

Unmachined parts go in, finished parts come out

Starrag FMS enables fully automated turbine blade production

Sights on a world record

Burckhardt Compression: Four large machining centres in twelve years

Increased capacity without increased space

GEA Refrigeration Germany: Pressure to modernise machining – Over 40 % savings

Luxury Goods

The luxury goods segment is a field of application where Starrag is very present



In a modular design for optimum profitability

Starrag IPS-Modules increase productivity

Content



12

Interview with Daniel Ramm, Head of the Starrag Training Centre in Rorschacherberg, Switzerland

06

Starrag and Walter AG:
Turbine Technology Days 2017



28

Increased capacity without increased space –
GEA Refrigeration
Germany

05 Editorial

By Walter Börsch

CURRENT NEWS

06 Starrag and Walter AG: Turbine Technology Days 2017

Experience increases in productivity: Starrag and Walter share inspiration on efficient turbine production

09 "Industrie 4.0" and the Starrag Integrated Production System (IPS)

The internally developed IPS from Starrag offers customers a modular system of solutions tailored to their needs within the context of "Industrie 4.0"

CUSTOMER SERVICE

12 "Training precisely what you value"

Interview with Daniel Ramm, Head of the Starrag Training Centre in Rorschacherberg, Switzerland

AEROSPACE

15 Unmachined parts go in, finished parts come out

Starrag FMS enables fully automated turbine blade production

LEGAL NOTICE

Star – The Starrag magazine

Publisher:

Starrag Group Holding AG
Seebleichstrasse 61
9404 Rorschacherberg
Switzerland

Tel.: +41 71 858 81 11

Fax: +41 71 858 81 22

E-Mail: info@starrag.com

Managing Directors:

Walter Börsch (CEO)
Gerold Brüttsch (CFO)

Editorial staff:

Eva Hülser, Sabine Kerstan,
Christian Queens, Angela Richter,
Michael Schedler, Ralf Schneider,
Stéphane Violante

Picture credits:

© Photographs and illustrations:
Starrag 2017
© Page 19–22, Ralf Baumgarten

Design:

Gastdesign.de

Printing:

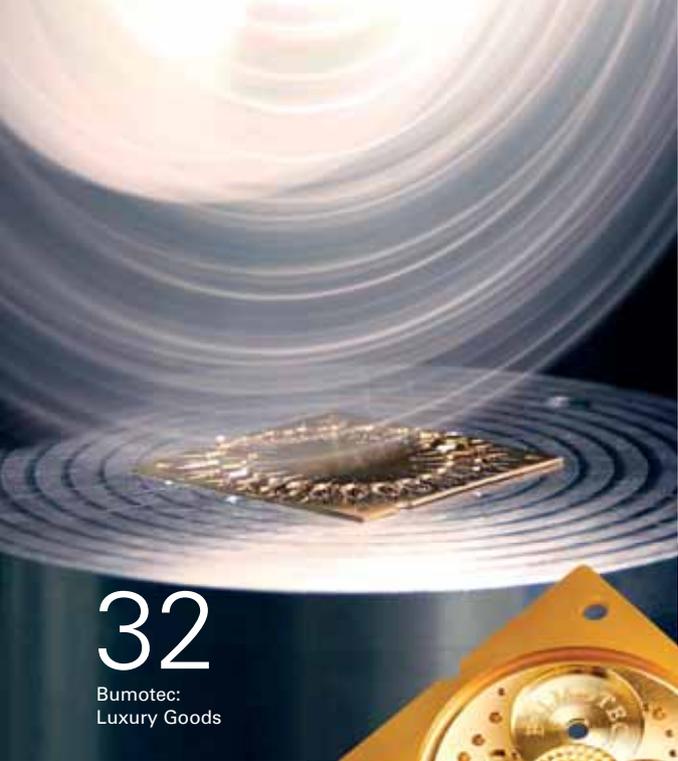
Druckhaus Süd, Cologne

Reprinting:

All rights reserved. Contents may not be copied without written confirmation.

