

Smooth gliding, productive machining

STC 1250 HD: hydrostatic bearing brings about a leap in performance in titanium machining

Fresh Starrag wind for Chinese wind turbine gearboxes

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Setting the course for high precision

AMMANN Components (Switzerland) is a system supplier, specializing in complex, high-precision workpieces

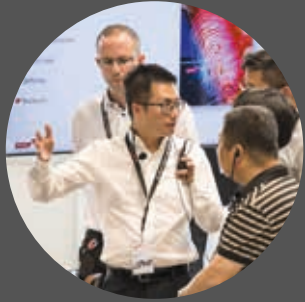
Micrometer precision with emotion

Interview with Adriano Della Vecchia, Stéphane Violante and Mark Huneycutt, Principle of Equipment Engineering at Bell

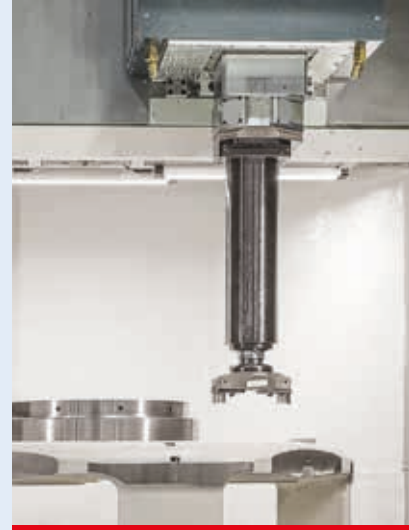
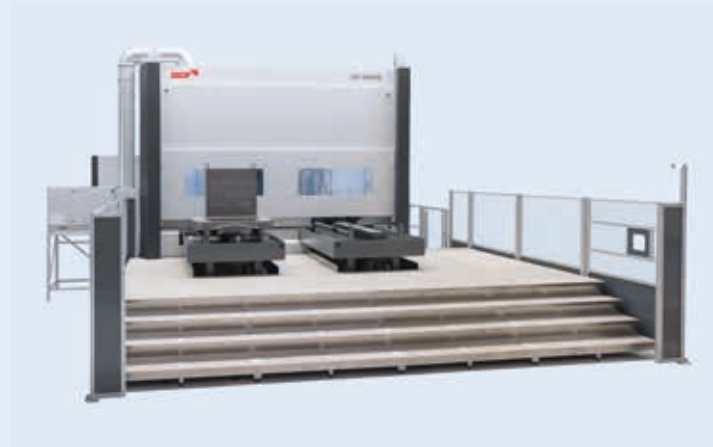
thyssenkrupp rothe erde
relies on optimized Starrag
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turning and grinding machine



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Starrag Technology Days 2023



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Martin Buyle
CEO of the Starrag Group

Dear reader,

The energy transition is a global challenge. Together with regular customers such as the Chinese NGC Group, we are already rising to it. The leading manufacturer of drive technology for wind turbines has already produced 100,000 wind turbine gearboxes. To further expand its market position, the NGC Group has increased the number of our machines to 20.

Many wind turbines would not rotate without slewing bearings and rings from thyssenkrupp rothe erde. Seven Dörries CONTUMAT vertical turning grinders play an important role in the plant in Lippstadt – the last machine ordered with two modified and optimized supports.

But in a country with a high-priced subcontracting landscape, how do you go about transitioning from subcontractor to system supplier for complex, high-precision workpieces?

The answer from AMMANN Components in Tägerwilen is: investment in high-tech production technology that can be automated. Here, the change succeeded thanks to a machine park dominated by Heckert machines. AMMANN now expects a further boost from the recently delivered Heckert H75, which, due to preparatory cooling in the set-up room, can even machine large aluminum gearbox housings with close-tolerance center distances with ultimate precision.

Of course, Starrag also uses its own products. For example, the Group's center of excellence for mechanical production in Chemnitz will receive a flexible production system with two Heckert machining centers and a Droop+Rein large machining center, which will machine XXL components such as machine beds for the Starrag Group on a footprint of 72 by 46 feet (22 by 14 meters).

As a contrast, the components that well-known manufacturers of luxury watches have been producing on high-precision Bumotec machines for decades now are small, fine and highly precise. Find out how we were inspired by the precision of luxury watchmaking and successfully transferred this know-how to solutions for medical technology.

Our events are crucial for the dialogue with customers, for example the Heckert Open house in Chemnitz, where the Heckert H85 and H95 machining centers exhibited, which are easier to automate than the predecessor machines, were presented. There was a world premiere at the Aerospace & Turbine Technology Days in Rorschacherberg: the Starrag STC 1250 HD horizontal machining center was demonstrated. Thanks to the hydrostatic bearing of the horizontal linear axes, it is particularly suitable for five-axis heavy machining of complex titanium structural components.

I hope you enjoy the Star issue 02-2023. Let us surprise you with how we are already shaping the future of production together with customers.

Yours,
Martin Buyle

In search of increased productivity



A brief review of the Technology Days 2023, which offered numerous approaches to solutions

The Aerospace & Turbine Technology Days at Starrag in Rorschacherberg are a first-class event for production managers and employees in these industries. Because here they not only get to see machines, they are also offered solutions that ensure efficient and reliable production. No less valuable are the discussions with the experts from Starrag and partners who effectively improve production processes down to the last detail in joint projects.

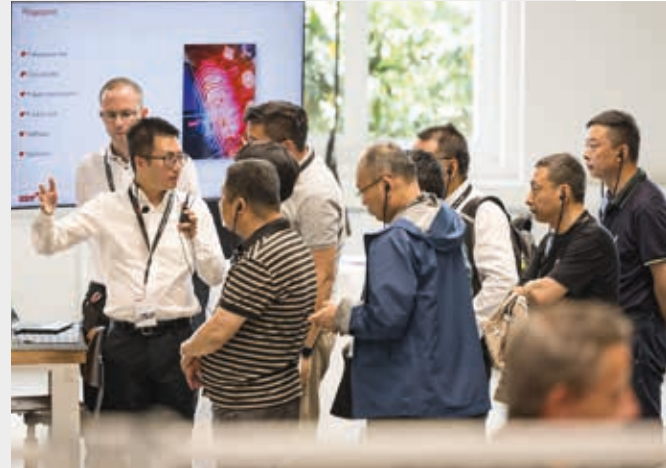
150 customers from 17 countries attended this year's Aerospace & Turbine Technology Days. They were welcomed by Martin Buyle, who has been CEO of Starrag Group since 1 April 2023 and was previously responsible for the realignment of the large-scale machine business as Managing Director of Starrag Technology. "In our group of companies, and especially at the Rorschacherberg site, we have been closely associated with the aviation and energy sectors for many years and have built a great deal of application know-how," explains Martin Buyle. "Our employees pass on this knowledge to the Technology Days – with a passion that always makes this event very special." Christian Kurtenbach, manager of the Rorschacherberg site, also ascribes great importance to the event's solution

approach: "We're not here to sell machines. The focus is on our customers and their needs. Together with many interesting partners, we show solutions on how to improve processes and reduce cost-per-part." Christian Kurtenbach has been in charge of the new "High Performance Machining Systems" business unit, which includes the Ecospeed, Heckert, Starrag and TTL product ranges, since June 2023. He points out that the Technology Days are increasingly becoming a Group event. This year, Droop+Rein and Berthiez machines were also involved in the projects presented.

Collect information, exchange experiences

The consistent high international attendance and the enthusiasm of the participants

on site demonstrate that the solution-oriented concept of the Technology Days, which are taking place for the 14th time this year, is well received by customers. For example, a production manager responsible for the production of turbine blades confirmed that Starrag does not just supply excellent machines for this task, but also outstanding technology. Here on site, he and his colleagues have the opportunity to get to know the latest developments that also affect the periphery, such as robotics, mould handling and sensor technology. He believes this is an important topic for discussion that could initiate progress in the company. Asian visitors also shared the opinion that they get a lot of ideas on how to develop the technology of their business at the Technology Days. They also emphasized that



the exchange of experience with other production companies and potential customers is extremely valuable for them.

The above all positive atmosphere this year was welcoming recovery following the challenging COVID years. One of the many Starrag customers who had travelled from the USA explained that his company—which specializes in structural components made of aluminum—was suffering, like many others, from a shortage of skilled workers. That is why he is on the lookout for automated manufacturing solutions. His statement: “I have already found a great deal of inspiration here in a short period of time.”

How do I lower the cost per part?

Twelve stations were set up dealing with machining tasks that are important in the aerospace and energy industries. The process idea and the ways to reduce unit costs were always the key focus. A world

“The focus is on our customers and their needs”

Christian Kurtenbach
 Manager Business Unit
 High Performance
 Machining Systems

premiere attracted special attention: the Starrag STC 1250 HD horizontal machining center, whose horizontal linear axes are mounted hydrostatically (see also article on page 12). Frictionless, wear-free, extremely rigid and highly damped—these properties make it ideal for five-axis heavy machining of titanium structural components. The new STC 1250 HD achieves up to three times the material removal rate during roughing than its roller-bearing predecessor model. The improved dynamics come into play during finishing, ensuring excellent precision and surface quality. The result: shorter machining times and less tool wear lead to lower unit costs – despite a higher purchase price. Another advantage is that the Starrag STC 1250 HD consumes less energy

during roughing. This can be explained as follows: The greater cutting depth reduces the roughing time. In this way, the user saves part of the previously required drive power plus basic load – despite higher power consumption – and, depending on the component, lower energy consumption is achieved. Keynote speaker Dr Matthias Lange, Head of Research and Technology at Premium Aerotec, Varel, also referred to such energy-saving potential. In his presentation, he addressed the topics of sustainability, energy efficiency and CO₂ footprint in the aircraft industry. His conclusion was that the greatest potential for savings in the production of aluminum and titanium components lies in the blanks and their machining. As far as cutting is concerned, he recommends

“The greatest potential for savings in the production of aluminium and titanium components lies in the blanks and their machining”

Dr Matthias Lange
Head of Research and Technology
at Premium Aerotec, Varel



in particular higher feed rates, because – as shown when using the Starrag STC 1250 HD – less energy is required per volume cut.

Automation solutions in demand like never before

Impressive process improvements could also be experienced at all other stations. A selection: Recent Starrag FMS (Flexible Manufacturing Systems) developments demonstrated how machines from different Starrag brands complement each other to form an FMS that combines different technologies such as milling (on a Starrag STC) and turning (on a Berthiez TVU).

