

Turbine Technology Days 2019

Process chains for efficient turbine production

Customised solutions: ServicePlus

EMO ambassador Miriam Rickli interviews
Günther Eller, Head of customer service at Starrag

**One-hit savings on oil & gas valves
and fluid ends**

DBF has replaced two roughing
machines and one finishing machine

95Plus⁺
Machine Availability

One position replaces three:
Complete machining in a
single clamping position
with the Heckert DBF 630



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Expert talk
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EMO, Hall 12, Booth B58



EMO, Hannover
16 – 21 September 2019
Hall 12, Booth B58

www.starrag.com



Dr Christian Walti
CEO of Starrag Group

Dear reader,

You are holding the latest edition of our customer magazine, *Star*, published just in time for EMO Hannover 2019. The world's leading trade fair for metalworking will be held on 16 to 21 September with the motto "Smart technologies driving tomorrow's production!"

A prime example of smart technology is the "dynamic duo" at the Premium AEROTEC plant in Varel, Germany: Starrag linked two ECOSPEED F 2040 machining centres to a flexible manufacturing system, which recently paved the way for the aircraft manufacturer to enjoy low-intervention, unattended and digitalised production in which data acquired from sensors is used to optimise the production process even further.

We learnt that the new investment in Varel has a 10 to 15% shorter running time than the older ECOSPEED systems.

A visit to another satisfied Starrag customer showed that performance can often still be improved. "One of our best work horses" is how Alexander Peters, Managing Partner of NEUMAN & ESSER GmbH from Übach-Palenberg, Germany, described a Starrag gantry machining centre from the Droop+Rein T product line. This centre has proven its worth, particularly for the complete machining of very large, sophisticated machine components, since 2011. The investment has paid off because, depending on the size, the machining time has fallen by an average of 30 to 40% and accuracy has doubled even in critical areas.

British valve manufacturer KOSO Kent Introl from Brighouse, England, is also very happy with the excellent performance of Starrag machines. Its Heckert DBF 630 5-axis horizontal machining centre fully machines parts from the raw material to the finished part in a single clamping position, without waiting times. Significantly more parts are now produced per week than would be possible on two separate machines. The new Heckert DBF 1000 horizontal machining centre tops this performance, even replacing two roughing machines and one finishing machine when machining units made of high-strength materials.

Turbine production is another domain in which Starrag machines excel: Visitors experienced this for themselves first-hand at the traditional Turbine Technology Days event at our headquarters in Rorschach, Switzerland.

As varied as all these reports are, they share a common denominator: Every application hinges on machine availability. This is where Starrag's ServicePlus concept comes into play, increasing the technical availability of machines to at least 95% thanks to enhanced support, thereby further increasing our customers' competitiveness.

I hope you enjoy the exciting insights and findings in the new 2/2019 edition of *Star*. Better yet: Get to know Starrag and our products and services by visiting one of our locations or our stand (hall 12, B58) at EMO Hannover 2019.

Christian Walti



Starrag, Kennametal and Rolls-Royce provide aerospace specialists with material awareness of the future

A packed audience of aerospace production specialists were treated to a font of advanced manufacturing knowledge at the AMRC with Boeing Centre, Sheffield, when machining solutions specialist Starrag joined forces with tooling expert Kennametal to present their 'Optimised Titanium and Inconel Machining' event – with the added bonus of an insight into some of Rolls-Royce's activities.

The event not only included technical presentations – on the benefits of Starrag machining centres and a number of new Kennametal developments – but there were also demonstrations of best-practice machining of Inconel and titanium workpieces on the AMRC's Starrag STC 1250 machining centre, as well as an insightful keynote speech on 'High Performance Manufacturing' by Rolls-Royce's Technology Partnership Manager, Dr Jamie McGourlay.

Dr McGourlay outlined Rolls-Royce's manufacturing achievements during the past decade of collaboration with the

AMRC embracing, for example, process modelling, intelligent fixturing, multitasking machining and the use of advanced cutting technologies.

"Working closely with the AMRC over the past 10 years has enabled our adoption these high-performance manufacturing technologies," he said.

He went on to describe some of the company's current groundbreaking work, including the Ultrafan engine project that involves new generation materials and processes, the Tempest fighter jet programme and the E-FanX hybrid electric/gas turbine engine.

Importantly, too, he highlighted some of the challenges that lie ahead in terms of:

- the increasing combination of electric/electrical and mechanical engineering;
- the fusion of physical and digital technologies; and
- the growing demand for cleaner, safer and more competitive power sources.

The 60 or so attendees also learnt about innovative products from Kennametal, including a flat bottom drill for the fast and



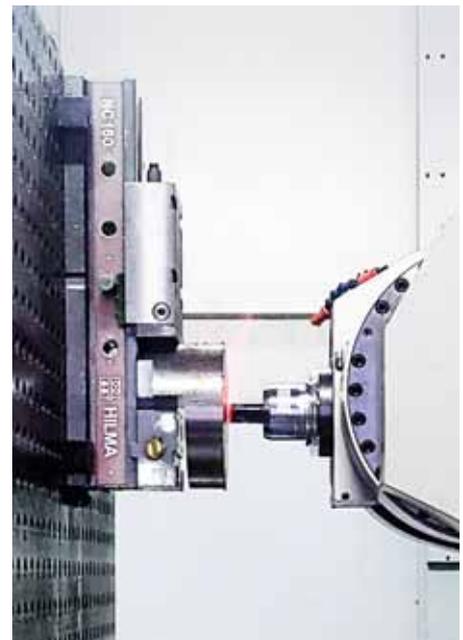
“Today we have seen some fine examples of how a machine tool manufacturer and a cutting tool supplier work together to produce manufacturing solutions.”

effective pre-drilling of pockets and corners, and the KM4X spindle – successfully used on a Starrag customer’s STC 1000 machining centre – that offers ultra-high clamping force (higher than HSK types, it was stated) plus the HARVI Ultra 8X helical milling cutter.

Starrag has eight machines in-situ at the AMRC and the accompanying Nuclear AMRC, and it was on the STC 1250 machining centre that two live machining demonstrations using a variety of Kennametal tooling wowed the audience. The first, on Inconel 718, saw a KCRA 63 mm diameter cutter with KYS30 ceramic for face milling

taking 2 mm depths of cut at 5,052 rpm and at 2,425 mm/min; followed by profile milling using a 32 mm KIPR end mill at 8,000 rpm and 1,680 mm/min.

