would allow us to reliably load the tapered seal but could be simply readjusted for use with other components«, adds the operations manager. »By supplying this support, Agathon had provided an excellent way of solving this remit.« As the idea of the support was jointly developed and implemented by a process of on-going dialogue, it stands as a typical example of the cooperative partnership which grew up between the two companies during the course of the project.

The 255 CL is currently in operation 20 hours a day. Since it was first commissioned, the production portfolio has been systematically expanded, during which the flexibility of the centreless grinding machine has certainly paid dividends over and over again. »As a full CNC machine



**4** It was only with the development of a Vee-shaped carbide tipped workpiece support that the automation concept could be implemented for tapered seal production

equipped with four CNC axes and a ›Sinumerik 840 D‹ system, the 255 CL is capable of running a variety of centreless programs«, emphasizes Becker. »The spectrum ranges from plunge and throughfeed grinding through angular infeed and creep feed grinding to concentric grinding.« With one longitudinal axis each for the grinding and control spindle and a transverse axis for the dressing systems, the 4-axis concept of the 255 CL affords excellent accessibility to all areas of relevance to the operator. At the same time, it provides comprehensive scope for the application of fixtures. The centreless machine can be used for the universal grinding of high-precision components with diameters ranging from 0.5 to 30 mm and lengths of up to 125 mm. Larger diameters are possible on request – depending on the material and stock removal volume.

**5** Jointly responsible for getting the overall package up and running: Peter Roth, Holger Becker and Marc Colijn (left to right)

**i USER**

**Wandfluh AG**
CH-3714 Frutigen
Phone +41 33 6727272
Fax +41 33 6727212
→ www.wandfluh.com

**i MANUFACTURER**

**Agathon AG**
CH-4503 Solothurn
Phone +41 32 6174500
Fax +41 32 6174700
→ www.agathon.com

## A joint solution that works

»To ensure that we can access this universal application scope, we worked right from the machine acceptance stage with several workpieces from three different component families«, reports Colijn. »Our thinking was that if we could produce these parts, then we would quickly be in a position to produce other parts from the same families. To date, events have proved again and again that this approach was the right one.« Alongside its impressive flexibility, the operations manager considers the process reliability afforded by the 255 CL to be another key issue. After all, the machine is required to run unmanned throughout the night. Not only does it manage this with impunity, it also reliably adheres to concentricity precision values of below one micrometer, and $R_a$ values of just 0.2.

»The whole package works«, sums up Roth. »That is down primarily to the cordial cooperation between our two companies.« By setting out a transparent long term agenda, both partners have drawn valuable benefits from this collaboration. »The immediate benefit for us«, adds Colijn, »is a highly flexible machine which is ideally suited for small production runs. At the same time, it offers easy scope for automation – a requirement which is firmly entrenched in our production strategy. So overall package works, and it does that unmanned for 24 hours a day (Fig. 5).« ▮

**Dr. Michael Hobohm** is Editor-in-Chief of Swiss Quality Production at Carl Hanser Verlag in Munich/Germany
→ hobohm@hanser.de