

Key solutions for implants

Bumotec machining centres for efficient complete machining

Reaching new heights

Flexible production system represents a productivity leap for aircraft manufacturers

Evolutionary step

Starrag also offers MT-hybrid versions of STC machining centres

Precision on a grand scale

Large-scale machining centres from Chemnitz in mould making

Instrumental in developing cutting-edge medical technologies

Interview with SMTP Technology Co., Ltd

Customer service is "lifecycle management"

– intensive customer support throughout the life of the product



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**Star – The Starrag Group
magazine**

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Starrag Group

Close to our Customers

The Starrag Group Customer Service System



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Walter Börsch
CEO of the Starrag Group

Dear reader,

It would be a great quiz question: What do implants, surgical instruments, aircraft landing gear and packaging machines all have in common? Well, only a few will know the answer but I'm sure plenty of our Star readers know that all of these products, components and systems are made on Starrag Group machine tools for users from these market segments.

In the last issue, I mentioned the all-encompassing claim. True to the motto "Engineering precisely what you value," we provide all of our customers with precisely what they need

and what is important to them: nothing more, nothing less. We applied this motto when the Swiss aircraft manufacturer Pilatus, commissioned a flexible production system that processes medium-sized aluminium structural components with two ECOSPEED F machining centres, in a highly automated process. In comparison to previous results, production capacity for the customer increased by around a third.

Such a customer-oriented solution would be incomplete without the tailor-made service offered by our Customer Service business unit: Over 300 specialists from this global business unit work together with the customer to find the perfect solution for their machines.

It comes naturally to us, as we set up our own machines and equipment and are therefore one of the internal core customers of Customer Service. The Starrag Group happily uses the services of this business unit, whose service range is clear for all to see; ranging from typical after-sales service, to supplying spare parts, production support and retrofitting. A particular highlight is our service for spindles, developed together with well-known companies and partly built by us. Within the scope, we can not only respond quickly in the event of an outage, but also give the user advice about upgrades. Read how our Customer Service team supports the customer throughout the entire service life of the machine.

You can find this and other "Star" stories in this issue of our customer magazine and at one of the many Starrag Group events happening in 2017: In February, it was announced that the Technology Days Precision Engineering 2017 will be held in Tuttlingen, the German "medical valley." Demonstrations, carried out by TechCentre für Medizin und Feinmechanik, will include the six-sided processing of complex, medical engineering products featuring two Bumotec machining centres. You can look forward to other equally exciting events such as EMO 2107, which takes place in September in Hanover, where the Starrag Group will present itself not only as a machine manufacturer but also as a system supplier with the focus on Industry 4.0. I eagerly await your feedback, in person or otherwise.

Sincerely, Walter Börsch

Key solutions for implants

Bumotec machining centres for efficient complete machining

From 15–17 February, Starrag Group held its Technology Days Precision Engineering 2017 event in the new TechCenter für Medizin und Feinmechanik in Immendingen (Tuttlingen). The focus was on the Bumotec high-precision machining centres s191 and s181. Interested visitors were impressed with their highly efficient precision machining after watching live demonstrations and taking part in individual discussions. The event was supported by specialist partners Hoffmann Group, Haimer and Condat, whose products – including tools, tool holders, shrink units and coolants – play a significant role in the process chain.

Almost 400 medical engineering firms have their production sites in “medical valley” around Tuttlingen. And there are numerous precision engineering businesses towards the Swabian Alps. The leaders of the Starrag Group saw these as the ideal conditions for a new TechCenter and set one up in Immendingen for medical and precision engineering.

To appeal to a wider audience for the relatively new TechCenter and its related skills, the Technology Days Precision Engineering 2017 were held there. Oliver Lenhardt, Head of Application Technology at the TechCenter, demonstrated the variety of processing options of the s191 Linear using the example of a micro-mechanical sample piece to show how to completely machine a 35-mm bar on six sides in one step. It is rotated, subject to five-axis milling and drilled. A plane surface and a diameter are sanded, and an external tooth system is applied. “The complex machining takes just 20 minutes”, emphasises Oliver Lenhardt. “Then a double gripper removes the piece and places it in the palletizing system.” The application specialist says the particular strengths

of the s191 lie in the linear drives on the Z and Y axes and in the thermal stability of the machine, which is facilitated by water-cooled components. “We achieve accuracies in the µm range and surface finishes that are ideal for applications in medical engineering and precision engineering.”

The Starrag Group has more than just technical data to win customers over. Marc Lehmann, Head of the TechCenter, points out that they are always striving to work in close partnership with the customer; whether it be for application advice, piece timings, a detailed offer or sample work, if requested: “The entire Starrag Group believes in offering a complete package that includes supporting the customer when developing their processes and peripheral devices.



The representatives of Mathys AG, who came all the way from Bettlach in Switzerland for the event, used their time to prepare a joint engineering study with the Starrag Group and find out about useful peripheral devices.

Ultimately, we are in the position to deliver ready-to-use production systems that ensures maximum process security.”

Visitors happy to travel from further afield

The representatives of A.K.TEK Medizin-technik travelled to the Technology Days in Immendingen all the way from Hagen in Westphalia. The company develops turnkey solutions for dental implantology, spinal surgery and hand surgery. Junior Manager and QM representative Björn Arndt explains: “We see ourselves in the top area of quality and always want to go one better than the competition when it comes to our products. This means we need reliable, high-precision machines.” He praised Bumotec machines for their excellent technology and an appealing



The high-precision machining centre Bumotec s191 Linear used a micro-mechanical sample piece to show off its wide range of processing capabilities.



At the Technology Days Precision Engineering event, which took place between 15–17 February 2017, the Starrag Group demonstrated for the first time how complex components can be machined in a single clamping operation even with small batch sizes, yet still remain profitable.

“We achieve accuracies in the μm range and surface finishes that are ideal for applications in medical engineering and precision engineering.”

This abutment is only a few millimetres in size with very close dimensions. The s181 completely processes pieces in record breaking time. Most importantly, this offers the option of using a counter unit to process the rear side at the same time.



machine design with good accessibility: “After an interesting conversation at the AMB, we wanted to take the opportunity to see the s181 and s191 in action.”

Of particular interest to the medical engineer from North Rhine-Westphalia was the application running on the s181: an abutment. This is the connection between a dental implant and the visible dental crown. It is only a few millimetres in size with very close dimensions. A.K.TEK already process this type of abutment. “This means we can assess performance directly,” says Björn Arndt. “The time-saving parallel processing through the counter unit is definitely a plus point of the s181.” He also appreciated the chance to have a detailed discussion whilst visiting the TechCenter: “They provided us with every single detail on

machine construction. This is critical for us, because such a cost-intensive investment needs careful consideration. We may even think about the s191, which has a more versatile setup.” A future joint sample processing will seal the deal.