Next was plunge and pocket milling, plus heavy 5-axis profile cutting (using the new HARVI Ultra 8X cutter at 65 m/min and 0.15 mm per tooth and 80 mm depth of cut and 10/25 mm width of cut) on titanium 6AL4V: using a 60 mm diameter flat bottom drill applied at 45 m/min and 0.12 per tooth; a 25 mm diameter HARVI 1 (four-flute) solid carbide end mill at 70 m/min and 0.12 per tooth; and a HARVI 2 (five-flute)



The highly-successful Starrag STC 1250-Kennametal tooling demonstrations on titanium 6AL4V (left) and Inconel 718 (right)

20 mm diameter solid carbide end mill to finish a pocket in a single pass at 110 m/min and 0.1 per tooth.

Delegate Paul Shuttleworth, manufacturing manager of Holygate Aircraft Components, summed up the audience’s reaction to the day-long event: “Today we have seen some fine examples of how a machine tool manufacturer and a cutting tool supplier work together to produce manufacturing solutions.” ▀



Turbine Technology Days 2019

Process chains for efficient turbine production

Hugely popular once again and now in its seventh year, the Turbine Technology Days 2019 in Rorschacherberg attracted 200 leaders in the aerospace and energy industry, keen to find out about solutions for managing turbine production with greater productivity and reliability. They were optimally taken care of by Starrag and event partner Blaser Swisslube – with the presentation of numerous functioning process chains that enable huge savings to be made in the production of blisks, blades and impellers.

The demands placed on turbine production are constantly increasing in terms of the materials to be machined, the tolerances to be adhered to and, above all, the resulting unit costs. At the Turbine Technology Days 2019, keynote speaker Colin Sirett, CEO of the Advanced Manufacturing Research Centre (AMRC) at the University of Sheffield, noted how turbine machining is extremely inefficient – especially in the case of blisks. Far too many steps are still performed manually, such as

handling materials between the individual operations or surface finishing, which cost valuable time and involve risks. To manage the growth that is predicted in this industry over the next ten years, he continued, we need to rethink manufacturing processes and install new automated processes.

Dr Christian Walti, CEO of the Starrag Group, adds: “The Paris Air Show for the aviation and space industry took place shortly before our turbine event. There

was much to learn about how positively the aerospace industry is developing and how hard OEMs and suppliers are searching for solutions to make their production processes more efficient.” But he is seeing the energy sector take great interest in further optimising the efficiency of turbine production too.

This provides the perfect basis for successful business – since Starrag has already been aligning itself with customers’ needs for a long time now.



Small groups, intense discussion, hands-on lectures — these are what visitors appreciate about the Turbine Technology Days.

The best for blisks – on the new Starrag BAZ NB 151, visitors at the Turbine Technology Days 2019 saw for themselves how better roughing, finishing and accessibility can be achieved.



Marc Blaser, CEO of Blaser Swisslube, relies on application-related research and development to make the coolant an efficient liquid material.

Walti explains: “We take a holistic approach. This means that selling machines is not our primary concern. We prioritise delivering production systems that offer customers a long-term benefit. This is why we are expanding our range horizontally, as well as working closely with premium partners, who play an important role in the whole process.”

One such partner is the coolant manufacturer Blaser Swisslube, who collaborated on this year's event. CEO Marc

Blaser remarks: “We take a holistic approach like this too, focusing on customers and their needs. In this respect, joining forces with Starrag is a great opportunity as we have already spent many years working together on numerous technical research projects and developments.” The aim, he explains, is to show both existing and potential customers how closely co-ordinating machine tools, tools and coolants create solutions that enable customers to make substantial and sustainable progress.

Blisk manufacturing in a single step

The hosts created a total of 13 stations, all with a focus on processes. Even at the world premiere of the NB 151 5-axis machining centre, which rounds off Starrag's specialised Blisk machining range, the emphasis was on process advantages. After all, the machine is designed for the complete, rapid and reliable machining of blisks and impellers in a single step.



20% more productive
than standard
solutions

Dr Bernhard Bringmann, Head of the Starrag plant in Rorschach, explains: "With our NB 151, we also offer highly productive roughing cycles, which are in turn only possible as a result of advanced tool developments and optimised coolants. The machine is also designed for the efficient smoothing of blisks with high dynamics and precision, with the result that the entire blisk machining process is around 20% more productive than standard solutions."

The 5-axis Starrag BAZ NB 151 is suitable for the complete machining of blisks and impellers weighing up to 300 kg and measuring up to 600 mm in diameter and 290 mm in length. A special feature of this machine are the two circular axes, which are developed and manufactured by Starrag in-house.

The coolant, a key factor for success

Both partners demonstrated the hidden potential of coolant, which Blaser likes to describe as a 'liquid tool', on the somewhat larger NB 251 blisk machining centre. It was adapted by Starrag for machining with oil and produced remarkable results during roughing trials using TiAl6V4 with an indexable insert milling cutter. For example, after 30 minutes of machining time, around 40% less wear was measured on the indexable inserts compared to machining with emulsion.



The elixir of life for machine tools: At the Turbine Technology Days 2019, Blaser Swisslube demonstrated just how much of an effect the right coolant can have on productivity, efficiency and process stability.



Dr Bernhard Bringmann, Manager of the Starrag plant in Rorschach, promises around 20% greater efficiency in blisk machining with the new Starrag NB 151.



Dr Christian Walti, CEO of the Starrag Group, registered great interest among OEMs and suppliers in further optimising turbine production in terms of cost efficiency.

Unique, simple, standalone automation

A Starrag LX 021 machining centre helped visitors understand how to minimise downtimes. The smallest model in the LX series, which was developed for the highly precise, efficient, simultaneous 5-axis machining of turbine blades, is designed for the complete machining of a compressor blade. The machine loads and unloads the parts automatically from a pallet storage system, enabling this process – which is normally carried out manually – to be completed in a matter

of seconds. A special device is responsible for repositioning the workpiece between base machining and blade machining, thus saving even more time.