Visitors were most interested in the details – such as the cell computer developed by Starrag or the fully automatic tool management system implemented together with Haimer and Broetje, which offers great potential for savings, particularly in titanium machining. Automation was also the theme for the Starrag LX 021. The machining center is used for high-precision, efficient 5-axis machining of turbine blades. Equipped with a bar loader, it can work unattended for up to 24 hours. A special feature of this solution is the process control with force measurement from partner pro-micron and the patented spike technology. This enables measuring and visualization of

the forces directly on each tool cutting edge. Another example of automation was highly productive pocket milling on an Ecospeed machining center. The partner company Hexagon equipped this with state-of-the-art measuring technology, including an ultrasonic probe for thickness measurement. The manual version is not reliable enough to ensure a measuring accuracy of $\pm 30 \mu\text{m}$. On the other hand, the Hexagon probe, which can be exchanged like a measuring probe, ensures maximum process reliability. Automated solutions for temperature-measurement and laser scanning of the surface also give rise to safe, time-saving processes. ▀

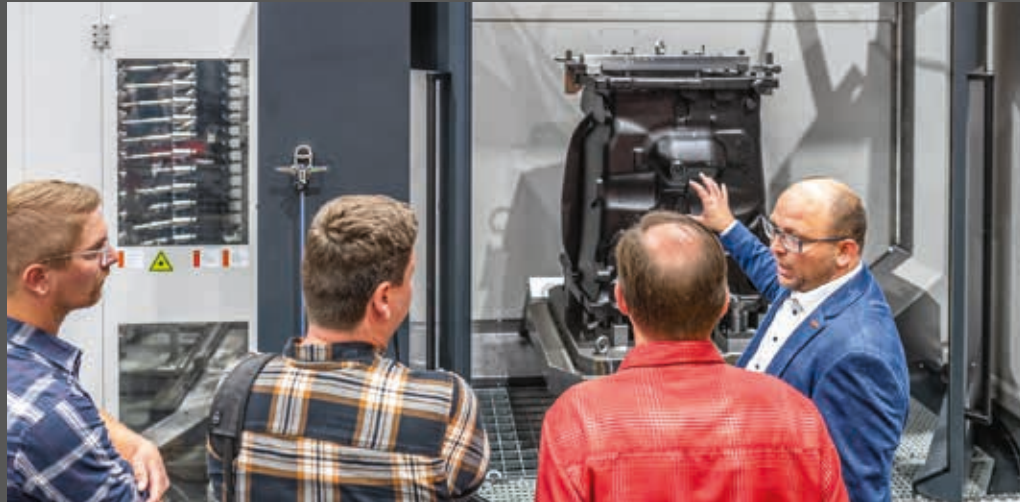
Machines that inspire

Trend-setting Heckert Open House in Chemnitz

It has been seven years since Starrag GmbH held its last in-house exhibition in Chemnitz. A lot has changed in the meantime. The new compact machines in particular are causing a stir. It was about time to inform customers, employees and interested parties on site about the latest developments and plans.

For Martin Buyle, CEO of the Starrag Group since April 2023, events such as the Heckert Open House 2023 in Chemnitz are an important instrument for intensifying customer loyalty and inspiring employees and their families to pursue Starrag's goals: "We can showcase state-of-the-art manufacturing solutions here and hold in-depth face-to-face conversations. This is invaluable, so in future we will be holding such events at every Starrag location."

The Open House in Chemnitz took place over one week in July. Kai Bohle, Sales Manager of Starrag for the Transportation & Industrial segment, had invited customers to show the latest machine developments, and had called on experts who could answer all their questions.



Starrag also used these days for employee training and temporarily opened the factory halls for family members and interested parties.

"After the long break, we have restarted with the current Open House," says Kai Bohle. "We will certainly develop the concept further." In future, Christian Kurtenbach will also be involved in them; as head of the new "High-Performance Machining Systems" business unit, he has been responsible for the Chemnitz site and the Heckert product range, among other things, since June. He attaches great importance not only to presenting new developments in the machine sector, but also to presenting approaches to solutions in which the broad Starrag know-how comes to bear. "The topics of automation and digitalization will also continue to gain significance," Kurtenbach adds. "Our machines are prepared, and with the robot cell we are showing a new, innovative automation offering here."

Impetus for innovation

The keynote speech by Professor Dr Gunter Dueck, which introduced the Open House, was about "The New and its Enemies". The mathematician, innovator and economic philosopher used a



Professor Dr Gunter Dueck, Keynotespeaker

number of examples to show that many innovations are first laugh at, then resisted, and only when they are the state of the art do they receive approval. His conclusion: If you want to be successful, you should not be afraid of new things and not declare every obstacle a No. Only the willingness to change will make the power shots possible in the future.

For Christian Kurtenbach, this means, "We have to go two ways: continue to improve our excellent machines and also venture into something completely new." At the Chemnitz event, the focus was primarily on the former – in the form of the new Heckert compact series. The Heckert H85 and H95 machining centers were presented to a select audience for the first time. "They will replace our four-axis



Heckert HEC 630 and HEC 800 centers, which have been our core business up to now," explains Jonny Lippmann, product manager for Heckert compact machines. "We have managed to make our success machines even better in many aspects."

For example, the Heckert H85 and H95 are easier to automate than their predecessors. This is ensured by extended clamping hydraulics and simplified interfaces to pallet storage systems and robot cells. Improved integration into the



Jonny Lippmann (right), Heckert Product Manager

"The Heckert developers showed great flexibility in meeting our requirements, which they ultimately succeeded in doing."



Kai Bohle (left), Sales Manager of Starrag for the Transportation & Industrial

customer's infrastructure was also realised – with central connections for cold water, coolant and data exchange. Not to mention the reduced space requirement, higher payloads, extended spindle selection and much more.

Experience the machining of gearbox housings live

It was particularly interesting for the visitors to see machines such as the Heckert H85 and H95 in action with actual practical components such as gearbox and axis housings. Because precisely these machines, along with others, have already been sold to AGCO/Fendt in Marktobendorf. The main site of the agricultural machinery manufacturer Fendt is located there. Dr Jan Cachay, plant manager of the gearbox plant in Marktobendorf, explains: "We work with about 70 Heckert machines from the CWK, HEC and H series,



Dr Jan Cachay (centre), plant manager of the gearbox plant, Fendt, Marktobendorf

covering pallet sizes from 400 to 1600. This year we are getting twelve new machines on which we will machine gearbox housings and frames for the tractors." As the construction of a new production hall was delayed, a pragmatic agreement was reached with Starrag:

Fendt employees are currently working on the new machines at the Starrag plant in Chemnitz and producing parts for Fendt. For this reason, the visit to the Heckert Days was a special highlight for Jan Cachay. "I am pleased about the teamwork between the Heckert and



Fendt employees. I also saw some innovative approaches with real added value for practice," says Cachay.

Other visitors, other interests

Friedrich Oberländer, Head of Production Technology at Voith Turbo in Heidenheim, has also maintained close contact with Starrag for a long time. He is particularly interested in the Heckert-T series, i.e.

the 5-axis machining centers with turning function. "We bought one of the first Heckert T45 machines," states Friedrich Oberländer. "The Heckert developers showed great flexibility in meeting our requirements, which they ultimately succeeded in doing. After a joint development period, the end result is outstanding." At the Open House, he looked at the slightly larger Heckert T55, among others: "Before making a new

investment, I have to watch the machines in action and discuss some details with the Heckert experts – which I am able to do here."

Marcel Herzog, team leader of large-part machining at Gressel AG in Thurgau, Switzerland, came to Chemnitz to experience the Heckert H75 first-hand. In his area of responsibility there are currently four Heckert HEC 500s, which are connected to a pallet system and automated. "We want to replace one of them soon," Herzog explains. "It's interesting to see at first hand what changes have been made to the machine and what the improvements look like specifically, for example in the tool changer or in terms of automation." He also praised the excellent organization, the fruitful discussions with Starrag employees and the professional exchange with production managers from other companies. ▽

Investment in mechanical production



The Starrag plant in Chemnitz is not just a development and production site for Heckert compact and large machines. The Starrag Group's center of excellence for mechanical production is also anchored at the location.

Components that predominantly require the highest precision or are particularly large and valuable are manufactured there for Heckert and other product areas. These include certain machine beds, columns, tables and Z-slides, but also smaller parts such as bearing blocks for ball screws, gearbox housings and guide parts for the main spindles.

The basis for the demanding tasks is the high level of manufacturing expertise in the workforce and the corresponding equipment. The Starrag managers recognized

potential for optimization of the equipment. To bring this important department up to the state of the art so it can operate even more efficiently, flexibly and diversely, they approved investments in the double-digit millions.

A significant portion of this sum is going into a flexible production system with a length of over 98 feet (30 meters), which consists of two Heckert HEC 800 X5 MT machining centers with room for a third. The machines are interlinked via a Fastems linear storage system with

64 pallet storage locations. The second important part of the investment is a Droop+Rein FOGS HD large machining center with a footprint of 72 x 46 feet (22 x 14 meters). This enables all machine beds and other large parts to be machined with the utmost precision. The investment is accompanied by the bundling of all mechanical production activities in a completely modernized hall. In addition to the new acquisitions, the large Heckert HEC 1800, 1250 and 1600 machines are already in use and a SIP 5000 jig boring machine is also located here. ▽



Smooth gliding, productive machining

**Hydrostatic bearings bring
about a leap in performance
in titanium machining**

A little push – and the twelve-tonne column accelerates on the machine bed without any further action. EMO visitors can experience this live at the Starrag exhibition booth. The machine manufacturer will be showing its newly developed STC 1250 HD 5-axis machining center there, with its horizontal linear axes that have hydrostatic bearings. That is where the frictionless gliding comes from, which gives rise to significantly higher stock removal rates, improved dynamics and longer tool life.

The STC series is predestined for simultaneous 5-axis heavy machining of titanium and Inconel parts due to its excellent static and dynamic properties.

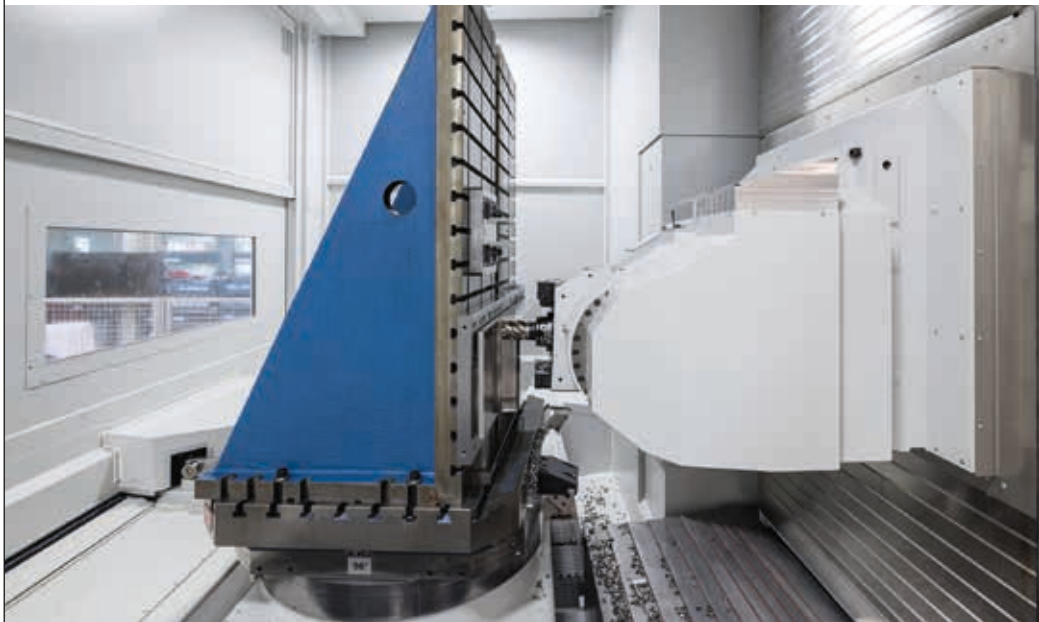


“The essential feature of hydrostatic guides is the permanent oil film between the slide and the bed or the standing structural part.”