The representative from Mathys AG, who travelled from Bettlach in Switzerland, is already familiar with what the Bumotec s191 can do. The company specialises in products for artificial joint replacements (i.e. hips, knees, shoulders, fingers) and is currently looking for a new machine for machining plastic balls for hip prostheses. Process Engineer, Beat Uhlmann, thinks the concept of the s191 is very innovative: “We already visited the Bumotec plant to find out about the technical capabilities of the machine. It proved its fundamental suitability for the

planned product series. Because we wanted to take on more components in this range, we attended the event for more details and to see what other automation options there may be.”

Under the leadership of Erwin Fässler, Starrag Group Area Sales Manager for Switzerland and Austria, the Mathys representatives discussed a joint engineering study at the Technology Days event. They also used their time in Immendingen to find out more about the Starrag Group. Beat Uhlmann explains: “We want a partnership with our suppliers and really appreciate their experience in the entire process chain. We therefore find it valuable to make personal contact with the Starrag Group’s partner companies and get feedback on our own production.”

Partnering for efficiency

Starrag Group Customer Service System

Preventive Services

Training
Maintenance/condition monitoring
Production monitoring
Service contracts

Re-active Services

Remote diagnosis
Trouble shooting/repair
Geometrical alignment
Relocation

Spare Parts

Spindle pools / overhaul

Retrofit



A large industrial machine, likely a lathe or mill, is shown in a factory setting. A worker in a dark blue shirt and blue pants is standing on a metal platform, inspecting a large, circular metal component that is mounted on the machine. The component has many holes and a central flange. The machine is blue and has a control panel with a screen and many buttons. The background shows the factory floor and some other equipment.

We create pure
added value
for customers

Customer service is “lifecycle management” –
intensive customer support throughout the life of the product



Value-added statement

50 %
lower costs

Günther Eller, Head of the 'Customer Service' business unit at the Starrag Group: "As the Service product develops directly with the customers' premises, its success stands or falls by their involvement."

Customer Service is one of four business units in the Starrag Group. But in contrast to the machinery and equipment from the three operative business units, the Service product only matures when it reaches the customer. A special challenge for the over 300 specialists in this global business unit, for whom teamwork with the customer is part of everyday life.

"Just knowing how customer service works doesn't achieve anything" claims marketing expert Axel Haitzer from Rosenheim. The message from the Bavarian lateral thinker, trainer, and author: "You have to feel and sense like a customer – then and only then can you delight customers."

These words fit very well with the Starrag Group and their Claim: "Engineering precisely what you value." Customers can only receive exactly what they need and what is important to them if the service provider sees the complete project through the eyes of the customer. This is easy for the Starrag Group: The group uses its own machines and equipment and is therefore one of the regular customers of Customer Service.

The bandwidth of the business unit comprises a large number of services: In addition to the typical after-sales service (e.g. spare parts service, maintenance, fault clearance, service contracts), these also include specialities such as the spindle service, geometric alignment,

production monitoring or retrofitting. This is the job of over 300 highly motivated, globally-active employees with many man-years of experience and knowledge. At the heart there is a very powerful de-centralised "field service" with 150 technicians working on site with the customer. In ideal cases, "embedded service teams" are even located directly in the customer's factories.

"Our team ensures the customers' production levels by maintaining high, stable availability of Starrag machines," explains Günther Eller, Head of the Customer Service business unit. "But at work there needs to be very close cooperation with regular contacts. This is because the Service product only starts to develop directly with the customer, and success stands or falls based on their involvement." More and more customers book a service at the same time as buying a Starrag machine tool: They are tapping into the significant knowledge of Starrag staff, something application support experts in several sectors have already experienced.

Production accompaniment ranges from assistance in machining new, complex workpieces, programming customer-specific application cycles to support in developing a machining strategy. A regular customer of Starrag comments: "We aren't just buying a machine, but a machining process."

This is only one of the strengths of the Customer Service unit. According to Eller it sets itself apart with its holistic concepts, in which his colleagues accompany customers intensively across the whole product lifespan in the name of "lifecycle management". In ideal cases, they work meshed closely together across several areas. This applies, for example, to fault resolution, teleservice and remote diagnostics. After a real-time analysis of the machine state, it's time for the extensive remote service infrastructure to come into play. This assists the customer via the Internet, a technical hotline or what is known as "remote diagnosis". Often, this very effective organisation can diagnose and resolve machine faults from afar.

Should the “remote diagnosis” not achieve the desired result, the appropriate steps are taken – by deploying a mechanic or shipping a replacement part.

Spare parts service: Continuously optimised

Here the supply of spare parts becomes key, and these can be divided into three groups: original spare parts, compatible spare parts after the original equipment has expired and assembly replacement pools. In order to be close to customers all over the world, main and regional warehouses in Europe, Asia and North America along with logistics partners are able to supply customers directly. Eller: “We rely on sophisticated inventory management and highly professional, pre-installed global logistics processes – instead of the usually not very helpful and expensive part stockpiling by customers.”

Value-added statement

60 %

shorter delivery time

Teamwork : In the Weingarten factory, mechanical maintenance by Schuler and the Starrag Group's Retrofit team has improved a 30-year old Wotan large boring machine in many vital respects.

Take three: Strategies for spindle failures

For very special spare parts there is an extra service: This means motor spindles, since workpiece quality, productivity and safety rise and fall with their availability and reliability. The Starrag Group therefore not only develops and builds customised spindles, but complements them with a tailored, three-stage spindle revision including customised maintenance measures, collision protection systems and a replacement pool for motor spindles.

But some failures can be avoided in advance. Preventive maintenance is a growing trend, acting before any failures occur. “For example, there is a big increase in preventative annual maintenance with condition monitoring, which should definitely be carried out by our people because of the levels of experience and knowledge needed,” says Eller. “The successes can be measured: The number of unplanned outages and larger, avoidable faults reduces significantly, while reliability and productivity rise.”

Proactive operations of this type can be planned within the framework of service contracts, which Starrag individually customises from standard service modules.

- Spare parts supply
- Teleservice and remote diagnostics
- Service staff permanently on customer premises
- Operator and maintenance training
- Response time (depending on response time agreement)
- Availability guarantee
- Production support
- Preventive maintenance, status-oriented maintenance
- Warranty extension

But since service theory is a grey area, here is a practical example of a custom service contract, at the centre of which lies module 3 “permanent service presence on the customer’s premises.” A customer with approx. 50 Starrag machines has a strong team constantly on site: It takes care of training, condition monitoring, preventive maintenance and repair. In regular meetings, the on-site team discusses and plans with the





Spindle revision: With customised maintenance measures, a collision protection system and a replacement pool for motor spindles, the Starrag Group is preparing for all situations.