Starrag has a wealth of experience in automation, including with regard to multi-machine systems and Flexible Manufacturing Systems (FMS). Starrag has been carrying out such turnkey projects for manufacturing turbine blades and structural components in Rorschacherberg for over twenty years, using a wide variety of Starrag Group machines. It is these FMS that prove

Starrag's extensive process expertise. Numerous elements – special carbide cutters, fixtures, the RCS CAM system, blade machining components and control centre software – are the result of Starrag's own innovations. For other components, Starrag relies on the proven expertise of its selected partners, whose products – including grinding machines, tool systems and software solutions – complete the process chain. A number of them also had exhibition stands at the Turbine Technology Days to hold discussions with visitors and share their technical expertise. ▾

Customised solutions: 95Plus⁺

Machine Availability

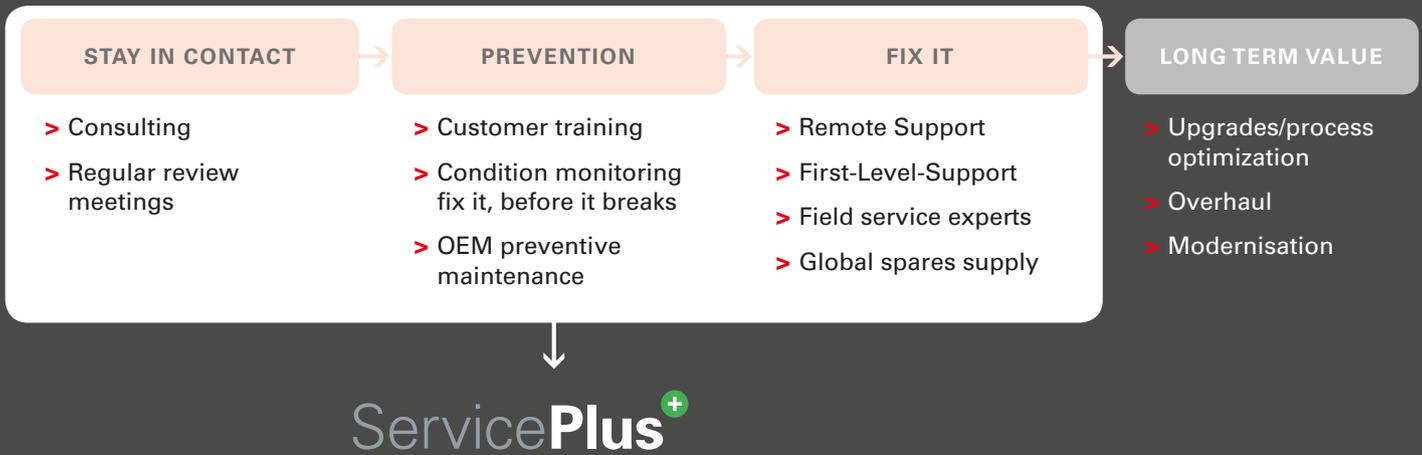


Reliable production conditions at least with 95% machine availability that's the Starrag promise. Starrag EMO ambassador Miriam Rickli interviews Günther Eller, Head of Customer Service, about how Starrag keeps its promise.

Dear Günther, I have heard Starrag Group offers a new service product named ServicePlus and achieves with it long term availability of at least 95%! Can you explain what this means?

Günther Eller: ServicePlus is an all-inclusive solution at a fix price for optimised availability and long term machine value retention. Customer environment and customer requirements are very specific. Therefore ServicePlus is customised individually. In a close partnership ServicePlus becomes a success. Together with customers we customised the ServicePlus and set targets for availability. The results are monitored and reviewed regularly. Identifying improvement potential and continuous implementation of improvement measures is part of ServicePlus.

EMO ambassador
Miriam Rickli
interviews Günther
Eller, Head of
customer service
at Starrag



Please, give us an overview about the content of ServicePlus.

Günther Eller: The basic content of each ServicePlus offer are our annual OEM preventive and predictive maintenance, spare parts, wear parts and repair inclusive like in warranty as well as priority access to Starrag’s global field engineers, technical hotline and remote diagnosis. Customised are parts storage and parts supply concepts, motor-spindle solutions, customer training, technology and production support. As said before, availability targets will be set and a bonus/malus system for achievement can be agreed.

What does such a ServicePlus contract cost?

Günther Eller: With the wide range of Starrag’s product offer from a small Bumotec s191 for watches to an Ecospeed for airplane wing skins there is no flat answer to costs. Also the customised ServicePlus content results in price differences. But let me give you an example. A 3-year ServicePlus ordered together with a titanium milling centre with 2 mCHF value would be about 3 TCHF per month. ServicePlus is also offered for older machines. In that case, there will be a proper

inspection of the machines, if necessary followed by overhaul before starting ServicePlus.

And what costs can be saved as a result?

Also not easy to answer and depending a lot on customer priorities. But let me also use an example. One of our European customers started a ServicePlus for a few older machines. Availability was on 85%. With ServicePlus it could be ramped-up to now stable 97%. With an estimate cost rate for the machine of 150 CHF/hours and 3-shift production this could be a 100 TCHF benefit per machine and year. But not only increased availability are customer benefits from ServicePlus. Also the plannable costs, the much lesser unexpected breakdowns, the reliable machine accuracy resulting in quality of machined parts and last but not least the machine value retention are additional customer benefits. It is beyond our skills to express this in money but I am convinced customers will do their calculations.

Starrag provides tailored solutions! Can you give us an example to this?

Günther Eller: Well, tailored service solutions are not only offered to ServicePlus

“Thanks to Günther, I have learned that Starrag not only sets best in class standards with innovative technologies, but also provides innovative life-time support with their comprehensive service offer and the all-inclusive ServicePlus.”

Miriam Rickli,
EMO ambassador

customers. They are our standard for all customers. We deliver machines and technologies for dedicated applications to a global customer base. Our service solutions have to meet the specific requirements of different application fields, locations and individual customers. Based on standardised and proven service products customers all over the world can choose a ServicePlus menu or a la carte. ▀

A HIGHLY DYNAMIC DUO

Premium AEROTEC's Varel plant in North Germany produces highly complex machining components made of aluminium and titanium using one of Europe's most advanced pool of machines. And this pool has recently been boosted by a new, highly dynamic duo: A Starrag ECOSPEED F 2040 FMS (Flexible Manufacturing System) consisting of two linked machining centres.



5 sided machining: The angled milling head makes it possible to carry out special cutting and drilling operations for difficult to reach areas, which was previously done afterwards on a different machine.

Christian Walter

HÖTEC



Concentrated parallel kinematics: ECOSPEED machining centres with a tripod drive head dominate large-part production at Premium AEROTEC.

It was almost 20 years ago that Europe's largest aircraft manufacturer first took a chance on the parallel kinematics of the ECOSPEED product lines – a technology that was revolutionary at the time. Thanks to highly dynamic 5-axis simultaneous cutting with a tripod head, these machines still set the benchmark for machining large, complex aluminium structural components today, especially in the aviation industry. Daily tasks include cutting pocket corners with an only slightly inclined land, which requires the angular position to be changed. While standard fork-type milling heads typically make huge swivel

movements to do this, parallel kinematics are significantly faster and more dynamic. This is one of the main reasons why 13 ECOSPEED centres are now in use at the Varel site.