For many years now Starrag machines have been setting standards in the economical machining of structural components, multiblades and casings, as required in the aerospace industry and for power generation. The STC series is predestined for simultaneous 5-axis heavy machining of titanium and Inconel parts due to its excellent static and dynamic properties. The machines are equipped with Starrag’s own robust gear spindle and an extremely compact swivel milling head, which enables the use of

shorter and therefore more stable tools, thus contributing to efficient machining. To further increase this efficiency in titanium machining, the heavy machining specialists at Starrag have carried out a wide range of studies. Bernhard Güntert, head of the test field at Starrag AG, explains: “The main sticking points are the machine’s rigidity and damping properties.

customer demands and the lessons we’ve learned, we wanted to change it back.” So the Starrag developers re-addressed the topic of hydrostatics and achieved an impressive result, as Rainer Hungerbühler enthusiastically confirms: “Our new STC 1250 HD is fantastic. The first tests have already shown that it sets a completely new benchmark in terms of



These factors have far-reaching effects on the possible cutting depth and the tool wear, and therefore on the economic efficiency.”

Hydrostatics increase performance

The most important test result: when it comes to vibration damping, hydrostatic guides cannot be topped. This is an area in which Starrag already has experience. Rainer Hungerbühler, Sales Director for Aerospace and Turbines, takes a look back: “More than 15 years ago we already had hydrostatically guided machining centers. However, the dynamics of these machines left a lot to be desired, which is why we equipped the subsequent STC series with roller guides. Given today’s

stock removal rates during roughing. It even has considerable advantages to offer in terms of dynamics.”

A look behind the technical scenes

Rolando Senn is the lead designer in hydrostatics. He explains the strengths of this technique: “The essential feature of hydrostatic guides is the permanent oil film between the slide and the bed or the standing structural part. This means that there is no contact between the guide rails and the carriage travels completely without friction.” Owing to the lack of friction, there is no wear and the oil dampens the vibrations that occur during machining. The large contact surfaces also ensure tremendous rigidity.

"We have increased this even further by choosing one with pre-tensioned handle guides instead of a statically open system," explains Rolando Senn. To be able to classify these strengths, it is necessary to look at the essential characteristics of other guide systems. Hydrodynamic guides, for example, have many similar properties to hydrostatic guides, but one major disadvantage: the guide elements come into contact when stationary. The separating oil film only forms when they are moving, so static friction has to be overcome when starting up, which causes the undesirable stick-slip effect. Pure sliding guides also exhibit a stick-slip effect and are additionally subject to high friction and corresponding wear. Roller guides are not as prone to friction and wear, but they are also less rigid and damping. In addition, micro-vibrations occur during the rolling process, which can impair the surface quality during finishing operations.

Triple chip volume during roughing

The user derives the greatest advantages from the use of hydrostatic guides in roughing operations. Due to the significantly higher rigidity and damping compared to roller guides, the cutting depths can be increased threefold. The roughing times are reduced accordingly.

The damping effect can be heard and felt – or in other words: the chipping is barely noticeable. During a test machining operation, even experienced machinists were surprised by this, as Rainer Hungerbühler reports: "We were standing right next to the machine and hardly noticed any noise or vibrations. Only a glance through the window showed us that the cutting process had already started; the milling cutter was in full engagement and really thick titanium chips were flying." The new STC 1250 HD also benefits from the hydrostatic bearing during finishing.

The increased rigidity reduces pitching of the column, which limits jerking and acceleration. "To support the dynamics, we have also made the work strands on the STC 1250 HD more robust," adds Rolando Senn. "Instead of using a 2.5 in. (63 mm) diameter ball screw as before, we now use one with a 3.1 in. (80 mm) diameter on the HD. That means a 61% larger cross-sectional area, which is in-

provides enormous improvements in this respect, i.e. significantly longer service lives, even when the speeds are increased. According to Rolando Senn, this offers a huge savings potential: "With intensive machine use, the savings put the additional costs of hydrostatics into perspective." The frictionless movement of the two linear axes and the absence of micro-vibra-



With the hydrostatic STC 1250 HD, it was possible to halve the roughing time and reduce the total machining time by a total of 30%.

corporated 1:1 into the rigidity in the axial direction." The higher dynamics are noticeable in higher starting speeds, accelerations and faster five-axis movements. This ultimately also reduces the finishing times.

Greatly reduced tool wear

One of the biggest cost factors in titanium machining are the tools, which are subject to heavy wear. The excellent damping

also benefits accuracy and surface quality, particularly in 5-axis simultaneous machining with its frequent changes of direction. Starrag ensures further process optimization by equipping the hydrostatic guides with pressure and temperature sensors. Users can thus track the loads on the guides during the process and use the recorded data for further adjustments.

The true values show themselves in practice

Using the example of a typical structural component, a framed door with dimensions of 3.1 × 11.8 × 48 in. (80 × 300 × 1,220 mm), Starrag made a comparison with the previous STC 1250. The 81.8 lb (37.1 kg) forged part made of Ti6Al4V had a 0.5 in. (13 mm) allowance on each side and had to be machined to 12.1 lb

the basic load, which consists of the power consumption of the cooling lubricant system, hydraulics, pneumatics, cooling, etc. Overall, the exemplary component consumes 33% less energy.

Another plus point: the minimal maintenance required

Due to the lack of friction, the guide rails of the hydrostatic system do not

pressure builds up there, which creates a 0.0008 to 0.0012 in. (0.02 to 0.03 mm) gap filled with oil between the bed and the slide. The oil that permanently escapes at the guide edge flows back along the bed into a collection container. Another pump delivers it back to the hydrostatic unit via a changeover filter. The undesired mixing of the hydrostatic oil with other oils is simply avoided by Starrag. Rolando Senn explains: "We also use the hydrostatic oil to lubricate the turntable and other bearings. Even if small amounts of oil were lost from these components, they would end up in the hydrostatic tank, where they would not cause any damage. On the contrary. If, over time, the amount increases slightly, you can drain some oil and use it to dispose of impurities collected at the drain plug."

To prevent service and maintenance measures and ensure safe processes, Starrag protects the guide rails and the associated hydrostatic circuit from dirt, water and chips in two ways: with telescopic steel covers and bellows underneath.

Starrag has also thought ahead for the worst case scenario, a crash, and defined an initial wear point. The pressure pockets installed in the guides are made of a material that is significantly softer than the machine bed and can therefore absorb most of the energy. As these pockets are easy to replace, the damage is limited in the event of minor accidents.

And what about the costs?

The hydrostatic guide is more expensive than a roller guide. Of course, this is reflected in the costs when buying a machine. But in the end, it is the unit costs that count. Due to shorter processing times, the higher purchase price is usually amortised in a relatively short time. ▀



"We were standing right next to the machine and hardly noticed any noise or vibrations." Rainer Hungerbühler, Sales Director Aerospace and Turbine

(5.5 kg). The specification: a perfect surface with thin walls and floors. With the hydrostatic STC 1250 HD, it was possible to halve the roughing time and reduce the total machining time by a total of 30%. These values can be used to calculate another, initially unexpected advantage: the reduced energy consumption during roughing. This is because the halved roughing time saves the user – despite the one-third higher power consumption – half of the drive power previously required plus that of

wear out, whereas with roller guides they have to be replaced at great expense every five to ten years. In addition, the entire hydraulic system is extremely easy to maintain. Here is a brief look at the technology of hydrostatic bearing.

On the Starrag STC 1250 HD, the hydrostatic unit actively delivers the oil into the pressure pockets of the guide plates at a pressure of 80 bar. A dynamic

Fresh Starrag wind for Chinese wind turbine gearboxes

The NGC Group from China has already produced 100,000 gearboxes for wind turbines, including eight Starrag machines at the main factory having also proven their worth in the process. Reason enough for the Chinese market leader in wind turbine powertrains to increase the number of machines in the Berthiez, Dörries and Heckert product ranges to 20.





**Since 2006,
100 machines
alone have been
delivered to China,
of which about
one in five
went to NGC**



Nanjing High Speed Gear Manufacturing Co., Ltd. (NGC Group). The company from Nanjing, the capital of the eastern Chinese province of Jiangsu, is the leader in gearboxes for wind power trains in China, with a market share of 60%.

China wants to be carbon neutral by 2060. Wind power plays an important role in this plan: China is already the world champion with an installed capacity of over 365 GW, but it is still expanding this position. From 2026 onwards, wind turbines with a total capacity of 130 GW each are to be built year on year.

Chinese companies such as Nanjing High Speed Gear Manufacturing Co., Ltd. (NGC Group) play an important role in this. The company from Nanjing, the capital of the eastern Chinese province of Jiangsu, is the leader in gearboxes for wind power trains in China, with a market share of 60%. The company has also been one of the three leading manufacturers of drive technology for wind turbines internationally for years.

NGC: “Only a green future is a good future”

The driving factor for NGC is the clear commitment: “Only a green future is a good future”. Founded in 1969, the company sees itself as well-positioned to follow this sustainable path thanks to its more than 50 years of experience in researching and developing high-quality and efficient drive solutions. Huai’an, the third factory in China in addition to the production facilities in Nanjing and Baotou, will set the course for a carbon-free future. Units for the large offshore wind turbines with 15, 18 and 20 MW capacity have also recently been built there. This is where Starrag comes in, with its Renewables market segment, which has made a good name for itself worldwide for decades

with machines for manufacturing drives for wind turbines. Since 2006, 100 machines alone have been delivered to China, of which about one in five went to NGC.

Direct on-site service in Shanghai and Beijing

However, the Swiss machine manufacturer also owes this success to its special attitude to service, which is also a distinguishing characteristic of its customer NGC. Consistent and direct on-site support from the Starrag headquarters in Shanghai and a branch office in Beijing is the recipe for success. A large, experienced team supports local customers on site during the entire life cycle of a machine tool: from consulting, application engineering, service to comprehensive on-site training.