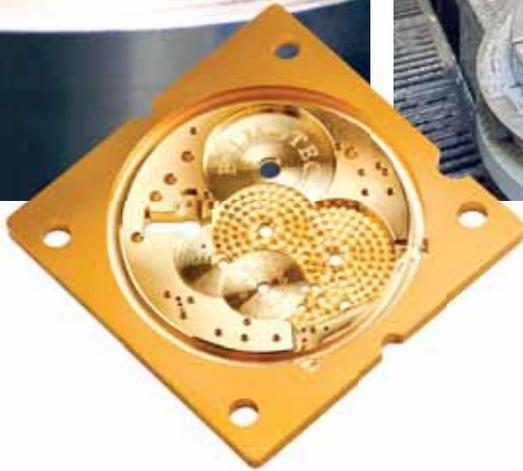
Star – the Starrag magazine appears in German, (official Swiss spelling rules), English and French. Despite careful editing, no guarantee can be made. Star appears biannually.

www.starrag.com



32

Bumotec:
Luxury Goods



19

Sights on a
world record



ENERGY

19 Sights on a world record

Burckhardt Compression: Four large machining centres in twelve years

TRANSPORTATION

23 In a modular design for optimum profitability

"Industrie 4.0" modules increase productivity

INDUSTRIAL

28 Increased capacity without increased space

GEA Refrigeration Germany: Pressure to modernise machining – Over 40 % savings

32 Luxury Goods

The luxury goods segment is a field of application where Starrag is very present

starrag

Engineering precisely what you value

“Industrie 4.0” –
Long since a reality at Starrag!

Cell
Controller



Machine
Qualification System



HMI



Machine
Protection System



IPS Integrated
Production
System

Efficiency
Control



Process
Quality Control



You can talk about “Industrie 4.0” – or go ahead and implement it. This is what we have already been doing for many years at Starrag! At this year’s EMO we will show you specific solutions for networking and automating manufacturing processes with our “Integrated Production System” (IPS).


EMO
Hannover
18-23.9.2017

We look forward to your visit.

Hall 12, Stand B60



Walter Börsch
CEO of the Starrag Group

Dear reader,

Whenever I visit Starrag customers, I hear the same thing again and again: they all use our machines, such as our HEC 400, FOGS or s191 Linear. When talking to plant managers, maintenance engineers and operators alike, they are all proud of our good, solid “made by Starrag” production technology that they use to produce things like minute implants, gigantic aircraft components and heavy tools.

All of these machines are assigned to a product range: the HEC 400 is produced in the Heckert product range, the FOGS in the Droop+Rein product range and the s191 in the Bumotec product range. This underlines the competence of the individual Starrag sites and is also reflected in our communication with you: on your machines, on our website and on our business cards.

This marketing strategy fits perfectly with our motto “Engineering precisely what you value” – a statement that also aligns with our new orientation to customer groups. Starrag has divided the four industries that we supply into a total of 11 market segments:

Aerospace:

Aero Engines – Aero Structures – Avionics

Energy:

Oil & Gas – Power Turbines – Renewables

Transportation:

Heavy Duty Vehicles & Engines – On-Road Vehicles

Industrial:

Industrial Components – Luxury Goods – Med Tech

However, that was not enough for us, as our motto is that we always provide the customer with precisely what they need and what is important to them: nothing more and nothing less. So, we have divided all 11 market segments into application groups, which we are offering as new, special Starrag solutions. For example, the Aero Structures market segment is organised into the application groups of aluminium, titanium and landing gear.

This reorientation has been carried out as part of our new single-brand strategy. Starrag will only be using the “Starrag” brand in external communication and is gradually renaming all companies involved in production within the Group as “Starrag”. To use a single brand is appropriate and consistent, because we are linked through the same brand values – regardless of location or product range: expert, focused, dynamic and working together successfully.

Find out what this reorientation means for you at one of our Starrag sites around the world. Alternatively, why not visit us at EMO Hannover (Hall 12, Stand B60) from 18 to 23 September – we are looking forward to seeing you there. Among other things, we will be presenting our very special solutions for “Industrie 4.0”, which are available for all four of the industries that we supply. More information on our style of digital transformation and other new Starrag solutions can be found in the “Star” stories in the latest issue of our customer magazine.