“In addition to their reliability, it was the high overall dynamism of the ECOSPEED machines that won us over,” explains Christian Welter, Head of Large-Part Production at Premium AEROTEC. “This is why we chose two ECOSPEED F 2040 machines as our latest investment, which have been linked to create a flexible manufacturing system.” This is the newest highlight of Hall 8,

where Starrag machining centres with a drive power of 120 kW currently take centre stage. Having a large number of similar centres makes it easier to train staff, operate the machinery and perform maintenance, explains Welter, but with each new investment, Starrag and its ECOSPEED product lines must once again face the competition. He adds: “In this tender, we once again saw that the dynamism of the machine is still in a league of its own. But despite this, in the future we will continue to explore other options on the market.”

“In addition to their reliability, it was the high overall dynamism of the ECOSPEED machines that won us over.”

Christian Welter, Head of Large-Part Production at Premium AEROTEC



Complete process: This fuselage side panel for the Airbus A320, made from an aluminium blank, was machined in a single clamping position. Thanks to parallel kinematics, the ECOSPEED F 2040 FMS can even cut pockets with an only slightly inclined land quickly and elegantly.

A new angled milling head that can be changed automatically now enables aluminium workpieces measuring up to four metres long to be machined on the FMS – not just completely but in a single clamping position too.

Flexibility is a must, since the aircraft manufacturer currently machines 700 different components on its ECOSPEED machining centres alone, for clients including Airbus and the European Space Agency (for Ariane 6).

What's more, this investment in new, even more productive technology is happening in a production environment that is currently undergoing big changes. “This is a permanent construction site,” says Welter,

“We are extremely happy with the service that Starrag offers compared to that of other manufacturers.”

Christian Welter, Head of Large-Part Production at Premium AEROTEC

smiling. “More and more sensors are being built into the machines, which generate a lot of data. We’re currently in the process of learning how to handle and utilise this huge quantity of data”. One of the key aims of digitalising production is to allow the process to be carried out with only a few operators, or even no operators at all.

The new Starrag manufacturing system complements this strategy perfectly because the Varel plant

has recently switched to using linked systems. “We want to keep set-up separate from actual machining”, says Welter. “And this works extremely well with the new ECOSPEED F 2040 FMS, where we have operators work at separate set-up stations”

The Varel plant has been pursuing digitalisation for a long time now, since before the term “Industrie 4.0” was even coined. Consequently, the company has a systematic focus on

networking. “For example, we don’t have any standalone Starrag machining centres; they are all networked or linked to each other”, explains Welter. “There is also the factor of security of supply, which we must be able to offer as a manufacturer of Airbus components. This is why, next to each machine, there’s another one that can perform the same tasks”

So why not adopt robot handling?

“The FMS currently machines 40 different components, which means we would have needed 40 actuators for the workpiece holder”, explains Welter. “It also became apparent that the robot would be stationary most of the time. A cobot system would be an interesting way of facilitating set-up here. We are already robotising certain areas of small parts manufacturing, however”

Small footprint: Auxiliary units and control cubicles are installed on a peripheral platform above the conveyor system to save space and facilitate maintenance.



It is difficult for Welter to quantify the impact that Starrag's claim "Engineering precisely what you value" has had on his machine pool. The new investment has not been used for series production for long, he says, but its running time is 10% to 15% shorter than that of older ECOSPEED systems.

Machine availability plays an equally big part in production at Varel, and it all comes down to manufacturer support. "Overall, we are extremely happy with the service that Starrag offers compared to that of other manufacturers," says Welter. "We've developed an excellent relationship with staff at Starrag over a very long period of time. In particular with regard to certain companies, where, due to rebranding, it's not always clear who's responsible for what." ■



Christian Welter, Head of Large-Part Production at Premium AEROTEC. "In this tender, we once again saw that the dynamism of the ECOSPEED machine is still in a league of its own"

Ingenious: To produce this side panel, Premium AEROTEC cuts an element that clamps the component and is then removed after finishing.





Starrag and KOSO Kent Introl use their heads to open the floodgates to single set-up valve savings

KOSO Kent Introl's latest investment in the Starrag Group's Heckert 630 DBF horizontal machining centre is paying big dividends in the machining of valve bodies, not least because the machine's ability for single set-up, multi-tasking machining – milling, turning and drilling – has eliminated the need for two separate machines, and all the associated re-setting and queuing times, to produce finished workpieces.

The success of the DBF machine builds on the prowess of the company's other Starrag brand machines – in particular, a Scharmann ECOFORCE HT2 with integrated P600 facing head that has consistently and reliably proved its worth in the single set-up machining (milling, boring and turning) of larger workpieces at the company's Brighthouse (West Yorkshire) site.

And the Heckert DBF's record in increasing KOSO Kent Introl's machining capacity of smaller valve and globe bodies, and its ability to effectively transform the production process for such parts, is now similarly attracting acclaim.

Queuing times eliminated

"In addition to replacing separate machining operations, the Heckert DBF has effectively 'simplified' the production process by allowing us to load once with raw material, undertake complete machining, then unload a finished part ready for inspection. That also means we're effectively getting more parts per week from that machine than we were using separate machines by, of course, eliminating queuing times," says Richard Addy, Machine Shop Manager. "The elimination of multiple set-ups on a lathe, plus the queuing and set-up times for drilling, has produced dramatic time savings," he adds.

Established in 1967 (as Introl) and now a leading worldwide supplier of a wide range of valves (choke, control and butterfly), as well as actuators and instruments to a global customer base throughout industry sectors such as oil and gas, petrochemical and power generation, KOSO Kent Introl purchased the Heckert DBF to increase capacity of the machining of valve and globe bodies in the 1–6 inches range (flange outlet bore size) and from a variety of materials, from carbon steels through to super duplex and Inconel.

Separate turning and drilling

"We were previously using two machines to complete the bodies," continues

Mr Addy. "A lathe to produce the flange and plug-way in three operations; then the part had to often queue for a separate operation (and additional set-up) on a drill, the final operation.