The interplay of on-site service and high-tech paid off right from the start. "In 2007, we won NGC as our first Chinese customer in the wind power industry there," recalls Jörg Heinrich,

Director of Application & Technology Department at Starrag Shanghai Co., Ltd: "After successfully handing over the first machine, a Heckert horizontal machining center in 2009, NGC immediately

ordered three more Heckert machines." In addition to precision, productivity also spoke in favor of the newcomers from the Starrag factory in Chemnitz. According to NGC, the machining centers can



**Since 2022,
NGC has
increased
the number
of Starrag
machines in
its factories
to 20**

+25%

**According to NGC,
the machining centres
can process work-
pieces 25% faster than
competitor machines.**

process workpieces 25% faster than competitor machines. The production technology and the special on-site service were well received in China: since 2022, NGC has increased the number of Starrag machines in its factories to 20.

A Dörries vertical turning machine has gone to Baotou and nine machines from Starrag's Berthiez, Dörries and Heckert product ranges to the new factory in Huai'an, which plays an important role in the further expansion.

The facts also reflect this: NGC invested around five billion renminbi (exchange rate in July 2023: 650 million euros) in the first phase of the new plant: A factory for 1,000 employees was built on an area of 315 hectares. About 45 soccer fields in size (3,444,451 ft² (320,000 m²)) is the production area where NGC installed 560 machine tools, of which about one in three is a high-tech machine from abroad, machining with the highest precision. The Starrag machines also play an important role here (see also: Starrag machinery at NGC). They are used for

machining the complex structures of cast components for wind power transmissions. The Starrag machines already meet the high quality requirements for components for 20 MW gearboxes in the first production phase. Satisfied comment from NGC plant senior management: "This is a strong guarantee of the highest gear stability."

This positive response to the nine newcomers in Huai'an points to the proven and long-standing cooperation between NGC and Starrag. "Once again, we were able to individually adapt the machine configurations to the wishes and requirements of our Chinese customer," says Dipl.-Ing. Hubert Erz, Senior Consultant Sales Renewables at Starrag, with satisfaction. "In teamwork, we jointly developed machines in the right sizes and with the right configuration in each case for the production of new, customized components for the wind power drive train. We are now looking forward to continuing our trusting and successful cooperation with a view to China's carbon neutral future, in which we are happy to accompany NGC with our know-how and production technology." ▀

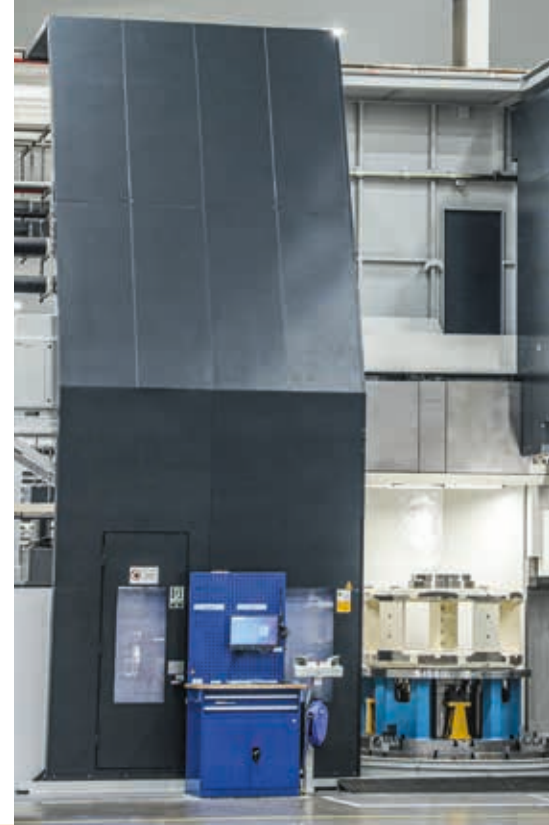
Starrag machinery at NGC

> Berthiez

Starrag S.A.S from Saint-Étienne (France) has made a very good name for itself throughout the energy industry world-wide with its large vertical Berthiez turning and grinding machines, because grinding takes on an important task in the manufacture of drive elements. Therefore, the new factory in Huai'an received four vertical grinding machines (RVU) from the Berthiez product range. The advantage of these machines is their high-precision grinding in the μm range, which always takes place with extremely high repeat accuracy. NGC uses the grinding quartet primarily for finishing planetary gear bores. Both, integrated roller bearings and the increasingly used plain bearings make high demands here. The high required surface quality of the



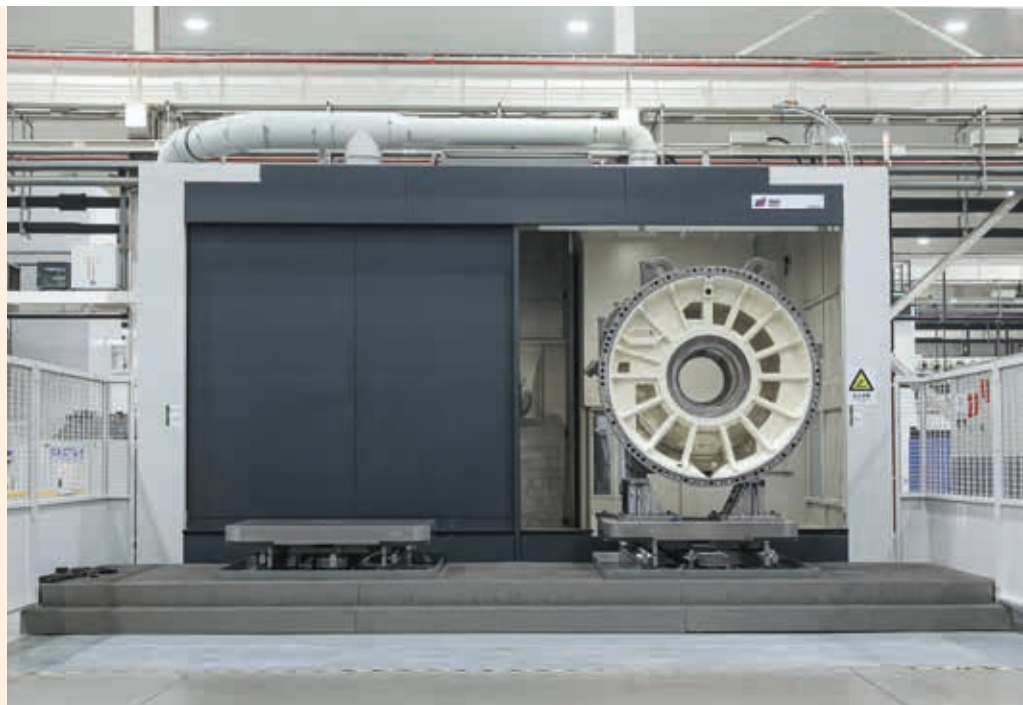
bearing raceway can only be achieved by grinding the hardened surface. The four turning and grinding machines have 25 kW and 35 kW motorised grinding spindles, turning tool holders for Capto C6 tools and measuring probes for workpiece measurement. The machine concept is rounded off by adjustable dressers, tool magazines (4 places for grinding wheels and 8 places for turning tools) for automatic changing of grinding wheels and turning tools.



> Dörries

Higher productivity through complete machining thanks to integrated drilling and milling drive is what characterises the eight vertical lathes (VCE/VC) of the Dörries product range, which are in use in all three NGC factories. The company uses them to machine planetary carriers, ring gears and torque supports in





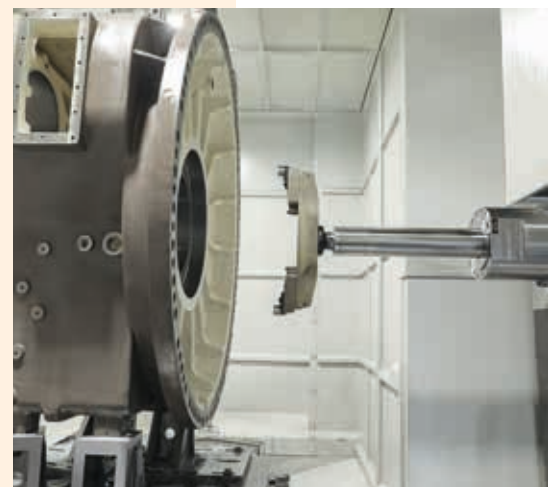
a single clamping operation. The new three vertical lathes (VCE) in Huai'an are designed for the effective machining of planetary carriers. For this purpose, they were equipped with rotary tables with two very powerful AC servo motors with 59 kW each and 2-stage gearing (max. torque: 74,000 Nm; max. speed: 224 rpm), milling spindles with 37 kW drive (max. 1,200 Nm; 3,000 rpm) integrated in the tool slide and a column magazine with handling unit for Capto C8 or HSK 100 tools. Collisions of tools with workpieces are monitored by a monitoring system from Brankamp.

Higher productivity through complete machining thanks to integrated drilling and milling drive

> Heckert

This is where it all started: We are talking about the horizontal machining centres of the Heckert product range (HEC), which, thanks to their large interference circle, are designed for the economical machining of XXL workpieces weighing up to 13 tonnes with a maximum edge length of 3,300 millimetres. Since 2009, the NGC main factory in Nanjing has been using four Heckert horizontal machining centres, all with quills. The new factory in Huai'an has been machining gearbox housings with two Heckert horizontal machining centres since 2023. Starrag also supplied both machines with the tried-and-tested quill spindle. With a diameter of 150 millimetres and an extension length of 760 millimetres, it meets the special requirements of the wind power industry.

The new duo has two pallets (1,600 mm x 1,800 mm) each and a compact tower magazine with 375 places for heavy, large and extra-long tools with HSK-A100 tool holding fixture. Low non-productive times are ensured by a tool handling system that automatically changes tools (diameter: 500 to 950 mm; tool length: up to



800 mm; max. mass: 50 kg) from the tower magazine to the main spindle, whose powerful AC servo motor with an output of 48 kW (S1 operation), a speed of up to 5,000 rpm and 1,200 Nm maximum torque is also suitable for 4-sided complete machining of very heavy XXL gearbox housings. For deep drilling, the Heckert horizontal machining centres (HEC) were equipped with high-pressure cooling. The scope of delivery also included: workpiece measurement, cooling lubricant supply and extraction device. ▀



Grinding optimized:
Plant fitter Laura Patrzek
and machine operator
Walerij Fabrizius check
the completely revised
grinding support.

Optimizing the “finishing touches”

Wind power boom: thyssenkrupp rothe erde relies on optimized Starrag Dörries CONTUMAT vertical turning and grinding machine



Since 2008, thyssenkrupp rothe erde has received six Dörries CONTUMAT vertical turning and grinding machines from Starrag. Satisfied with the results, the world market leader in large-diameter anti-friction bearings, which are used in wind turbines, among other things, ordered the same model again – but with two modified and optimized supports.



Nine out of ten wind turbine manufacturers worldwide use large-diameter anti-friction bearings and rings from thyssenkrupp rothe erde in their drives.

Without them, many wind turbines would not be turning; these are large-diameter anti-friction bearings and rings from thyssenkrupp rothe erde, which are used in the drives of nine out of ten wind turbine manufacturers worldwide. The industrial company is continuously working on improvements in order to maintain and expand this leading global position.