I look forward to receiving your feedback, in person or otherwise

Sincerely, Walter Börsch



Starrag and Walter AG: **Turbine Technology Days 2017**





Experience increases in productivity: Starrag and Walter share inspiration on efficient turbine production



The number of people attending the Turbine Technology Days continues to grow. On 27 and 28 June, over 200 industry professionals from 19 countries came to the trade meeting in Switzerland.

Starrag and Walter – who have already teamed up successfully three times – held their fifth “Turbine Technology Days” event; the trade meeting for turbine production. Over 200 visitors from 19 countries travelled to Starrag headquarters in Rorschacherberg by Lake Constance to pick up tips on managing turbine production in an even more efficient and reliable manner. After all, the aviation industry is booming and demand for gas turbines is growing in the power generation sector.

That means OEMs and suppliers need to balance increasing their production volumes with meeting more stringent quality criteria. At the same time, globalisation is making the competitive environment more difficult.

For Starrag and Walter, the aerospace and energy industries are strategic fields of business, where they work in close partnership with their customers to develop application-specific solutions. For Starrag CEO Walter Börsch, this application-based approach is the key to the increases in productivity that improve competitiveness: “We possess excellent process expertise covering machinery, tool and fixture technology



as well as software and automation. In line with our motto ‘Engineering precisely what you value’, this enables us to offer not only Starrag machines, but also complete production systems that are tailored to the customer’s needs and provide maximum benefit”

Walter AG is also adjusting to future requirements. Walter offers customers a complete process, from the tool to the machining strategy. Mirko Merlo, CEO of Walter AG, stresses the importance of digitalisation: “Digital solutions are the future of modern machining, which is no longer simply about turning, cutting, drilling and threading. Perfection and precision are the fundamental requirements”



Efficiency of
jet engine
component
production
increased
by 42 %



The TurbineTechnology Days event is focussed on applications in the field of turbine production. Participants can visit 14 activity stations with real-world relevance to pick up tips on how they can improve profitability and reliability and thus generate growth.

Walter showcased solutions that go far beyond tools, with customised and efficient processes as their essential prerequisites. Walter used the example of smart glasses to give visitors a live insight into digital networking and “Industrie 4.0” at the event.

Keynote speaker HyunSoo Yoon, Director of Engineering Division, Aerospace & Defense Group at the South Korean company Hanwha Techwin, spoke about how successful automation can be in the context of innovative production systems. In partnership with Starrag, he has increased efficiency in

the production of jet engine components by 42 % by using flexible production systems and robotic automation. He believes that the new technological opportunities must be studied continuously and implemented in practice.

The Turbine Technology Days offered plenty of inspiration in this regard. Together, Starrag and Walter created 14 stations demonstrating practical ways to increase productivity. One striking example is a blisk machining process using new barrel-shaped and torus milling cutters, which reduce costs by up to 60 % compared with conventional

approaches. In addition to the machining examples, Starrag and Walter highlighted the wide range of potential improvements that can be made through digitalisation and state-of-the-art software.

The event was supported by the nine specialist partners whose products – from coolant, testing and measurement technology to tool systems and software solutions – play a significant role in the process chain. On an optional third day, Walter opened the doors of its headquarters and new technology centre in Tübingen to visitors who wanted a deeper insight into the future of machining. ▾