"In need^{ing} to increase capacity, and with a good working relationship with Starrag, we had no hesitation in selecting the Heckert 630 DBF which offers a machining capability and specification that more than meets our needs for valve body machining: 630 – 630 mm pallets: X-, Y- and Z-axis travels of 1,070 mm, 870 mm and 1,200 mm, respectively, and traverse speeds

of 40, 40, 60 m/min in X, Y and Z; plus +/- 35 mm in the U (turning) axis; a 45 kW/1,700 Nm spindle.

"The DBF machine enables the production of complete body machining in one or two operations, depending on casting type and size," says Mr Addy. The DBF strategy – for angle bodies in one-hit and for globe bodies in two operations of set-up for machining the plug-way (including drilling) then set-up and machine the flanges (including drilling) – has replaced a comparatively longer and laborious process of:

- Load to lathe
- Set-up and machine first flange
- Set-up and machine second flange
- Set-up and machine the plug-way
- Move body to drilling cell
- Set-up and drill

Established record of success

KOSO Kent Introl's company's association with Starrag stretches back over many years; indeed, its heavy machine shop exclusively features Starrag brand machines – a Solon 4 machining centre and a Dörries vertical turning lathe plus

"Starrag machines have always demonstrated reliability and consistently high-quality machining results."



"Not only are separate machining processes no longer needed, but the Heckert DBF considerably simplifies the production process too. We now machine the parts completely – from raw material to finished part – in a single clamping position, without waiting times."

Richard Addy
Production Manager at KOSO Kent Introl

the Scharmann ECOFORCE HT2 machining centre equipped with integrated P600 facing head.

With X, Y and Z axes capacities of 2,000/2,500 mm by 1,600/3,500 mm by 2,200/3,650 mm, respectively, and able to accommodate workpieces of 10,000 kgs, the ECOFORCE not only offers the capacity for the company's larger workpieces but also the power – a main spindle rated at up to 63 kW spindle that produces 4,000 Nm of torque for even the heaviest of milling and boring cuts, and the facing head for in-process turning at up 300 rpm.

Proven reliability

"We've proven the reliability and consistently high-quality machining results from our Starrag machines and, coupled with the fact that we've always received excellent after-market back-up and support from the company, it made complete sense to continue that single-source association when we needed to address the throughput needs of our smaller valve bodies," says Mr Addy.

"We also knew that the multi-tasking, single set-up benefits we would gain by using Heckert's DBF head made even

more business sense and has really brought to life Starrag's philosophy of 'Engineering precisely what you value'."

The Heckert DBF machine features an integral U axis that carries Starrag's innovative DBF multi-tasking head for a wide range of internal and external machining operations.

The DBF spindle head comprises a faceplate with integrated work spindle and CNC radial facing slide. For turning on a fixed workpiece, the rotating turning tool – which has an axial runout of just five/six microns – can be radially adjusted

Instead of two machines:

The Heckert 630 DBF enables valve bodies to be fully machined in one or two operations. This means that this 5-axis machining centre can produce significantly more parts per week than two separate machines.

"Because of our good collaboration with Starrag, we didn't hesitate to invest in a Heckert DBF 630."





Starrag experts played an important role, not only in the initial equipping phase but also in setting up the processes and programming the DBF.

by +/- 70 mm. In addition to external, internal and face turning, the head also permits conical and contour turning courtesy of the radial facing slide's NC axis. For milling and drilling, the work spindle is arranged in its central position.

Balancing tool wear

Mr Addy confirms that KOSO Kent Introl makes good use of the machine's 45 kW, 3,500 rpm and 1,700 Nm torque spindle

by, for example, often applying a high-feed Capto milling cutter on carbon steel (WCB) at speeds of 800 rpm and feeds of 3,000 mm/min. He continues: "The machine is really rigid and on softer materials we are taking cuts of 2–3 mm deep – on Duplex bodies, for example, we're taking 3 mm cuts at speeds and feeds of 60 m/min and 0.25 mm/rev. But it is a careful balance between cutting depths and speeds and tool wear; we aim to prolong tool life as much as we can.

This is especially so when milling the rear of flanges – an operation that can be particularly onerous on the wear of the 'slitting saws' used. "In addition to working closely with Starrag on the initial fixturing, Starrag engineers also played a key role in helping us establish the DBF process(es) and programming," says Mr Addy, "which meant the machine was immediately into production and saving us money." ▀



One-hit savings on oil & gas valves and fluid ends

The productivity benefits that oil and gas companies can gain by using Starrag's Heckert DBF horizontal machining centres are unquestionable – thanks to the machines' integral U axis that carries the Starrag DBF multi-tasking head, the rewards for one-hit, multi-facet, multi-face machining are unrivalled!



“Whether you want a standalone solution or a highly automated one, the DBF series offers the highest throughputs with a superior surface finish and excellent precision.”

Doug Henderson,
Vice President of Sales
at Starrag US



Prepared for unmanned operation: Thanks to the additional six-pallet linear storage and a 320-AC tool changer, the new Heckert DBF 1000 machining centre can also work without human intervention.

The DBF spindle head comprises an integrated work spindle with CNC radial facing slide for the U-axis travel. For turning on a fixed workpiece, the rotating turning tool – which has an axial runout of just five/six microns – can be radially adjusted by +/- 35 mm. In addition to external, internal and face turning, the head also permits conical and contour turning courtesy of the radial facing slide’s NC axis. Unlike other U-axis tools add on units, the DBF provides 1,200 rpm, 45 kW of continuous power, and 1,700 Nm

of continuous torque allowing the U-axis to efficiently rough and finish features with a superior degree of accuracy.

For milling and drilling, the work spindle is arranged in the U-axis central position and is capable of delivery 3,500 rpm, 45 kW of continuous power, and 1,700 mm continuous torque. This allows the machine to perform effectively as a horizontal machining centre for roughing and finishing when the U-axis is not required.

77% reduction in cycle times

Utilising the DBF machines’ single set-up ability to mill, drill and turn fluid ends, gate valves, drill bits and pump housings, for example, users have been able to slash machining times – in one instance, on control valves, from 20 hours to just 4.5 hours, achieving a 77% reduction in cycle times and a 95% reduction in overall processing times.

In a case, when the machine was complemented by a six-pallet linear



“Heavy metal” in sight: The new Heckert DBF 1000 machining centre is particularly suitable for highly efficient heavy-duty cutting of heavy housings weighing up to 4,000 kg, such as on the fluid ends.

storage system and 320-tool ATC storage, a DBF 1000 machining centre – ideal for fluid ends due to their weight – runs unmanned and undertakes a non-stop routine of face milling using a 125 mm diameter cutter at a feed rate of 5,000 mm/min, end milling using a 50 mm diameter tool, solid drilling (70 mm diameter tool) then turning with an 89 mm diameter tooling and a 300 mm diameter external turning tool.