Continuous optimization and innovation are therefore part of everyday life, and thyssenkrupp rothe erde Germany GmbH

in Lippstadt, which manufactures large-diameter anti-friction bearings, is playing an important role here. The finishing of the bearings is now carried out on seven Dörries CONTUMAT vertical turning and grinding machines.

Designed for growth

In 2021, the company took delivery of a larger Dörries CONTUMAT VC 6300/500 MC F So, which has also proven to be an instrumental addition.



No more separation: Instead of a separate motorized drilling spindle, the turning/drilling support on the right-hand side was fitted with an integrated drilling spindle with HSK 100-A tool holder, which sits centrally between the two turning tool holders from Kennametal.

“The new Dörries CONTUMAT vertical turning and grinding machine fits in with the current trend towards ever larger wind turbines and thus larger anti-friction bearings.”

Hubert Erz, Senior Consultant
Sales Renewables at Starrag

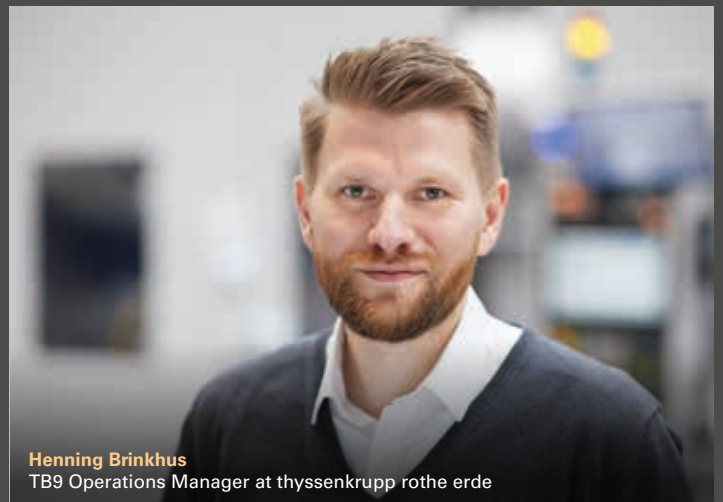
Dipl.-Ing. Hubert Erz, Senior Consultant Sales Renewables at Starrag: “Despite a fundamental satisfaction with the familiar machine concept, the experts in Lippstadt understand that new technological challenges require modifications.” The plant in Lippstadt therefore ordered the machine with some important new technical details that Starrag has improved.

For example, the portal of the machine is designed to be larger than is currently required. The newly installed base supports a base table which holds a magnetic chuck

with a diameter of 197 in. (5,000 mm). The base table can, however, be extended to 236 in. (6,000 mm) by means of ring segments, which allows it to support a larger magnetic chuck. “The machine can be adjusted in size,” explains Erz. “It therefore fits in with the current trend towards ever larger wind turbines and thus larger anti-friction bearings.” For future machines, there is even conversations of an extension to 276 in. (7,000 mm).

Although the basic machine configuration corresponds to the predecessor model, the supports have been completely revised

at the customer’s request. Starrag installed a new grinding support on the left with a centrally positioned motorized grinding spindle. Instead of a separate motorized drilling spindle, the turning/drilling support on the right-hand side was fitted with an integrated drilling spindle with HSK 100-A tool holder, which sits between the two turning tool holders from Kennametal. Customer advisor Erz: “We have designed the tool holder of the right-hand support in such a way that the modular size KM63 turning tools and the rotating HSK 100 tools can be picked up directly from a pick-up



Henning Brinkhus
TB9 Operations Manager at thyssenkrupp rothe erde



Universal: The dresser with its two diamond grinding wheels can be individually adjusted to the respective dressing or grinding operation.



Positive feedback from the shop floor: The optimized Dörries CONTUMAT vertical turning and grinding machine was also well received by machine operator Eduard Abt.



Focus on grinding support: Dr Matthias Töfke, Head of Series Production (left) at thyssenkrupp rothe erde, and his TB9 Operations Manager, Henning Brinkhus, in the working area of the new Dörries Contumat vertical turning and grinding machine.

“The multiple dressing positions allow operators to precisely adjust the dressing process to the grinding operation.”

Hubert Erz, Senior Consultant
Sales Renewables at Starrag

magazine, meaning an additional drilling unit is no longer required.”

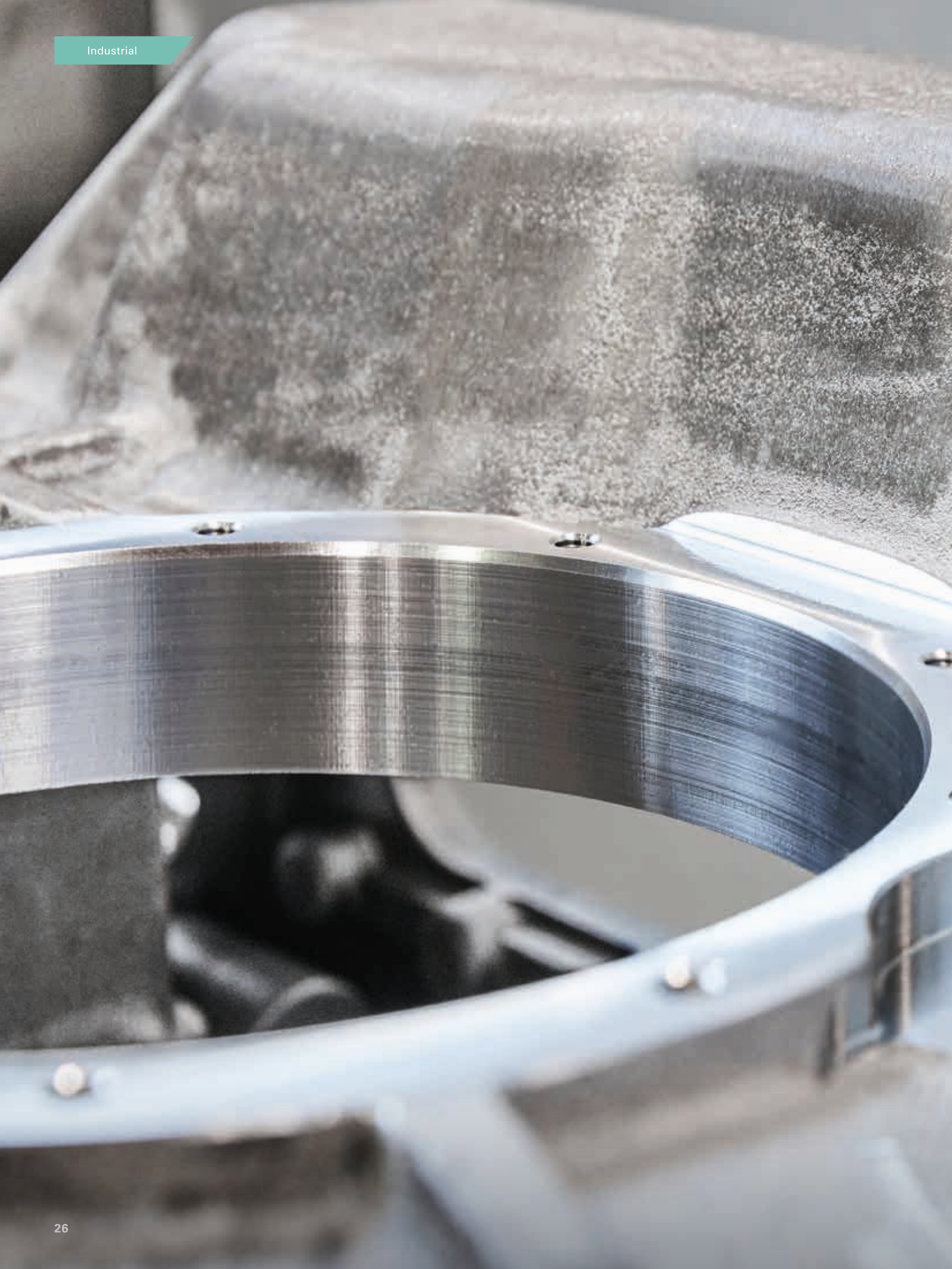
Optimization based on shop floor feedback


Feedback from operating personnel was also the impetus for numerous improvements. Starrag changed the dressing position, for example, to eliminate the previous bottleneck

to the protective cover. Now grinding wheels of all types up to a diameter of 26 in. (650 mm) can be easily dressed on the left and right. “It is a significantly optimized, universal dresser,” emphasizes Erz. “The multiple dressing positions allow operators to precisely adjust the dressing process to the grinding operation.” Another point of criticism concerned the machine enclosure. Starrag therefore commissioned a new

manufacturer for the complete enclosure, whose construction and assembly, according to Erz, are distinguished by “the fact that the company delivers the enclosure ready for assembly and pre-tested and sets it up very efficiently”

This optimization was not only well received by management in Lippstadt, Erz reports after an on-site visit: “Machine operators Eduard Abt and Walerij Fabrizious, who have been using the predecessor machines for years, also responded positive and satisfied.” ▀





Setting the course for high precision

Fifteen years ago, AMMANN AG changed its strategic business orientation: a contract manufacturer for machined switch and track parts became AMMANN Components, a system supplier specializing in complex, high-precision workpieces. Success and growth soon set in - thanks to the encouraged employees and their expertise as well as the high-quality machinery, which is dominated by several Heckert compact machines. The Swiss precision machinists are expecting a further boost from the recently delivered Heckert H75.

The Ammann family has been involved in blacksmithing and locksmithery since 1732. In 1860, Conrad Ammann founded the first company in the Swiss town of Tägerwilten, a locksmith's shop with four to six employees that mass-produced wooden drills and agricultural and forestry equipment. This set the foundation for the company, which has now been based in Tägerwilten for eight generations. Throughout this long tradition, the last 40 years have been particularly exciting.

At the beginning of this period, the company, which at the time specialized in forged parts, entered into a close partnership with an engineering office for switch and track technology. A business that developed spectacularly.

Innovative ideas were formed by the AMMANN production team. The forging of fastening elements was increasingly accompanied by the machining of cast blanks.

AMMANN invested. In addition to the first four-axis Heckert machining center purchased in the early 1990s, it was primarily the two Heckert CWK630 machines purchased in 1999 that met the growing demand for milling capacity.

Markus Halder, who joined the AMMANN production team in 1999 as a prospective engineer, remembers: "With these extremely stable machining centers, we were able to drive through the cast blanks at high feed rates and remove up to 4 mm of chips.