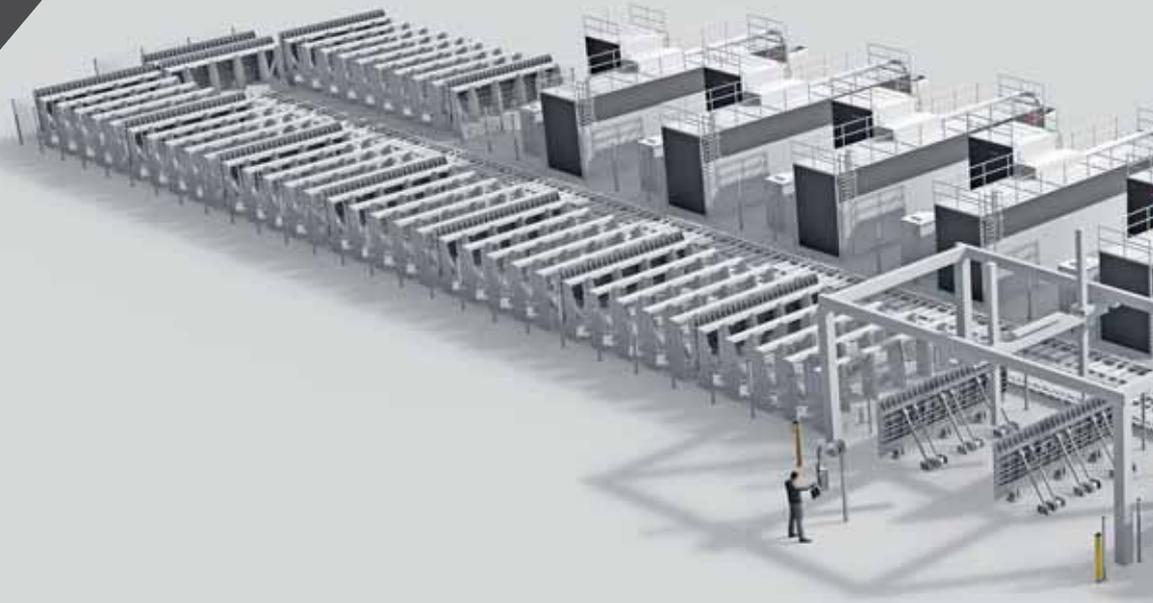


On linked large machines, sheet metal forming tools can be completely machined in one clamping operation. The result is a 31 % reduction in processing time.

IPS Integrated
Production
System

“Industrie 4.0” and the Starrag Integrated Production System (IPS)

The internally developed IPS from Starrag offers customers a modular system of solutions tailored to their needs within the context of “Industrie 4.0”



IPS

Integrated
Production
System

“The unique selling point and basis for reliable production planning is the cell controller technology that Starrag has developed in house, and that is used to control manufacturing systems and lines with maximum process reliability.”

Customers receive networked manufacturing solutions that are completely tailored to their needs using customer-specific modular systems, living up to the claim “Engineering precisely what you value”. The impressive results include increased profitability, improved safety and higher growth.

But what exactly does “Industrie 4.0” mean? We have moved through “Industrie 1.0” (mechanisation), 2.0 (mass production) and 3.0 (automation), and we are now on our way to “Industrie 4.0”. This new stage of development will shape the future of industry like never before. Ultimately, it is about forming

an integral link throughout the entire value chain, from developing initial ideas right up to final recycling, including the customer services that are connected to each stage of this process.

By developing IPS, Starrag has made a crucial contribution towards achieving this aim. It allows customers to gradually automate their production processes so that they can ultimately take full advantage of all the options provided by the system. This begins with individual machines with add-on functions and moves on to flexible manufacturing systems (FMS) and even entire production lines. At each

stage of expansion, modules are available that are adapted for the respective specialised task.

The unique selling point and basis for reliable production planning is the cell controller technology that Starrag has developed in house, and that is used to control manufacturing systems and lines with maximum process reliability. The cell controller monitors all the processes, thus ensuring digital transparency. It manages all the information relating to the production system centrally and passes this on, if necessary, to higher-level data processing systems via standard interfaces.

Maximum cutting performance when processing high-strength aircraft-grade aluminium – the linked ECOSPEED F provide a significant increase in productivity.



If a customer operates at the final stage of expansion, all they need to do is feed the parts for processing into a material accumulator. The rest happens fully automatically: from loading and storing the raw material, to various machining steps and, finally, to unloading the finished workpieces. All the data and resources are managed by the cell controller, which receives the orders directly from the end customer's ERP (Enterprise Resource Planning) system.