“Industrie 4.0” solutions with Starrag’s IPS

When applied in fully automated systems integrated by linear pallet

systems and sophisticated, highly intelligent software routines to create high-performance manufacturing cells that boast maximum automation with minimal operator involvement. These “Industrie 4.0” solutions are ideally supported by Starrag’s IPS (Integrated Production System).

Another example – the production of fluid ends which have average life cycles of 2,000/3,000 hours – sees a DBF model machining the ends from solid stainless steel blocks of four tonnes in just 32 hours instead of 50 hours. That’s a cycle time saving of 36%. The secret to the success of the Heckert DBF

range of 5-axis machines (6-axis machining – without axis interpolation – when a tilting, NC rotary table is added, resulting in less complicated fixturing) is the integral U-axis that carries the DBF machining head which allows both roughing and finishing on both the U-axis and the ‘standard’ horizontal spindle. Additionally, the machines offer an extended Z-axis travel to permit long-hole drilling as required in fluid ends, for example.

Combined, the capability of these axes therefore enable fluid ends to be cost-effectively and efficiently processed from roughing through to finishing.

Accuracies of just 5–6 microns

The capabilities of the DBF machines' axes offer unrivalled flexibility in the machining of a multitude of facets – internal and external – on every face of a workpiece (except the clamping face), and with an axial runout accuracy of just 5–6 microns, all tolerance and concentricity values are consistently held, whatever the range and complexity of machining applications.

“Compared to other machines that may offer, say, facing head tooling via a tool-changer, the integrated DBF spindle utilises industry-standard tool holders

such as HSK 100 and Capto, this allows DBF head users to buy standard tool holders to cover all turning sizes up to 500 mm versus an additional facing head being required for every 70 mm of travel.” says Starrag US Vice President of Sales, Doug Henderson.

“The result is that with the integrated U-axis, the tool tip is much closer to the spindle bearings and this leads to much more rigidity at the tool tip and therefore more accurate machining. Additionally, the integrated DBF spindle has the torque and power to maximise the machining process efficiency”

DBF has replaced two roughing and one finishing machines

Doug Henderson adds: “And, of course, the DBF’s all-in-one process obviates the need (and expense) for separate roughing and finishing machines – in one case, a single DBF machine has replaced two 4-axis roughing machines and one 4-axis finishing machine – as well as the extra time and potential inaccuracies of workpiece re-location that accompany separate processes. It’s a perfect example of Starrag’s philosophy of ‘Engineering precisely what you value’.

“Whether stand alone or highly automated the Starrag DBF solutions provide the highest throughputs with superior surface finishes and excellent precision. ▀

**“The cycle times have been reduced by 77%,
the total machining time by as much as 95%.”**



Watch this video of a Fluid End machining on a Heckert DBF 1000.



starrag

Droop+Rein T



“Thanks to the use of ceramic tools, we can largely manage without coolant.”

Technician Jürgen Seek



The strength of the Starrag Droop+Rein T portal machining centre lies in complete machining, which is performed with or without coolant depending on the workpiece. Minimal-volume lubrication, however, is not required owing to the high-strength materials.

The Starrag portal milling machine in customer hands: smooth operation in the Rhineland.



XXL satisfaction

Any manufacturer of XXL machine tools can probably come up with gigantic data and fantastical characteristic values. But the real size of this kind of investment is often not seen until after years of operation, as a visit to satisfied Starrag customer NEUMAN & ESSER GmbH & Co. KG in Übach-Palenberg showed.

Sometimes all it takes to make you listen is a brief comment. "And there at the back is the Droop+Rein, one of our best workhorses in the stable," says Alexander Peters, Managing Partner of NEUMAN & ESSER GmbH & Co. KG from Übach-Palenberg near Aachen (NEA GROUP), while on a tour of the company. "We are very satisfied with this machine tool, its performance and the service provided by the manufacturer."

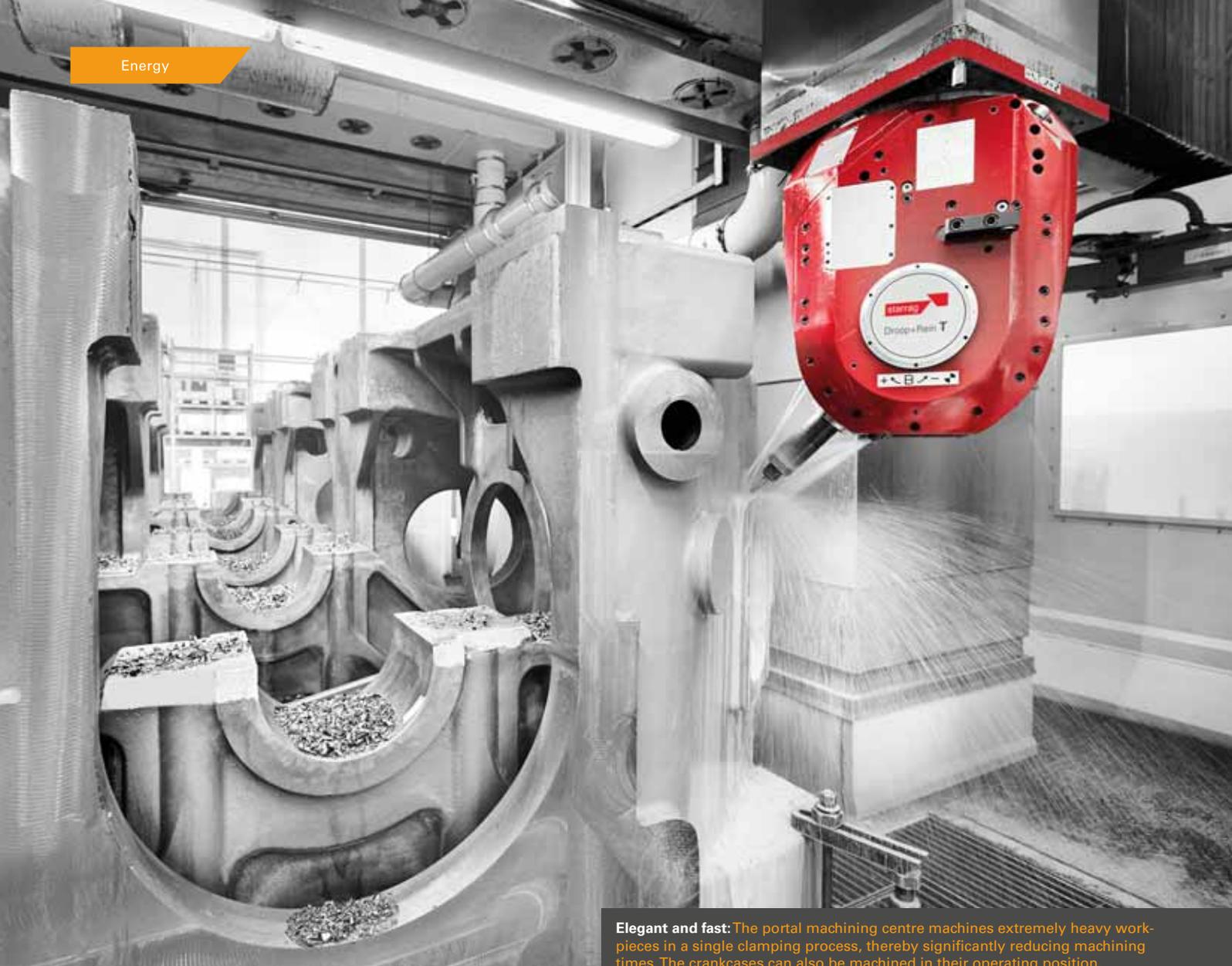
He is talking about a Starrag portal machining centre with adjustable crossbeam and movable clamping table (Droop+Rein T 30 40 DT R50 C). Currently the largest machine tool investment in the history of the NEA GROUP