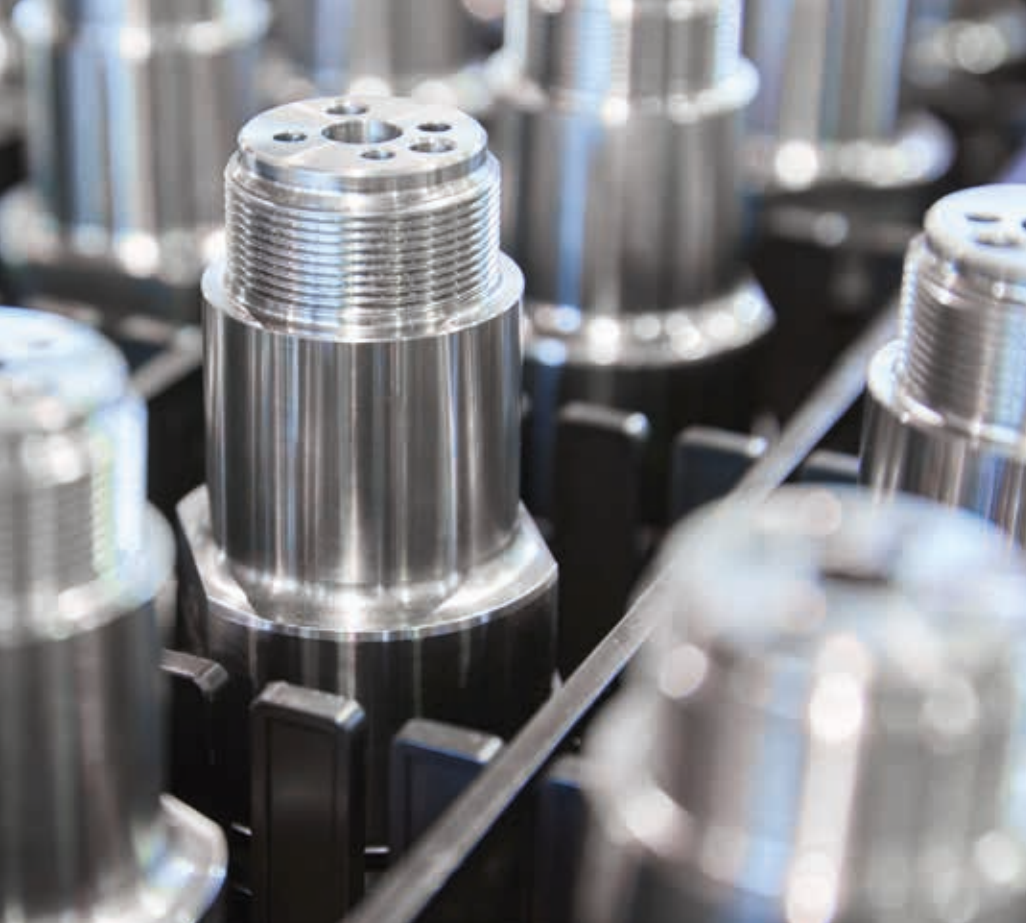
This ensured short processing times and ultimately economical operation." In order to further increase machining capacities, those responsible invested in a further Starrag machine and, in 2006, the first Heckert HEC 500 entered production.

Strategic realignment

But times change. In 2008, AMMANN AG was no longer working to full capacity for its partner. Markus Halder: "We proceeded very systematically and drew up a strengths and weaknesses analysis to help us realign the business."

The result: the prevailing labor costs in Switzerland were too high for less complex parts. "We had to find a niche where our strengths compensated for the costs incurred," Markus Halder explains. Managing Director Paul Ammann was aware of his company's capabilities: "At that time, we had four engineers with extensive engineering and production expertise, as well as special materials expertise in forged and cast parts. Furthermore, we had





“We want to improve with every new machine, become even more precise, even more flexible.”

Markus Halder, Sales Manager
AMMANN Components

the right thing to get our company back on track for success,” Paul Ammann is certain. “Our customers appreciate the added value we offer them by developing suitable machining processes for their workpieces based on our equipment. As a result, we have grown from 22 to over 50 employees in the last 15 years and continue to be in an expansion phase.”

In order to cope with the increase in orders, the company continuously invests in further Heckert compact machines. Since 2017, for example, a Heckert HEC 500 F has been part of the machinery, predominantly for milling aluminum alloys. The Heckert HEC 500 Athletics purchased in 2019 and 2020 will be used for heavy machining.

“These high-precision, compact machining centers are of significant importance to us,” emphasizes company boss Ammann. “Not only do they ensure we meet all component quality requirements, they also give us a high degree of flexibility in terms of workpieces.” After all, no order involves large-scale production. “In our niche, we tend to handle small and medium batch sizes, but they are recurring and have overall project durations of between 5 and 20 years or even longer.”

“These high-precision, compact machining centres are of significant importance to us.”



Paul Ammann, Managing Director AMMANN Components

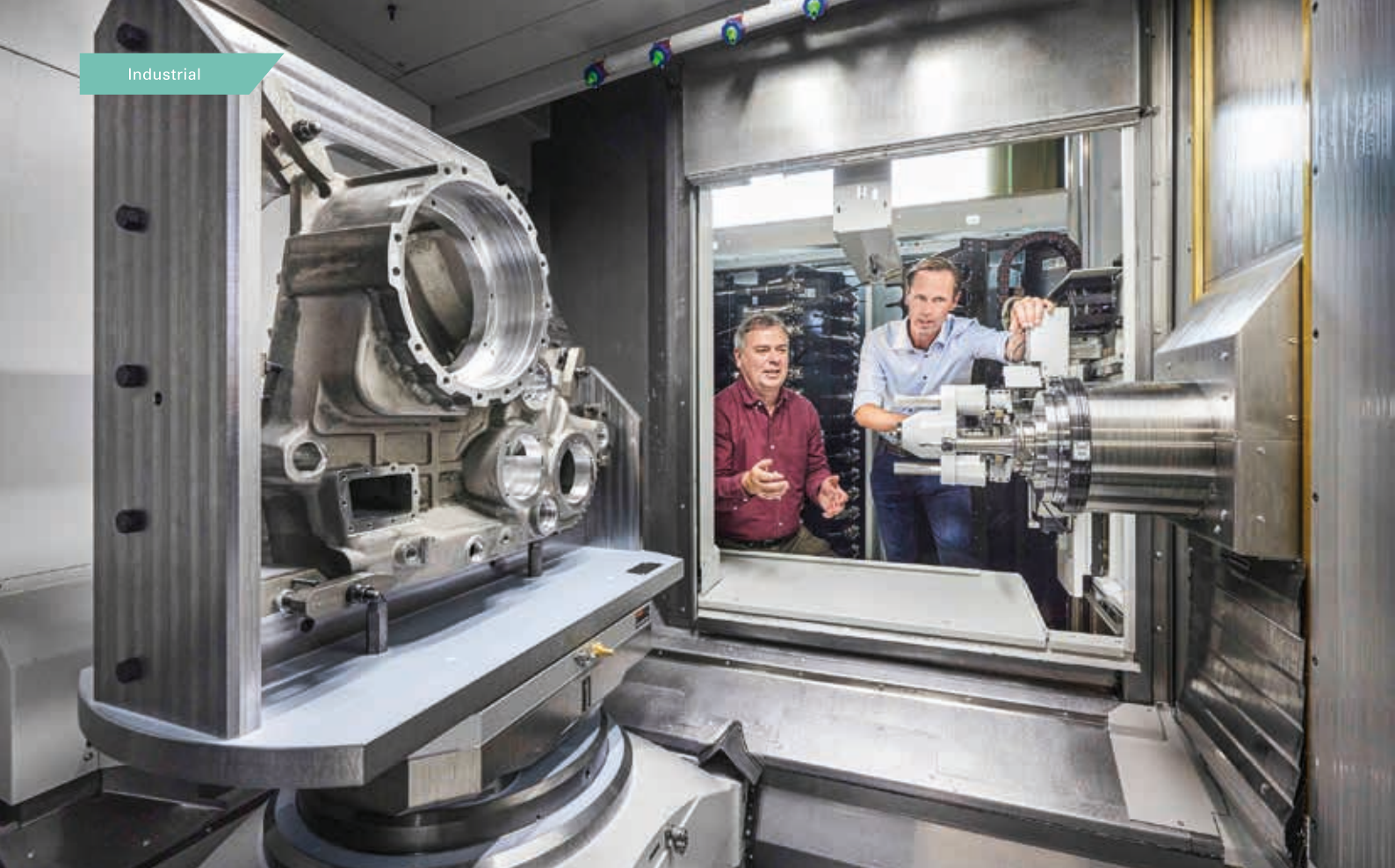
excellent machinery with which our employees had gained several years’ of experience.” This should have been enough for a strategic realignment of the company towards machining high-precision components up to a pallet size of 500.

Markus Halder, who has been working as Sales Manager since then, took over cold calling: “The search for suitable orders was like looking for the infamous needle in a haystack. With persistence and the knack of calling at the right time, we received our first order from Kuka for the machining of robotic structural parts.” During project meetings, it became clear that the Heckert HEC 500 was exactly

the right machine for machining these large cast parts. “We worked closely with the customer on this project and learned a great deal,” summarizes Markus Halder. “This success gave us confidence and the certainty that our Heckert compact machines can not only master heavy-duty machining, but can also achieve high productivity and process-reliable precision.”

Precision machining of large parts

AMMANN Components was able to establish itself and position itself broadly in various sectors with its “new” strategic offer. “In retrospect, our decision to undertake this strategic realignment was exactly



Competence grows with stringent customer requirements

Today, AMMANN Components describes itself as a system supplier for mechanical components. These primarily include turned and milled parts made of steel, cast iron and aluminum. It is primarily shaped parts that are milled, i.e. cast and forged parts. A key area of activity is large injectors and their housings, which are needed for ship engines or power generators. "One of the most difficult thing about machining them is

the 13.78 in. (350 mm) deep holes with a diameter of 0,12 in. (3 mm), which we have to create with a positional tolerance of 0,004 in. (0.1 mm)," Markus Halder explains. "When faced with such challenges, we tinker with tools and cooling lubricants until we achieve a process-reliable and economical result on our Heckert HEC 500."

Defence technology is also a significant customer industry. Whether it's chassis components or undercarriages for tanks – AMMANN Components supplies sophisticated components and ready-to-install

assemblies. Socket boards for hydraulics are a speciality. "We mill the sealing surfaces circularly without a shoulder and achieve surface finishes of N5 – on Heckert machines supplied by Starrag, of course," explains Markus Halder.

Investments for the future

Starrag's position as a machine supplier is not firmly set in stone. Before each purchase, those responsible intensively compare several possible machines: do they fit the strategic alignment? Are the performance, availability and service package right? "We want to improve with every new machine, become even more precise, even more flexible," says Markus Halder. "But we face stiff competition despite being a niche market, so we can't price our products arbitrarily. For realistic unit costs, the machines must function reliably and precisely for many years."

Amongst the 4-axis centers, the Starrag machines always came out on top. What speaks in their favor are the positive experiences users have had over many

"We mill the sealing surfaces circularly without a shoulder and achieve surface finishes of N5 – on Heckert machines supplied by Starrag, of course."



Markus Halder, Sales Manager AMMANN Components

years, their stable machine design and the consistently high quality and productivity that have been appreciated by AMMANN Components for a long time. It was only recently that one of the first Heckert machines, a CWK630, was replaced after 23 years of continuous use in shift operation. "The investment paid off," smiles the Sales Manager, who is also a member of the Executive Board. He expects a similar outcome from the replacement investment in the new Heckert H75 compact machining center, which was commissioned in May 2023.