Do it yourself: Thanks to Advanced Application Training, the user can optimise his machining centres on his own, to get maximum benefit from them.

customer all the measures that will be implemented, from machine revisions to complete retrofits. An example of how the machine availability and thus productivity can be increased in a stable and process-safe manner when working together with the customer.

Training: Help for self-help

An important building block for such service contracts is training staff to help themselves. Starrag offers, for example, professional personnel training in standard maintenance and machine operation. If that isn't enough, extra training can be booked: The Advanced Application Training, for example, which is aimed at making the best possible use of machining centres. The focus is on increasing efficiency. The training covers the entire process chain – from the detailed task analysis (HSC or HPC) and process planning to the optimisation of simultaneous 5-axis machining. Matthias Wimmers, Application Expert at Starrag Group, explains what this

means with a practical example: "Thanks to ECOSPEED, one customer was able to cut the time needed to machine a complex aircraft component by 27 % to eight hours compared to the previous conventional machine. After optimising the entire process, the actual processing time only took two hours." The Advanced Maintenance Training is just as well designed, focusing on building a solid, practically-trained maintenance crew.

The retrofit is a special service component that has developed into a successful service provision in the Starrag Group. Almost 50 specialists work in the Retrofit service at the Mönchengladbach site alone: The Starrag Group has its own construction department for machine modernisation. After creating the concept for the machine overhaul, the experts plan the retrofit and its sequence in detail together with the customer. The advantages of retrofitting in comparison to a new purchase are lower costs (usually 50 % lower), shorter delivery times (usually 60 % shorter) as well as rapid

re-commissioning with significantly increased dynamism and productivity.

A particularly successful example occurred in a factory belonging to the machine tool manufacturer Schuler in Weingarten, Germany: Together with the customer's mechanical maintenance, the retrofit team renewed an almost 30-year-old Wotan Rapid 6 large boring mill, on which components have to be machined very precisely. The maximum permissible deviation over the entire ten metre length (in the X-axis) is 60 µm. Many aspects of the Wotan that were critical from the operator's point of view were modified. The large boring mill thus received a completely new bed saddle with a double pinion drive and two electronically tensioned drives. For Schuler, the key advantage of the Starrag Group was that "they weren't just relying on the inventory documents, they were prepared to fundamentally consider the whole technical concept of the plant". And this only works when Service thinks and feels like a customer. ▀



The Packaging Artist from Lengerich

In customers' hands: Dörries CONTUMAT 2400/200 MC vertical turning lathe from the Starrag Group

A passion for new ideas has made Windmöller & Hölscher a global market leader. The company – which is a manufacturer of systems for producing and processing flexible packaging based in Westphalia – also expects a high level of passion and innovation from its machine tool suppliers. The Starrag Group is therefore proud that the Westphalian Packaging Artist has once again opted for their machine tool.

"It's like being at a luxury watch-making firm," says an astonished Ralf Baumgarten, a photographer who has made his name with illustrated books about watchmakers and their creations. He spontaneously takes a photograph of Heinz Schantin. The specialist from Windmöller & Hölscher KG (W&H) from Lengerich, is using a large magnifying glass to examine the surface of a part for an extrusion line, on which extremely thin plastic films will later be created. W&H adopts this type of quality control in advance of the conventional 3D image processing. However, the final checks on these machine parts involve the use of precise, high-tech measuring centres.

And the demands on production technology are equally high. "The machine tools at W&H are a central component of our production chain", states Matthias Richter, Head of Maintenance. "We exclusively manufacture complex components that require a very high level of accuracy and knowledge of manufacturing." Most of the machine tools run around the clock in 3-shift operation, to ensure a good supply of parts for the assembly of W&H machines. So when it comes to new investments, reliability, maximum technical availability and fast, excellent service are crucial deciding factors.

As an example, the business is very satisfied with the portal machining centre from Droop+Rein, which W&H brought into operation in 2008 to enhance two portal milling machines from another manufacturer. "On these machines, we primarily produce large frame parts for our whole range of machines," says Richter. "These components play an important role for us, as they make a significant contribution to the high quality of our printing machines, processing machines and film winders."

Just as important a role is played by the core components for blown-film extrusion lines, which are partially made

Batch size 1: Core components for blown-film extrusion lines are unique pieces, created in a single clamping operation on the CONTUMAT from forged blanks or from grey iron and cast aluminium turned parts.



A culture of quality: The extremely high-quality production technology at W&H is due in no small part to highly motivated specialists like Heinz Schantin, who can be seen here examining the polishing progress in detail.



Precise and low-vibration: Even with very large tools (pictured is a 650-mm-long solid drill with a diameter of 113 mm) the CONTUMAT fulfils the high requirements for safe, fast and accurate machining.



Matthias Richter, Head of Maintenance at Windmüller & Hölscher KG (W&H), based in Lengerich. "On our machine tools, we exclusively manufacture complex components that require a very high level of accuracy."

Decision-making criteria for the purchase of a Dörries CONTUMAT turning lathe:

> Reliability

> The highest level of technical availability

> Fast, excellent service

from chrome-nickel heat-treated steel forged especially for W&H, or from grey iron and cast aluminium turned parts. Every part is unique in batch size 1. In order to ensure productive machining, W&H relies on complete machining and quick tool handling. Due to growing demand, the Westphalians decided on a Dörries CONTUMAT VCE, a new vertical turning lathe from the Starrag Group.

The new machine's most important feature for the company is the ability to offer complete machining in a single clamping operation. "The additional angled drilling and milling head means we are able to work very flexibly and productively on the new vertical turning lathe," explains Equipment Planner Tobias Baune. "Every additional clamping operation produces deviations in size,

which we have to spend time correcting. So we manufacture our parts in a single clamping operation."

At the request of W&H, the 4.5-metre-high turning lathe also has a basement beneath it that is over 5 metres deep. The demands on the machine are very high indeed, since W&H predominantly uses the CONTUMAT to manufacture components for blow-moulding machines with an accuracy of 20 µm. The components can weigh up to 2 tons and have a maximum rotation diameter of 1,800 mm.

The driving force for this comes from two high-performance 40 kW electric motors (torque: 38,300 Nm). They are located in the basement, along with the water treatment equipment, which is accessible for servicing and maintenance. Richter: "When designing the basement, we received excellent expert advice from the Starrag Group." Environmental concerns are playing an increasingly



A positive surprise: Windmüller & Hölscher's production department has been able to machine pieces on the CONTUMAT that they hadn't previously expected to.