has proven itself in the complete machining of components – and especially demanding machine components – since 2011. These are primarily components for piston compressors in compressor systems handling all technical process gases and for pendulum-mill housings in crushing technology.

"We have had the portal machining centre in continuous operation since 2011," says Simon Prell, Manager of Mechanical Production. "We mainly use it to machine crankcases and spacers as part of three-shift operation. It stops gas escaping from the cylinder into the crankcase and oil from moving into the cylinder from there." The Rhineland-based

company also uses the machine tool to produce cast components for pulverisers. This usually entails complete machining, which is performed with or without coolant depending on the workpiece. Minimal-volume lubrication, however, is not required owing to the high-strength materials, such as iron and steel alloys with a high nickel or chromium content.

The new arrival went down well in Übach-Palenberg even during the commissioning phase eight years ago. The company says it was one of the smoothest introductions they had ever experienced, despite involving switching to a completely new form of machining. At that time, crankcases were still machined



Elegant and fast: The portal machining centre machines extremely heavy workpieces in a single clamping process, thereby significantly reducing machining times. The crankcases can also be machined in their operating position.

on a horizontal drilling rig, one of the main problems with which were long periods of non-productive time due to time-consuming clamping processes. By contrast, a portal machining centre machines the extremely heavy workpieces more elegantly and quickly in a single clamping process, thereby greatly reducing machining times. The crankcases can also be machined in their operating position. According to Prell, the portal machine is particularly distinguished by the fact that the different machining heads can be optimally positioned and aligned.

Right from the start, Production Manager Dipl.-Ing. Achim Hoch was aware of the portal machining centre, which in his experience is "a workhorse that you can

always rely on." "When machining crankcases on a horizontal drilling rig, we always had to reclamp them several times and move against the angle," recalls Hoch. "However, each additional reclamping process led to faults. And finally, after an informative visit to the Munich BMW tool shop which had several Droop+Rein portal machining centres, we decided to invest in this machine."

Technician Jürgen Seek, who was working on a 45-tonnes crankcase made of ductile cast iron (GGG 40) during our visit, is also satisfied with this investment. "Thanks to the use of ceramic tools, we can largely manage without coolant," Seek explains about the dry machining process. He is glad he no

longer has to reclamp the workpiece multiple times. The gigantic component is machined in three steps: After milling the lower, lasered surface, Seek rotates the housing by 180° to allow the bottom of the housing to be machined. He then turns the GGG 40 component back to its initial position for complete machining.

Although it sounds hard to believe, this is a routine job for the machinist. "The machine can do much more," he explains to us. "We've never been able to really wear it out – not even when even test-machining titanium." But what has been his most difficult job so far? Seek thinks for a moment and then says: "Retrofitting a 27-tonnes crankcase was extremely complicated. The crankcase, which was not assembled, was very



“The machine can do much more. We've never been able to really wear it out – not even when even test-machining titanium.”

Technician Jürgen Seek



Simon Prell, Head of Mechanical Manufacturing at NEUMAN & ESSER:
 “The unusually high permanent accuracy benefits us, for example, in retrofitting work with a high proportion of machining.”

unstable and difficult to clamp. Yet despite these unfavourable conditions, we had to machine it exactly to hundredths of a millimetre.”

The NEA GROUP has not regretted their decision. The investment has paid off because, depending on the size, the machining time has fallen by an average of 30 to 40%, and accuracy has doubled even in critical areas. Tolerance in the bearing race is now only 20 µm instead of 40 µm.

Starrag checks the geometry completely every two years and realigns it if necessary. Prell: “So far the realignment has been to such a small degree that we could actually go without it. This unusually high permanent accuracy benefits us,

for example, in retrofitting work with a high proportion of machining.” To ensure that even such demanding jobs are performed with precision, the NEA GROUP measures the components using complex 2D and 3D laser technology.

In eight years of continuous operation, there has not been a single failure, with Starrag only having to replace the ball spindles once. According to Prell, this replacement is not unusual with operations where “we often have to move the moving crosshead”. While he and his team have rarely seen Starrag service technicians, the department manager has always been satisfied with their very high-quality work. “We have a permanent contact who knows us well,” says Prell. “You can see that there is a good

communicative relationship between our employees and the Starrag service.”

But can satisfaction with the Droop+Rein T series portal milling machine be substantiated and summarised? “As a typical single-part manufacturer of classic German mechanical engineering with small batch sizes, it’s difficult for us to name specific production improvements,” says Hoch, Production Manager. “Furthermore, how long the machining process takes is not the most important thing for us. We prioritise quality and the portal milling machine is excellent.” “The machine does exactly what we hoped it would,” adds Prell. “So far we haven’t exceeded the limits of its abilities.”

Open doors to the market for minimally invasive devices: A Shanghai company relies on Bumotec

Shanghai Medical Instruments (Group) Co., Ltd.