New compact series for increased process reliability

The successor model to the successful Heckert HEC 500 comes with various improvements and promising options. Paul Ammann decided to have the Heckert H75 equipped with preparatory cooling in the set-up room, for example: "Since we don't have an air-conditioned hall, flushing with coolant is a big advantage. This tempers the parts in such a way that there is hardly any difference from the machining temperature and the component is not subjected to any stress."

This has impressed the production team from day one. The machine is used to machine large aluminum gearbox



Amongst the 4-axis centres, the Starrag machines always came out on top.

housings for which the customer specifies center distances with a narrow tolerance. Aluminum in particular reacts sensitively to temperature differences. Every degree means an expansion of 0.0008 in. (0.02 mm) for this gearbox housing.

Paul Ammann is also enthusiastic about the spindle with its maximum torque of 950 Nm and a speed of up to 12,500 rpm. This makes the BAZ equally suitable for aluminum and heavy machining, i.e. for a wide range of components. In order to maximize flexibility and keep set-up

times to a minimum, the Heckert H75 was equipped with large tool storage. With its four coupled towers, the tower magazine has capacity for almost 400 tools.

An eye on automation

The somewhat smaller footprint – with somewhat larger travel paths – also comes in handy for Ammann, as the space is currently cramped. "That will change," the Managing Director is pleased to say. Because there is a move ahead. "We are already far along enough in the planning that we can walk through the halls in the 3D CAD model."

As AMMANN Components plans long term with all its investments, the move has already had an impact on the Heckert H75, as Paul Ammann explains: "At the moment, automation is neither necessary nor possible. At the new location, however, we will expand the Heckert H75 and the Heckert HEC 500 with a pallet system to create a low-manpower production system. It was therefore important to us that the H75 is fully compatible with the Heckert HEC 500, so that a second set-up station is not needed. As we expected, our partner Starrag was extremely flexible and made the necessary adjustments to the Y-travel as well as the pallet changer." ▀



From the luxury industry to medical technology

The story of successful diversification

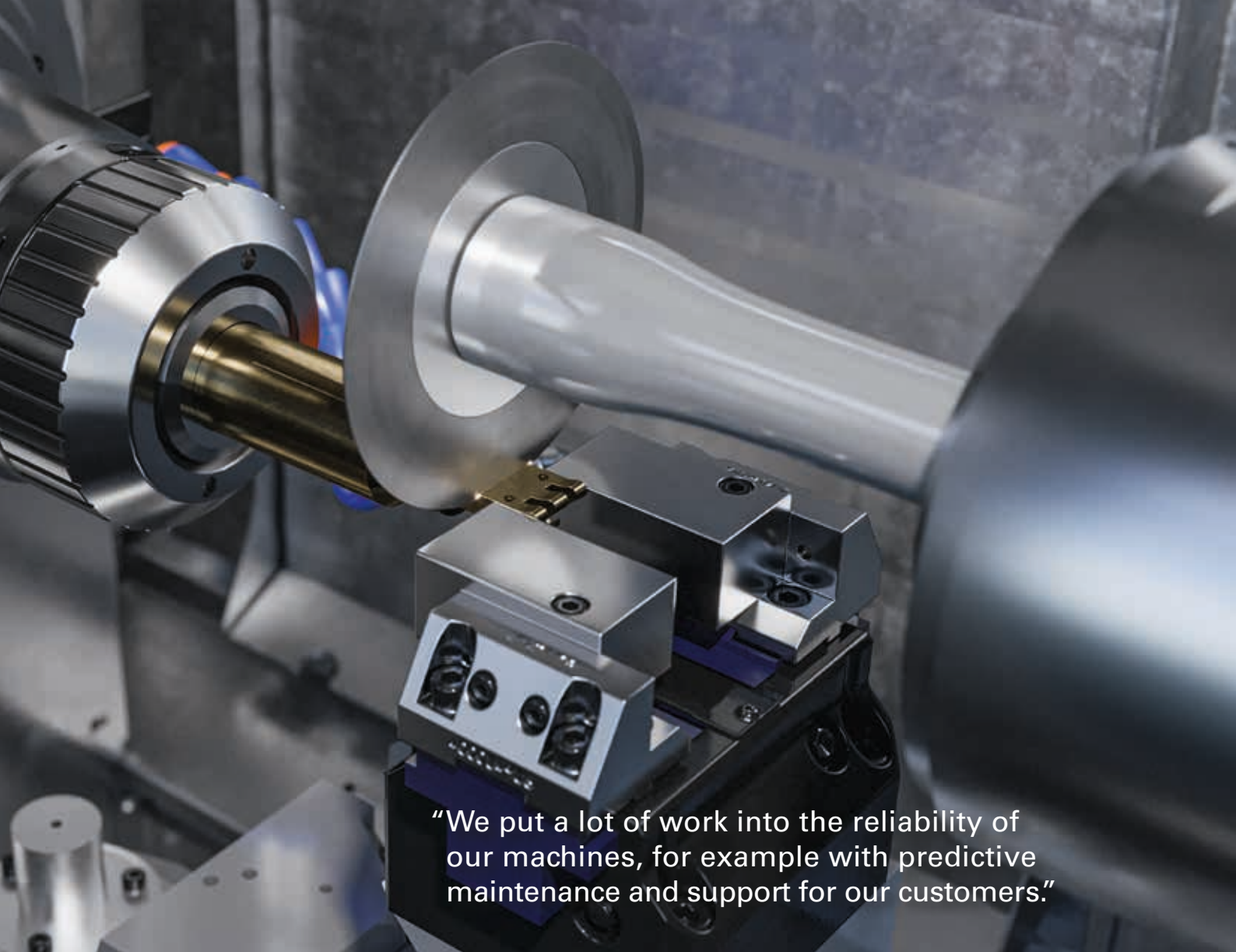
50 years of Bumotec (Part 2)

Traditionally, Bumotec has been inextricably linked to the world of watchmaking. From an outsider perspective, this universe has its own set of laws and specific needs that are far away from general mechanical engineering. This is not just due to the size of the parts that make up a watch, but also their complex geometries, which make clamping the workpieces difficult. Added to this are the requirements for accuracy, surface quality, cycle times and the precious and increasingly unusual materials that have to be machined. All these individualities require the use of highly specialized machinery in a very special area that at first glance bears little resemblance to other areas of the industry. However, some commonalities have emerged from the parts portfolio approach that has been adopted by Bumotec for several years, which in return have led to the development of more versatile machines that also meet the needs of other industrial sectors. The jewellery and leather goods industries are increasingly producing their creations by means of machining. Medical technology, aerospace, the automotive industry, joining technology and electronics are also sectors that require high-performance machining solutions.



Guy Ballif, Head of the Luxury Goods Market, and Damien Chêne, Head of the Medtech Market, talk about the developments in these very specific markets and present an outlook for the future.

Guy Ballif: "The luxury goods industry is an important sector for Bumotec. Between 1985 and 1990, the focus was mainly on watches. Both our history and our success received a powerful boost with the arrival of the steel bracelet produced from bars. We had developed the S94 for this purpose in the nineties, which later gave rise to other models that have since become flagships, such as the Bumotec S1000 and the transfer machines. This further development of our machines was influenced by the



“We put a lot of work into the reliability of our machines, for example with predictive maintenance and support for our customers.”

development of the luxury market and took place over 20 years - and is still continuing. Then came the complex watch mechanisms that required even more precise machines. Since 2005, the use of hard materials such as carbide, ceramics or even more unusual materials such as carbon has meant that our machines have had to evolve to meet the new demands of our customers. Jewellery making was added to the company's specialisms around ten years ago. This market was more artisan than industrial at the time. More and more large corporations wanted to offer machined jewellery with sophisticated geometric shapes. We were able to meet these requirements with our machines. Three to four years ago, with the onset of the

Corona pandemic, demand exploded. And for the last ten years or so, we have also been active in the leather goods sector, with parts such as buckles, clasps and other accessories that are becoming more and more technically sophisticated. Watch manufacturers have always been pioneers, but their standards are often later adopted by other manufacturers in the luxury goods industry. Our customers' requirements are becoming increasingly focussed on higher quality surface finishes, and they want to be able to produce finished parts on the machine without any post-processing, around the clock. This requires reliable machines for continuous production, although these are more complex and prone to malfunctions. We put a lot of work

into the reliability of our machines, for example with predictive maintenance and support for our customers. The machine is important, but efficient customer service is the key to success. The future has many exciting things in store for us, for example additive manufacturing, which still has a huge potential for development and which will one day have the precision required for the luxury goods industry. The question of sustainability is also of significant importance to our customers, and here too, we develop effective strategies. The exciting thing about the luxury industry is that you can work with clients who have very innovative ideas and who have the means to implement them concretely.”

Damien Chêne: "Our involvement in the medtech sector has evolved with the materials. From the moment watchmakers switched to stainless steel and then to medical stainless steel, we were able to acquire extensive knowledge about the specifics of working with these materials. To further expand this knowledge, we also turned our focus to new markets such as medtech, aerospace or micro-mechanics. By further developing the machines, especially in terms of the main and back-working spindle, we were able to offer machines that are suitable for the medical sector.

In this complex field, partnership with our customers is crucial, as developments are made together. Significant success is only possible with true collaboration."

Innovative technical solutions in the service of productivity

Today, Bumotec machines are used by a large number of industrial companies from a wide range of sectors. The Bumotec product range offers a comprehensive selection. From 3-axis machining centers to transfer machines,



Damien Chêne, Head of the Medtech Market

We later established branches in the USA, our biggest market, but also in Asia, France and Germany. We have even supplied transfer machines, in particular for orthodontics. But medicine is a very specific field with many administrative and traceability requirements. It is a very demanding market that is not profitable without a volume effect. The acquisition of Bumotec by the Starrag Group gave us the opportunity to further expand this area through the Group's subsidiaries abroad. Our major strength is that we can offer our customers a turnkey solution.

and machines for diamond cutting and faceting to combined milling and turning machines, Starrag's range covers a very broad spectrum. A Bumotec is first and foremost a customized machine that meets very specific expectations. Hand-scraped surfaces give the machine maximum precision, and the linear motors, a technology that has been used for almost 20 years, provide the necessary dynamics. But a Bumotec is above all a machine that can fully machine components without having to rework them at another station. Machining from bar



stock, back-working spindle, high-level automation - everything is in place to enable these machines to produce around the clock with Swiss reliability. Jérôme Zbinden, Head of Research and Development at Starrag Vuadens, explains the most important trends that have been decisive factors in these new developments.

"Several points were particularly important in the development of the Bumotec machines. The first is inextricably linked to the increasing complexity of the parts

A Bumotec is first and foremost a customised machine that meets very specific expectations.