Proof that the new marketing message "Engineering precisely what you value" has been a reality for some time.

important role in Lengerich, next to efficiency, performance, reliability and safety. For this reason, in the case of new investments, W&H ensures that the machine room is fully encapsulated with suction and filtration of emulsion fumes. This attitude goes down very well with employees, whose high levels of motivation are particularly important to the Westphalian firm. A comment from machine operator Andreas Gräler: "I am very impressed by the complete enclosure, as it makes my work on the machine quiet and safe."



Machine operator Andreas Gräler: "I am very impressed by the complete enclosure, as it makes my work on the machine quiet and safe."

Another bonus is the increase in flexibility, which is indicated by the suffix 'MC' (Machining Centre) on the type designation. Because this is actually a vertical machining centre, designed to be multi-functional thanks to its additional 30 kW drilling and milling drive (3,000 rpm). It was demonstrated very impressively by machine operator Andreas Gräler, through the precise, powerful and low-

vibration machining of a workpiece with a 650 mm-long solid drill (diameter: 113 mm). This is one of many examples that demonstrate the extreme versatility of the CONTUMAT. Baune comments: "We're only just discovering everything we can do with the CONTUMAT. We are now able to machine pieces that we previously hadn't expected to."

That is an indication of just how the machines are designed to match customers' requirements. Richter: "In fact, machine tools from the Starrag Group can be configured precisely in accordance with customer requirements." Proof that the new marketing message "Engineering precisely what you value" has been a reality for some time. ▀

Reaching new heights

Flexible manufacturing system represents a productivity leap for aircraft manufacturers

Pilatus Aircraft factories have re-established the machining of large components: Since October 2016, medium-sized aluminium structural components with a length of between 750 and 4,000 mm are being machined in a highly-automated manner by a Starrag Group flexible manufacturing system (FMS) including two ECOSPEED F machining centres. Production capacity has been increased by about a third.



The pallet system integrated by the Starrag Group includes a total of 16 pallets measuring 2,000 mm x 4,000 mm.

Final assembly hall at the Pilatus Aircraft factory in Stans, Central Switzerland: You experience the wonder of flying much more here than when you're sitting in an "ordinary" passenger aeroplane. Here there are the newest models of the PC-12, a single-engine multi-purpose aircraft which has sold more than 1,500 units, some examples of the highly-modern PC-21 training plane and three prototypes of the twin-engine PC-24 Business Jet. These were certified in 2017 and 80 orders have already been received for them: it's hard not to grab the joystick yourself and take off.

It's no wonder that Pilatus has conquered different niche markets with these relatively small aircraft. Because they impress with their high quality,

individual equipment and performance characteristics, as well as the multiple award-winning worldwide customer service. With around a 65 % share of sales, Asia is the largest sales market for the Swiss company, followed by America with 23 % and Europe with 8 %.

For years, turnover and orders have been increasing continually and now the PC-24, known as the Super Versatile Jet, has reached market maturity, production capacity requirements will reach a new high. Since neither available space nor staff numbers can be increased indefinitely, those in charge chose to breathe new life into the machining of large parts and therefore achieve additional capacity.

After all the new business jet, like all other Pilatus aircraft, consists of

numerous aluminium structural components from nose to tail fin and wing tips. "Machining them is one of our core competencies," explains Walter Duss, Head of Mechanical Production. "As they have a wall thickness of only 1.2 millimetres at times, they are extremely delicate. This is not the case for all aircraft manufacturers. Machining efficiency is therefore usually well over 90 %."

To increase productivity in this knowledge-intensive core segment, a flexible manufacturing system had to be installed for components between 750 mm and 4,000 mm in size, which enabled a largely automated production process.



Pilatus' FMS in Stans contains two identical horizontal machining centres of the ECOSPEED F type, which were specifically developed for the high-speed machining of mid-sized large structural components from aluminium.



"With the ECOSPEED F machines we achieve excellent quality and are much more productive than in the past."

Pilatus machines parts of between 750 mm and 4,000 mm in length using the new Starrag FMS. Walter Duss (left), Head of Mechanical Production, and Ahmad Rabah, a multi-skilled mechanic specialising in machining large parts, both from Pilatus, indicate that – having a minimum wall thickness of only 1.2 millimetres – the parts are extremely delicate.

Other important points in the specification were the ability to retool during machining time using a work buffer in the pallet magazine, as well as a generally reduced retooling requirement in order to economically handle Pilatus' range of over 200 parts in this size category.

Flexible manufacturing system creates additional capacity

Beat Müller, Project Leader for Equipment Procurement and responsible for the investment in the flexible manufacturing system, included all of the well-known aerospace industry suppliers

in his invitation to tender. They had to undergo an intensive benchmarking process, at the centre of which were numerous test processes. In the end, the tender was awarded to Starrag Group, who are to supply a flexible manufacturing system with two identically-equipped ECOSPEED F 2040 machining centres.

"What fundamentally shone for the Starrag Group was their comprehensive system knowledge and their many years of experience completing successful turn-key projects," described Beat Müller. On the machine side, the performance of

the ECOSPEED F machining centres was especially convincing, designed specifically for the machining of aluminium structural components and reaching a span volume of up to 160 l/min. Beat Müller described the Sprint Z3 parallel kinematic machining head as particularly innovative: "It especially impressed us when it came to pocket milling in the corners with different angles of attack." Another decisive factor was the spindle with its maximum speed of 30,000 rpm and an output of 120 kW. It provides a diagnostic function – "a must-have criterion for us," adds the project



The highly-automated production is supported by another product developed and supplied by the Starrag Group – a production control computer. This manages the machine duo's collaboration with pallet and set-up stations. Staff always have a clear overview of the processes on the monitor.

The pallet system integrated by the Starrag Group includes a total of 16 pallets measuring 2,000 mm x 4,000 mm.



leader. "Because this enables us to optimally design the process, also in terms of maintenance and other running costs."

The project leader also named the optimal chip fall of the ECOSPEED F as a deciding factor: "We estimate that nearly 700 tons of raw material is machined in the machine every year, of which more than 90 % is removed. This is a huge volume of chips that has to be removed from the machine and the production area." The vertical arrangement of the machine pallet guarantees that chips will fall directly into the central swarf conveyor. The conveyor moves the chips to a cross conveyor in the basement, which finally moves them to a silo with four

briquette presses. After pressing, the briquettes are transported from the hall to a waiting container.

The Starrag Group provides the project planning and engineering of the whole FMS, which includes a pallet handling system in addition to the machining centres. There are a total of 16 pallets in the system, with dimensions of 2,000 x 4,000 mm. Of these, one is located in each machine, and 14 are in storage locations. The system also

contains two set-up stations with a tilting table to allow vertical loading. The highly-automated production is supported by another product developed and supplied by the Starrag Group – a production control computer. This manages the machine duo's collaboration with pallet and set-up stations.