Surgical Instrument Factory, a subsidiary company of Yuwell Group

INTERVIEW

In the vast city of Shanghai, home to many international companies and firms which are well established on the national market, one such company has met with great success in the medical industry since 1928. Hidden away in the rather traditional environment of the suburbs of Shanghai, this prosperous business has been tireless in its pursuit of growth.

Shanghai Medical Instruments (Group) Co., Ltd. is a company in the Yuwell Group. Thanks to its four medical instrument production plants – including three finished product workshops and one workshop dedicated to forging, surface finishes and heat treatments – the company produces over 10 million parts, which are used in hospitals throughout China and also in some developing countries.

With a product catalogue of over 8000 items, its flagship brand JZ has won many awards including the “Shanghai Famous Trademark” and “Shanghai Famous Product” awards; JZ is the leading brand in the China Association for Surgical Instruments, which enables it to remain in constant contact with its end users and thereby plan future developments.

YAO JINHUA (Director of Third Manufacturing Department), **XU JIUJUN** (Chief of CNC Machinetools of Third Manufacturing Department), **PENG CHENG** (Office Manager)

Your company produces a vast range of products. Can you tell us what your product portfolio comprises?

As we specialise in medical instruments, our largest market is for key instruments such as clamps, scissors and surgical knives and our market share in China for these products is approximately 50%. We also produce 400 different types of micro instruments dedicated to anastomosis, treatment of lymphatic vessels, and limb reconstruction. We also offer instruments dedicated to ENT surgery, and for orthopaedic implants. We are experts in Minimally Invasive Instrument Technology: our catalogue contains 300 types of laparoscopic clamps used in endoscopy procedures, and 400 instruments for dental surgery (orthodontics and dental implants). We also produce surgical staplers and electric tools used for surgery.

How do you develop the production of so many different products?

We work closely with the hospitals and universities, in particular with Tongji University in Shanghai, to collaborate on instrument prototypes. Our R&D team works on the entire new product design process, from the studies and validation, right up until production goes live. All this takes place in-house, thanks to our production workshops, which allow us to be more flexible and responsive. Most micro instruments are prototyped using our three machining centres from Bumotec, the third of which was delivered back in March.

After the prototyping stage, how is the production process organised?

We manufacture a huge variety of different products, but we produce these in limited volumes, of around

200 or 300 parts for each reference number. To do this, our four machining workshops in Shanghai are equipped with a moulding unit to prepare the blanks, which are then machined on our CNC centres. In contrast, our Minimally Invasive Instruments and ENT instruments, which represent some 500 references, are machined from bar stock on our Bumotec machining centres. In addition, we work with around twenty subcontractors who support our in-house production, and an independent quality control department comprising 20 engineers.

Why did you choose machines from the Bumotec range to produce your medical parts?

Our conventional processes and machines were not able to produce Minimally Invasive Instruments effectively,



“I am very satisfied with our three Bumotec machining centres, that is why we have recently invested in the new Bumotec s181 model.”

as the stability in production, the relative precision obtained and the multiple complex clamping procedures required for the various stages of manufacture made production slow and inefficient. With Bumotec machines, we can work from bar stock to produce complete parts, i.e. six machined faces including finishes, with a single clamping operation and in record time. This has boosted our productivity and enhanced our efficiency. Our Bumotec machines have opened the doors to the Minimally Invasive Instrument market for us, and our business has profited as a result. In fact, with the most recent machine we received – the Bumotec s181 5-axis machining centre equipped with the ‘front live tools’ option – finishing operations on the sixth face are carried out concurrently, which has boosted our productivity by 20% on some parts.



An ENT surgical instrument produced on the Bumotec s181 which has boosted productivity by 20%.

Can you give us a specific example of parts you have produced using your Bumotec machining centres?

Since we received our first Bumotec s192 centre in 2005, we have developed a full catalogue of micro instruments. Here, for example, we have a two-part assembly for an orthopaedic instrument produced on our second Starrag centre,

a Bumotec s191 installed in our third plant in 2009. These two components are produced alternately on the same machine and are assembled to form the moving part of a clamp. This naturally requires a very high level of precision to be able to assemble the two parts without needing to retouch the components separately. Previously, we would



The product catalogue mainly comprises clamps, scissors and surgical knives.

use a turning centre, followed by a milling centre and electrical discharge machining (EDM) to finish the parts. Now, the Bumotec s191 machining centre alone is not only able to produce these two parts on the same machine from bar stock, but also to ensure such a high level of stability in precision that no retouch is required at the end of production. Two teams control the Bumotec machine, taking turns to produce these two parts in 30 minutes and 20 minutes respectively, with unrivalled precision and repeatability. You can imagine the time it used to take us to produce these same parts on three production machines using different finishes (turning, milling and EDM), taking into account the complexity of the clamping methods and the loss of production resulting from setting up these machines. To date, we have developed some 90 references of this type of part for orthopaedic instruments



Yao Jinhua
Director of
Third Manufacturing Department



Xu JiuJun
Chief of CNC Machinetools of
Third Manufacturing Department



Peng Cheng
Office Manager

using our Bumotec machines. Another example which is just as interesting, and much more recent, concerns the production of an instrument for ENT surgery produced since our Bumotec s181 centre arrived. This micro instrument is now produced in eight minutes instead of ten minutes, using the second machining station simultaneously.

How would you rate your three Bumotec machines installed in your plants?

I am very satisfied with our three Bumotec machining centres, that is why we have recently invested in the new s181 model. Their stability in production is extraordinary, and their ease-of-use makes training accessible even to the newest members of our team. Production changeovers are quick and easy using the recipes which are pre-set and programmed into the machine. The training



The new Bumotec s181 installed in March 2019 has already delivered an impressive boost in productivity.

provided on delivery of the machine by the experts in the Bumotec product range applications enabled us to return to production very quickly and efficiently. Thanks to the support of Starrag's Customer Services, we have been given quick and effective solutions during maintenance procedures and when replacing wear parts.

What projects have you got in the pipeline?

We want to continue to provide our customers with varied solutions tailored to their needs by speeding up the launch process for new products. We therefore plan to further expand our portfolio, thanks to our manufacturing solutions which enable us to constantly push the boundaries and thereby consolidate the image of our brand JZ. This will enable us to reinforce our standing as a key global supplier of medical instrumentation in China and abroad. ▀



An orthopaedic instrument comprising two assembled parts produced on the Bumotec s191 – this has dramatically reduced the number of stages in production.

You can rely on your production process

Machine availability is essential in the production process. We are happy to advise you on how you can continuously keep your machines at maximum availability and thereby achieve all of your production goals.

95Plus⁺
Machine Availability