Guy Ballif, Head of the Luxury Goods Market



that our customers are machining. Modern machine tools and their ability to control multiple axes simultaneously have swept away the last constraints on creativity and complex geometries. The extreme complexity of the parts produced by our customers meant that the operation of our machines also became increasingly complex. This brings us to the second point: the development of the most user-friendly HMI (human-machine interface) possible to make the user's work as easy as possible. By switching to a PC-based control system, which

still comes from Fanuc, we were able to realize this. The third point concerns the type of materials that are processed by our customers. The use of difficult-to-machine, hard or even unusual materials has driven us to implement solutions that can process these materials. The fourth point concerns the required footprint of our machines, which is becoming smaller and smaller. This is an important criterion, especially for our customers from the watch industry. And the last point concerns environment and energy, i.e. more economical machines. Based on these five points, we have implemented various technological solutions in order to offer increasingly efficient machines. The constant development of design and simulation software has been a great help to us, and CAM has enabled us to use our machines to their limits. The transition to high-speed cutting (HSC) in the nineties required much greater dynamics in the machines. This puts much more strain on their basic functions, i.e. their ability to cope with high frequencies. We have been using linear motors in our machines for a long time. Their use brings

many advantages, starting with very high dynamics, but also increased rigidity due to the magnetic pull of the motor. By eliminating the recirculating ball screw, there are no more problems caused by wear and thermal regulation is easier, as only the motor needs to be cooled. This makes our machines even more reliable, as the most important thing for us is and will always remain their availability. The increasing number of sensors and the processing of their data in real time already enable us to proactively prevent any risk of machine downtime in the event of tool breakage or excessive wear, a full chip container, empty bar feeder or low oil level. Today, we are striving to further minimize the risks associated with the wear of certain machine components, such as the spindle. AI, machine learning and other tools will enable us to develop predictive maintenance with increasing reliability in the short or medium term. At the moment, these new technologies are still in their infancy, but they harbor huge potential. Today, our priorities are the simplest possible HMI, cross-series concepts and customization." ▀

Micrometer precision with emotion

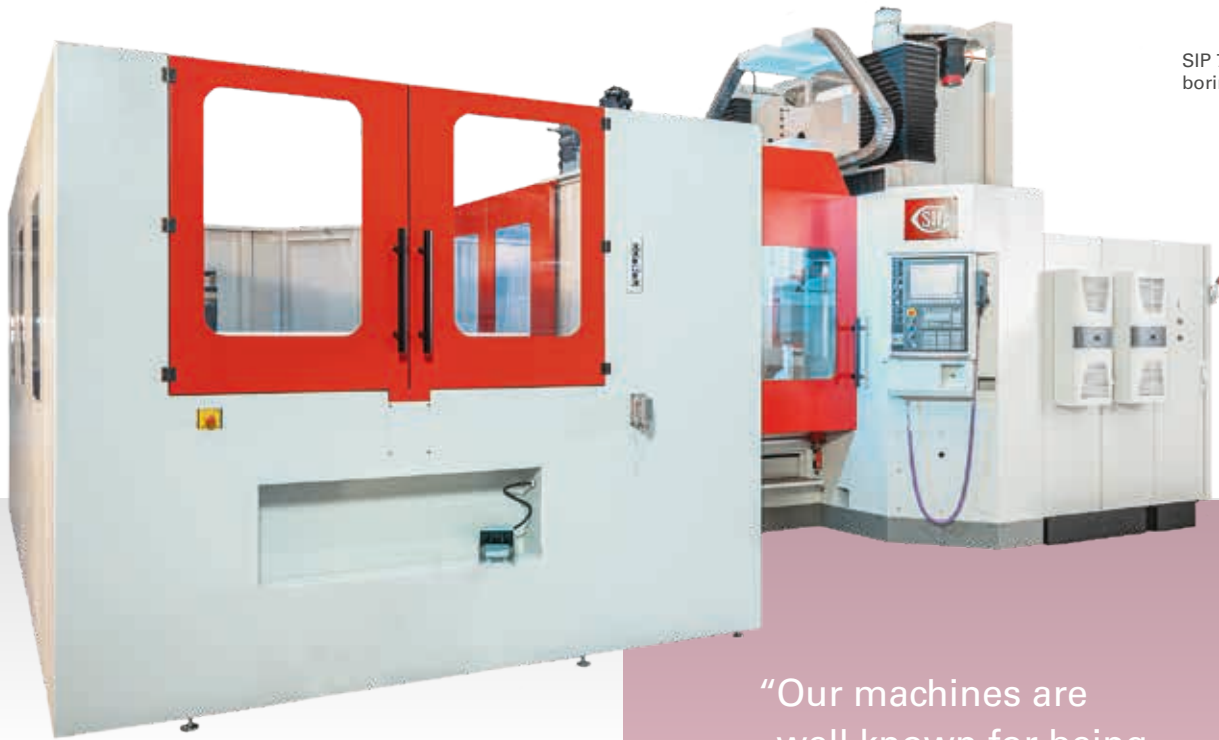
160 years of SIP: Interview with Adriano Della Vecchia, Stéphane Violante and with the kind participation of Mark Huneycutt, Principle of Equipment Engineering at Bell



Why, in this high-tech age, would a machine manufacturer forego electronic compensation and rely on mechanical finishing alone? Is it still possible to provide long-term guarantees of ultraprecision? The eyes of Adriano Della Vecchia, head of product range SIP, and Stéphane Violante, PR manager at Starrag Vuadens, lit up at their answers, showing their pride in the products that still represent the benchmark standard for uncompromising long-term precision in many high-tech industries worldwide.

SIP 7000 including a palletizer unit





SIP 7000 jig boring machine

“Our machines are well known for being stable all the time.”

Adriano Della Vecchia
SIP Product Range
Manager in Vuadens

Mr. Della Vecchia, what makes SIP so special?

Adriano Della Vecchia: We provide very accurate machines because for us this is not only a job, it’s a passion. Yes, we are proud of this. Maybe it’s only emotion, but it is the way we think and why we come to work every day.

One reason is the scraping of machine elements and their very precise assembly. They continue this centuries-old tradition. Other reasons?

Adriano Della Vecchia: Our machines are well known for being stable all the time and we always think of how we can improve our production solution by reflecting on how to optimize what we have around the machine.

Mr. Violante, in the preliminary interview you spoke of three important points in the machine?

Stéphane Violante: Over the years, we have introduced a few additional improvements and benefits that simplify our production process and automation solutions, staying at the forefront of innovation and maintaining our leadership of the ultra-high precision benchmark in the machining world. For SIP, this affects three important points: the tools changer, the pallet changer unit and the human machine interface. All things that are not directly linked or fixed to the machine. They are just around the machine and they work with the machine.

Please can you share some details about the parts that you can handle on your vertical and horizontal machining centers?

Adriano Della Vecchia: The clamping surface is up to 47 in. by 47 in. (1,200 mm by 1,200 mm) and the workpiece can weigh up to 8,819 lb. (4,000 kg). We know

it can take a pretty long time to fix these types on the machine. As a solution for this constraint we have developed a complete system including a setup station, a storage station and a transfer station. This means that the customer can prepare the part, take time to adapt the fixture if necessary, aligns the part and so on, in order to keep unproductive periods to a minimum. Because sometimes you need 20 minutes, sometimes you need more. The aim is to efficiently change pallet at the end of the production process and to maintain a high level of accuracy. While loading the same pallet, we can achieve a maximum difference of two microns in terms of repeatability.

What about the enclosure?

Adriano Della Vecchia: It’s a stand-alone solution. Neither the enclosure, nor the tool changer or any of the peripherals are in contact with the machine. And

“We are not reducing the actual machining time, but increasing production throughput.”

Mark Huneycutt
Principle of Equipment
Engineering, Bell

they have no influence on the machine itself. In front of the machine we have the palletization system. The team can work on it while the machine is boring or milling. As concerns safety, the operator can safely prepare the part on the setup station. Moreover as there is no contact between any elements, there is no impact on the accuracy of the machine.

Flexibility in the factory also depends on the automatic change of tools.

How is your tool changer designed?

Adriano Della Vecchia: You can have between 40 and 120 tools; depending on what you are producing, it can help you to save time by having spare tools in case of breakage.

Mark Huneycutt, Principle of Equipment Engineering at Bell in the USA, gives us his point of view on the collaboration with SIP which started a long time ago.

Mark Huneycutt: Bell is a well-known manufacturer of commercial and military helicopters used worldwide. Their production of precision gearboxes is perhaps the best in the world. And one part of Bell's success is the precision requirements of their gearboxes that provide high horsepower to low weight ratio. Bell is



SIP production center at Starrag in Vuadens

equipped with many types of machine tools and among them are 31 SIP machines throughout all facilities. Bell has worked with SIP over the years, primarily for the machine's accuracy capability. SIP has improved their production solutions, which provide ultra-precision and repeatability for many years. Newer technologies such as tool measurement and probing capabilities have improved throughput, but the basic machine design hasn't changed, and that's a big benefit!

But it's difficult to automate this type of a precision machining operation into a production process, which typically demands highly skilled human interactions with the parts. A challenging step to support an effort for a simple automation approach was to install a two pallet-changer for shortening the time of part-to-part changeover.

The biggest benefits are related to operational efficiency improvements such as reducing setup cost, part-to-part change-over time, and reducing spindle idle time. We are not reducing the actual machining time, but increasing production throughput. Now we can produce more parts in the same time frame with a pallet changing time of 1 to 2 minutes. The pallet changer integration with a high precision SIP will result in a very productive machine, with no loss in μm precision!

That was a very interesting example: What are the special features of your machines?

Adriano Della Vecchia: Most of our customers produce components with an extremely high level of accuracy. Just to give you an idea, some of the parts can cost around 50,000 USD after being



Adriano Della Vecchia, SIP Product Range Manager in Vuadens



Scraping requires expertise, something that SIP have been developing since the company's early years.



Control of precision at every step of the production process

machined. That means you cannot run the risk of breaking the part.

Does repeatability also play a role in spare parts?

Adriano Della Vecchia: Certainly! Some customers in the aircraft industry in the USA need to repair parts: They need to have the same level of accuracy and to use the same production configuration as when they initially made the part. And they know, that with our machine they can find the same exact position to

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Principle of Equipment Engineering, Bell

reproduce the component to be replaced. This is very important for the customer. This way they are sure that the part will be exactly the same as the original.

But quality is not only machine made, it's man-made. What's about the human machine interface?

Adriano Della Vecchia: We use the standard interfaces from Siemens and Fanuc. For some companies we have a special interface. We train the operators in the use of the control system and give some tips for special applications.

What else is particularly important to users of your machines?

Stéphane Violante: Machine accessibility, security and protection. These points should be treated together. We have wide machine access areas with large doors. Of course, you can enter in when the machine is not in production. You can work right inside the machine, calibrating with a probe, visually verifying each one of the machine elements before starting production, checking the positioning of tools. Thanks to the palletization system which works independently to the machine, safety is guaranteed for operators preparing new fixtures for the next production part. ▀

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