High process security enables unmanned night shift



Project leader Beat Müller: "Thanks to the high process safety of the Starrag Group FMS, we can now run the night shift with no staff."

30% increase in production capacity

The Starrag FMS has been in operation since the autumn of 2016. Production manager Walter Duss is satisfied: "With a similar production area and the same amount of staff, we generate approximately one third more capacity. This makes us much more economical – something that helps us meet strong international competition in an expensive manufacturing country like Switzerland."

Project leader Beat Müller also recognises that a major goal has been achieved: "We used to have a shift model in which our machine operators worked continuously 300 days a year from 5 am to 1 am. It was followed by four hours' unmanned operation. The system's process-safe operation

allows us to run the system unmanned from 10 pm until 5 am, and so free up our staff for other tasks."

As a further benefit he mentions that tooling – which happens manually due to the large variety of parts – can take place while the machines are running. The pallets are loaded during the day shifts. In order not to lose any time in doing so, Pilatus has integrated a raw material storage location opposite the set-up point to provide the required blanks. The setup pallets are stored in the magazine. From there, the Starrag production control computer automatically sends them for machining on the machines and ensures that they are returned to the magazine afterwards. Beat Müller indicates that some twelve



production orders run on the system at the same time. The pallets are thus placed in storage again between intermediary work steps. Beat Müller summarises: "The buffer effect of the pallet magazine definitely allows us to achieve higher utilisation." Once machining is complete and there is capacity for unloading, the finished pallet travels to the set-up point, where it will be manually unloaded and reloaded. ▀



Evolutionary step

Starrag also offers MT-hybrid versions of STC machining centres

Companies in the aviation and energy industry want to be able to machine casings, impellers and other complex components in one clamping operation. Starrag therefore offers the successful STC 5-axis machining centres in another MT variant which, in addition to drilling and milling functions, will also take on turning tasks.

The STC series has developed into the standard for economical machining of demanding structural components, multi-blades and casings. Their advantageous static and dynamic properties as well as the tried-and-tested swivel head set the benchmark for simultaneous 5-axis heavy-duty cutting of titanium and Inconel parts in the aviation industry and in energy production. Numerous equipment options make them readily usable for HSC machining of aluminium components.

The philosophy for machining such components has changed a bit in recent years, according to Project Manager Marcel Leuch. He explains: "Today our customers want to carry out as many operations as possible in one clamping operation and ideally then collect the finished component from the machine. This will provide clear accuracy benefits and allow you to profit from shorter downtimes." This trend is supported by advances in the programming of such hybrid machining centres.

In practice – for example with casings – it is a question of being able to carry out the necessary turning operations in addition to the predominant milling, drilling and threading operations. To give another example, machine operators want to be able to use the same machine to mill impellers and then carry out fine machining on them, by turning the outer contour.

Starrag has already been meeting requirements such as these for a few years, for example with the STC 800, the smallest version of the 5-axis machining centre range. It is offered as an MT version with a rotary table to meet all of the demands for high-performance turning. Since – as Marcel Leuch says –

For processing the interior of casings and similar components, the STC series can be equipped with angle heads, loaded completely and fully-automatically from the magazine to the spindle.



Machining in one clamping operation leads to: > **Increased accuracy** > **Shorter downtimes**

the demand for larger machines with this technology has increased, decision-makers at Starrag opted to develop a matching MT variant for every STC machine.

Securely-mounted rotary table sets standards

The central new component of the Starrag STC MT variants is the fast-turning rotary table, which replaces the conventional machining table while maintaining the same axis arrangement. This means that for models STC 1000 to STC 1600, the linear X-axis and the rotary B-axis are located in the work-piece. The Y- and Z-axes and swivel axis A are located in the tool. Being of a good size, the workpiece interference diameter is ideal for machining large, cubic parts such as casings.

The rotary table used in models STC 1000 MT to STC 1600 MT is designed and built at the Mönchengladbach site. They have also been used for a long time in turning lathes from Berthiez, also a part of the Starrag Group. "Our STC MT machines, or their users, are now also benefiting from this experience," says Marcel Leuch happily. Our rotary tables are built so well that they are able to maintain a comparatively high speed even under significant load. The STC 1000 MT can be loaded with up to 3 tons and rotate the component at up to 500 rpm. Even the STC 1600 MT with its load capacity of 8 tons can turn at 320 rpm.

The crucial advantage of the self-constructed rotary tables is in the rigid bearing. While alternative rotary tables use an internal bearing and external

motors for cost reasons, the Starrag Group uses a large external bearing that provides significantly higher resistance to tilt and radial rigidity. The rotary tables can run at high speeds even when heavily loaded, and are not short of torque: an STC 1250 MT, for example, provides 6,000 Nm.

Turning as if on a dedicated machine

Even when it comes to control, there is nothing left to be desired: Multi-task tools with several blades can be used, and eccentric turning is no problem either. "We have already produced several eccentric and conical polygons," confirms Marcel Leuch. To guarantee high machining quality, it's not just the tool that is clamped to the spindle while turning. On models STC 1000 MT to



The Starrag STC 1250 MT also demonstrates high turning performance. A test cut was able to achieve cutting depths of 8 mm with 7/10 mm pitch.



Starrag STC machining centres are now also available as MT hybrid versions. All milling and turning work on demanding structural components, multi-blades and casings can thus be done in one clamping operation.

STC 1600 MT it is also possible to clamp the rotary table guide. This reduces the effect of an imbalance in the workpiece, which would create small oscillations in the X-axis.

Marcel Leuch supports the theory with results of a test: "We put a sample casing blank with a diameter of 1,800 mm on an STC 1250 MT. In a test cut, we were able to achieve cutting depths of 8 mm with 7/10 mm pitch." This shows that top-quality turning is possible. The user can confidently dispense with clamping the component for further machining on a separate turning lathe.

The deployment of a Starrag STC MT machine therefore offers the user a

number of benefits. Since all milling and turning operations can be done in a single clamping operation, the re-tooling overheads disappear, reducing the setup time. Even in terms of pure machining time, the user is at least as fast as before. However, component accuracy increases since re-clamping errors are avoided. In addition, fewer fixtures are required, perhaps even saving the cost of the investment in a turning lathe. Component logistics are certainly simplified.

Milling quality as high as ever

When it comes to drilling and milling, the user fears no losses compared to the proven machining centres of the STC range. As before, several work spindles

are available to choose from, the majority of which were developed and produced by Starrag themselves in Rorschacherberg. The spectrum ranges from the 37 kW gear spindle with a torque of 1,300 Nm and up to 5,600 rpm for heavy titanium machining, to the 120 kW motor spindle which turns at up to 30,000 rpm for HSC and high-performance milling.

The customer can choose from various Starrag tool magazines and changers as required.

The Swiss machining specialists have developed a special solution for machining the interior of casings and similar components. The STC series can be equipped with angle heads, which can be loaded completely and fully-automatically from the magazine to the spindle. But not only that: Starrag offers the option of equipping the same angle head with a multitude of different tools using the tool changer. This opens up tremendous flexibility in terms of the complete machining the customer desires. ▀



Stefan Zatti, member of the board of management:
"We average around 21 hours of running time 7 days a week"

Precision on a grand scale

Large-scale machining centres from Chemnitz in mould making

Entrepreneurs sometimes have to make extremely brave decisions in order to achieve success – as demonstrated by the history of Otto Hofstetter AG. Thanks to these brave decisions, the medium-sized Swiss company has achieved such feats as becoming number two in the global market for mould manufacturing in the area of preforms for PET bottles. The decision to bring plate production in-house and to purchase three Heckert HEC 1250 large-scale machining centres for this purpose was also a significant factor in achieving the company's current success.

Otto Hofstetter Senior founded the company in 1955 as a sub-contractor for local companies but, just two years later, he began to produce injection moulds. He had recognised the potential of the emerging plastics and of the injection moulding procedure and quickly built up a good reputation as a manufacturer of high-precision moulds. The company specialised in moulds for thin-walled products involving highly-complex injection moulding, particularly in food packaging. 1977 saw a decisive turning point for the company from Uznach, Switzerland, when Coca-Cola began the search for new packaging, looking for a lighter alternative to the glass bottles used up until that point. A partner of the drinks giant developed a plastic bottle,

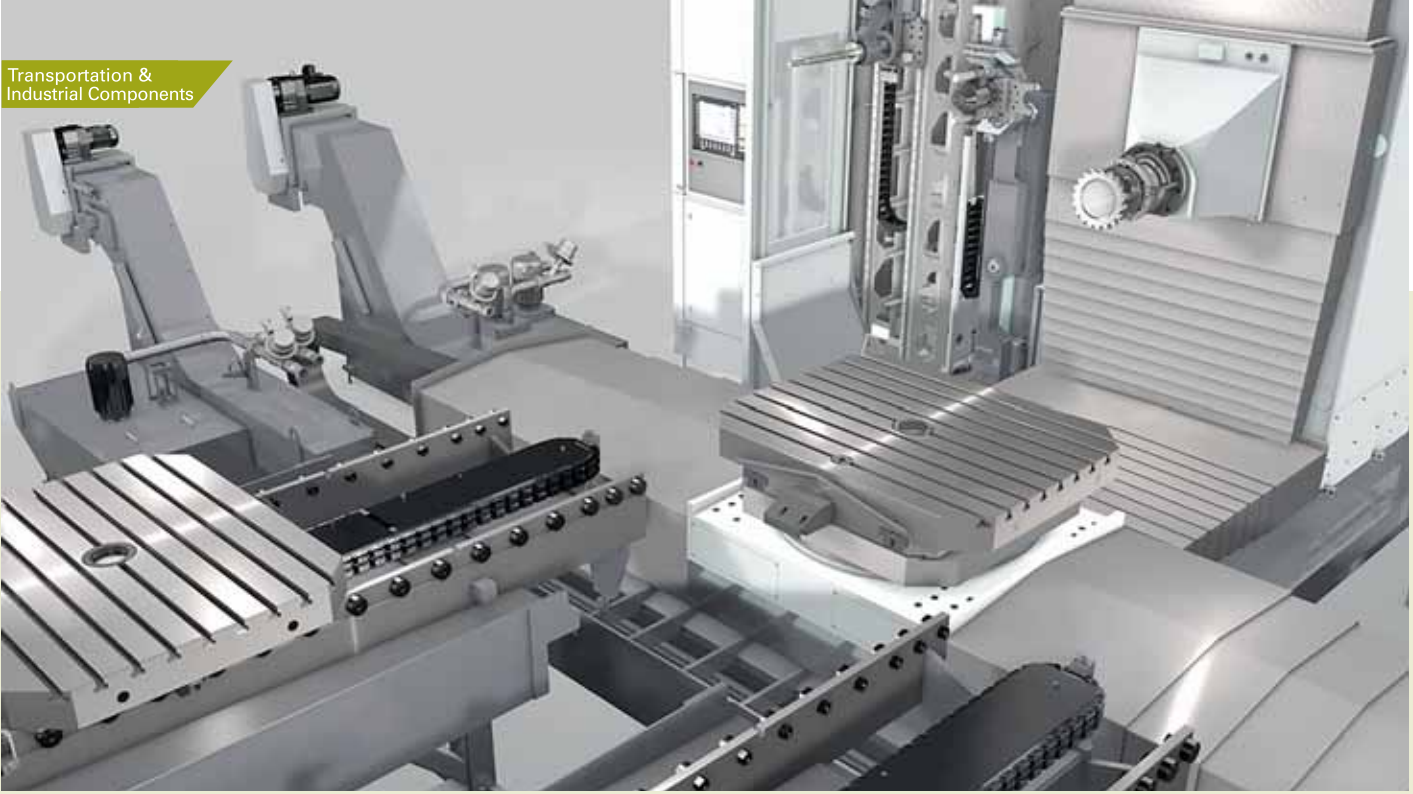
but was unable to find a mould manufacturer to produce them. Although plastic bottles are blown into shape, the material is placed into the blow-moulding machine as a preform. This injection-moulded preform consists of the threaded neck and a contour similar to a test tube; this is the material that is used to blow-mould the bottle into its final shape. Otto Hofstetter made an excellent impression in the subsequent selection phase and won the drinks giant's custom. As a result, the company spent ten years as the exclusive manufacturer of the injection moulds for the Coca-Cola bottle preforms in the USA.

In the mid-1990s, the boom in plastic bottles reached Europe and the business

exploded with the corresponding moulds. The son of the company founder Otto Hofstetter, who had taken over the management in 1997, decided on a large-scale expansion of production capacities: he intended to develop in-house production capacities for the preform plates, which had previously been manufactured externally. Of course, this meant that new machines had to be purchased,

Range of cartridges:
Silicon and coloured cartridges in various sizes. The distribution sector is the main customer group.





“The product is right, the price is right, the service is right –
this has been confirmed time and again with seven machines
from the Starrag Group over the course of many years.”

as the maximum workpiece size of the existing milling centres meant that they were far too small. Depending on the mould, the plates are up to 1.5 x 1 metres in size, 20 centimetres thick and 2,500 kilograms in weight, with a high level of precision required. A mould can have up to 144 cavities and the tolerance across the five base plates – which together form one mould – is less than one hundredth of a millimetre. After all, the base plates not only have to be exact in themselves, but they also have to be a perfect fit with each other.

As Hofstetter was already successfully using two Heckert CWK 800 machining centres with horizontal spindles, the decision was taken to approach the Starrag Group once again in the interest of increasing capacity. Stefan Zatti, member of the company board of management and Head of Sales and Marketing, recalls: “Both existing CWK 800 systems have proven to be reliable machines with a high level of availability so, when we were looking for larger machines for base plate production, we decided to approach

the Starrag Group again. Another important consideration for us was that Starrag had already proved to be a reliable, stable partner.” After visiting the Chemnitz site, the Hofstetter decision-makers were so impressed that they bought two CWK 1250 machines, instead of the one they had planned. In addition to the high level of quality of the machines, another characteristic that swung the decision was the pallet changer, which allows the automatic removal and replacement of workpieces. The CWK 1250 has two pallet clamping areas, where two workpieces can be clamped on each pallet. This means that up to four workpieces can be processed in succession in an unmanned operation. As Zatti says, the CWK 1250 enabled “an internal production rate of 100 % in plate production within a year of fully purchasing the equipment.” After eight years, the production capacity of these machines had been exhausted due to the high number of operating hours and the time had come to consider investing in replacements.

So Hofstetter ordered the first of a total of three HEC 1250 machines, each with

three pallet areas. The two additional machines followed. The third machine even enabled enough capacity to produce additional components in-house again, which were previously assigned to suppliers. The three machines stand next to each other in the purpose-built hall. Albert Kuster, Department Manager for mould base plates, is particularly impressed by the tool magazines of the HEC 1250: “Other machines feature chain magazines, which make the moulds difficult to access as you can only unload them from an unloading station. The Starrag Group systems use magazines with four towers each, where each mould is stored in four profiles, one on top of the other on the side. You simply look for the corresponding mould at an operator station, rotate the relevant tower, then open a door and remove the mould.”

The three systems have wear monitoring systems, which measure the required torque of the spindle during cutting and use this to calculate the status of the processing tool. In addition, breakage monitoring is carried out using laser measurement systems for workpiece measurement, so that long unmanned machining operations are also possible.



Hot runner plate: Section of a PET hot runner plate. More than 70 % of the original plate is machined.

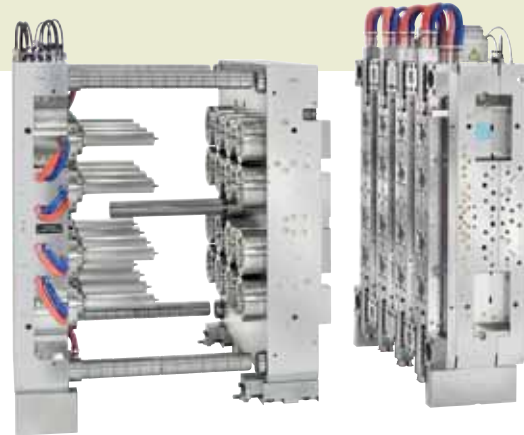


Impressive machines: The hall built by Hofstetter AG with the three Heckert HEC 1250 machining centres.

If a mould ruptures, the machine automatically continues to function with a replacement mould – if possible – or notifies the on-call employee via mobile phone. This means the machining operations, which can last up to 12 hours per workpiece, can be performed very efficiently overnight or at the weekend, without requiring shift work. This is an important factor in a country with high wages such as Switzerland. “We average around 21 hours of running time seven days a week,” Zatti adds. “The remaining three hours are spent on retrofitting and maintenance work. We are extremely happy with this high level of availability offered by the machines.”

“**We were extremely** satisfied with the assembly performed by the employees of the Starrag Group. We were even able to pick the service team and were therefore able to choose the employees we had already been working with for some time. Commissioning took six weeks per machine – an impressive number for such large machining centres. I found it extremely positive that our suggestions and proposed improvements were taken into consideration. So, the second machine incorporated improvements that

16x cartridge mould: A 16x mould for the manufacture of silicon cartridges.



we suggested based on our experiences with the first one – and the first machine was also brought up-to-date when the second system was commissioned!”

“**Our wishes** are heard,” Zatti continues, “and that is a good feeling. The three machines – and the new hall for them – were a major investment for our company. Thanks to the speed with which the machines were commissioned, we were able to start recouping the capital spent on the machines straight away. That is crucial in terms of the return on investment. Our injection moulding tools are used to produce up to one million preforms a day; this is only possible with the most stringent requirements for the mould and its manufacture. It’s not without good reason that we are number two globally when it comes

to PET moulds. We have achieved this position with maximum quality and short delivery times, and the HEC 1250s are a key factor in our success on both counts.”

When it comes to the collaboration with the manufacturer, Zatti’s response is purely positive: “The product is right, the price is right, the service is right – this has been confirmed time and again with seven machines from the Starrag Group over the course of many years. Our relationship with our suppliers is a partnership, not a typical supplier relationship, and that has always worked perfectly with the Starrag Group – especially in times when we have disagreed on things. If you want to move mountains, you need a reliable partner – and we have found this in the Starrag Group!” ▀

“How many μm can there be?”

High-precision kit for horizontal machining centres

The tuning kits for the automotive industry transform expensive luxury cars into even faster, more comfortable and nicer-looking one-offs. The Starrag Group high-precision kit prioritises the highest level of accuracy over speed, comfort and appearance. A highlight is the “solid rock” option: The optional granite bed made of natural stone provides a high level of long-term stability.



Dr Marcus Otto: “We are outstripping the competition with the solid rock machines and their unique temperature and vibration stability.”

“**The high-precision** kit is particularly suitable for our medium and large horizontal machining centres with their large traversing paths”, explains Dr Marcus Otto, Head of the Business Unit Transportation & Industrial Components. “Therefore, a special focus on accuracy was required here. We differentiate ourselves from the competition with our special machine bed (HEC 1000-1800 Athletic) and the tempered machine stand.”

The Chemnitz-based company was especially meticulous when searching for the ideal material for the machine bed: As the world’s foremost manufacturer of horizontal machining centres, they eventually decided on granite, which has

reliable long-term behaviour because of the material-related absence of internal stress and signs of corrosion. But the solution was not just any old granite. The Starrag Group found a supplier for the monolithic machine beds, which use natural stone with a very homogeneous structure, good damping characteristics and a very low tendency to absorb water. Last but not least, this natural stone is also used by leading manufacturers of measuring machines.

At comparable static rigidity, the thermal transfer is halved when compared to conventional steel, cast or mineral cast constructions. The material-related high heat capacity makes the machine beds

particularly resistant to short-term temperature fluctuations without additional control measures. These characteristics lead to a thermal stability of the machine beds that has not previously been achieved.

A temperature control system of the machine stand keeps all structural components at a constant temperature level and prevents temperature-related displacements. The efficiency of this temperature stabilisation was doubled by the patented insulation. This screens the machine stands from ambient temperatures and internal heat sources. Dr Otto: “Because neither the bed nor the stand move, the accuracy is



XXL machining with μm precision:

The high-precision kit with the bed made of natural granite is especially suitable for medium-sized and large horizontal machining centres with their large traversing paths.

increased enormously." This means that the customer can use the unique position accuracy of the Starrag Group machining centres without complex air conditioning in its production halls.

The user can quickly compensate for the price premium for the high-precision kit as the Chemnitz innovation generally makes air conditioning in halls superfluous: However, anyone who already has air-conditioned halls may not need the granite bed. "We are not selling granite or temperature benefits, but customer benefits," says the Head of Site. The user receives three benefits: The high-precision kit increases profitability thanks to a constantly

- More profitability thanks to process-stable production
- More production security through high long-term stability and low maintenance requirements

stable production process (even with changing ambient conditions) and increases safety (low maintenance costs through high long-term stability and low-wear ball screw). It also enables the user to produce high-precision workpieces in the micrometre range,

acquire new customers and industries and thus grow. Dr Marcus Otto is therefore sure "that we are positioning ourselves excellently in the international market with the solid rock machines and their unique temperature and vibration stability." ▀

Bumotec:

Instrumental in developing cutting-edge medical technologies



> Interview with SMTP Technology Co., Ltd > Gao Feng, Production Manager, Sun Yuting, Workshop Chief

SMTP Technology employs more than 50 staff and specializes in ultrasonic technology for medical equipments used in orthopedics surgery. As a customer of BUMOTEC, in this interview, the company shares its experience. We met with Gao Feng, Production Manager, and Sun Yuting, Workshop Chief, in their Zhangjiagang offices, in the Province of Jiangsu. SMTP Technology began operating in the medical industry in China in 2011. This young, dynamic company develops and manufactures the most advanced equipment with the cutting-edge technologies which are in high demand in the surgical sectors.

What is SMTP Technology's core business?

SMTP: We develop and sell the "XD Series" ultrasonic therapeutic equipment used in orthopedics surgery, neurosurgery and joint surgery, and we produce a comprehensive range of precision cutting tips specially designed for the XD series products.

As Mr. Gao explained, the ultrasonic equipment developed by SMTP is recognized by its users (mainly surgeons) as an ultra-powerful, safe, efficient and highly accurate equipment. This has enabled SMTP to compete with and beat those large international companies offering similar products.

The XD series product is designed as a power tool through ultrasonic vibrations to cut bones during surgical operations.

Such kind of ultrasonic-powered tool represents the 3rd generation of surgical tool for bone cutting. The 1st generation tools are hammers and rongeurs, while the 2nd generation tool is a high-speed drill, which damages soft tissues around. This 3rd generation-XD series products only cut hard tissues, with no risk of damage on soft tissues around, such as vessels and spinal cord. That's why the XD series product is the first choice of many surgeons for very delicate procedures such as operations on the spinal column and skull base.

How do you achieve the ultra-precision for which you are so renowned in the field?

SMTP: Besides the sophisticated and precise algorithms of our products and amongst other aspects, we highly focus

on developing the high quality and precision cutting tips, which have direct contact with patients during operations. We always believe in the high level precision of our cutting tips guarantees outstanding performance of our products. Therefore we very carefully select the machining tool for tips manufacture.

We selected a Bumotec s191H machining centre to produce our cutting tips, the s191H in FTLR configuration with 65 mm bar capacity, combined with a HP 3 for high pressure plus a bar feeder. It has simplified the development process as the tips are produced after a single setup, and the cycle of production is accelerated largely. Therefore, thanks to the Bumotec s191H machining tool, we are able to develop or optimize one tip model within a week on average.

What is your current customer base?

SMTP: We have already covered more than 150 top hospitals around China, and the demands for our XD series products are growing rapidly as our advanced technology and outstanding quality of cutting tips become increasingly well-known. We are based in China and viewing the world, as we are preparing to export our product overseas to enter the international market this year.

The exceptional precision of our tools increases the success rate for delicate surgical operations.



The Bumotec s191H machining centre enables 1 tool to be developed each week.

Why did you choose a Bumotec machine for your development work?

SMTP: We always focus on the quality of our product, and Bumotec is very famous for its superior performance in parts machining. Ever since the start up of SMTP Technology, our chief engineer has known of the Bumotec brand and its products for many years. We made contact with Bumotec at the China International Machine Tool (CIMT) show in 2015, when we were in need of a complete machining centre to produce complex and precise tips. We saw the machining demonstration at Starrag Group stand which was very impressive, and then we visited a rival supplier and made our decision: we decided like to purchase a Bumotec s191H FTLR machine, as we were convinced that the machine's rigidity would deliver the greatest precision in the long term.



Since we received the Switzerland made machine at the end of 2015, it has been used for many cutting tips development, and also for small production runs. Since the operator training is clear and straightforward, the team changeover operations are simple and seamless. The machining centre has been operating perfectly non-stop every day since, manned by two operators working in shifts each day to allow it to run from 6:00 to 23:00.

Which procedures do you use most often on the machining centre to produce your parts?

SMTP: We mainly use the turning/milling functions and the 5-axis simultaneous machining function; we also use other functions including tapping, drilling and deep-hole drilling in particular with the high-pressure unit; this enables us to drill up to 120 mm deep into the material, achieving exceptional consistency when drilling holes with very tiny diameters.

Can you give us a concrete example of a part manufactured on the s191H?

SMTP: Since the s191H enables us to develop a tip model within a week, and produce lots of cutting tips, as you can imagine, there are many many examples. One typical example, one particular

helical cutting tip is made of titanium, from an 8-mm bar, with the finished tip measuring 2 mm on its smallest end. The toothed part of the tip is produced using the 5-axis simultaneous machining function. The complexity of machining such tip lies in the precision required and in observing the permitted margin of tolerance of 10 µm when producing these teeth. They must all be of the same height and the same circumference in order to be effective. The tip end is composed of 8 helical teeth and the distance between these teeth must be strictly the same as designed. There must be no burrs inside the channel separating each tooth either.

The performance for our XD series products also relies on the production quality of the tip teeth. If these teeth do not comply with the specifications, the ultrasonic energy will be disrupted and the balance can no longer be maintained. This may result in a loss of control, even tip breakage during operations. Using the Bumotec machining centre to produce a perfect helical tip head in approximately 40 minutes, enables us to meet the market demand efficiently and remain at the cutting-edge of surgical instrument technology. ▀

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