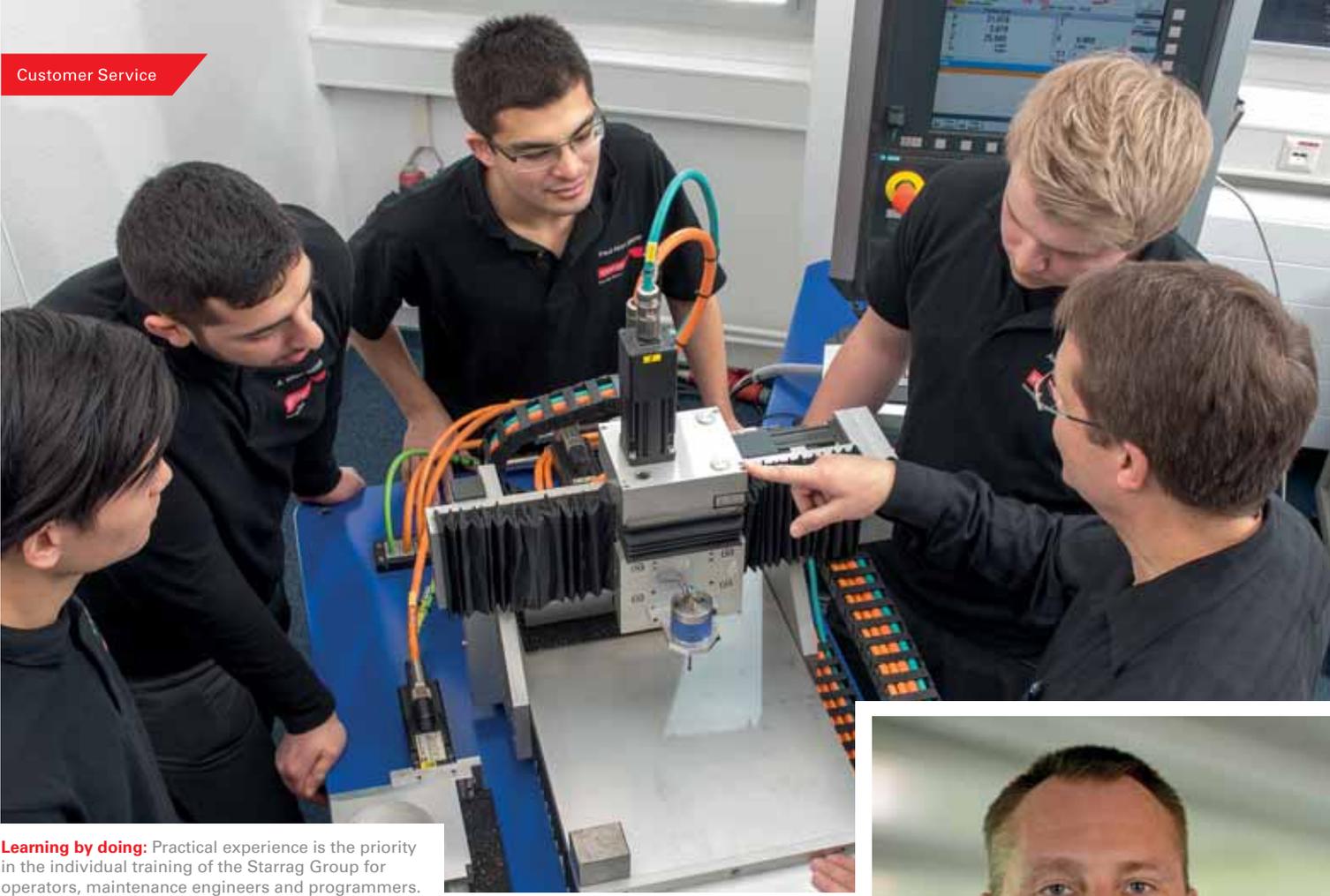
Communication between the individual components provides invaluable benefits. For example, it can safeguard production reliability by monitoring the

condition of machines, greatly reducing costs relating to maintenance and downtime. It also provides an opportunity to monitor and control energy requirements and consumption throughout the manufacturing process, optimising energy management. By better utilising their capacities and controlling production, companies can greatly increase their profitability or generate growth.

The components in the Starrag IPS system also address issues like mobility by making information available on mobile end devices or state-of-the-art human-machine interfaces such as "smart operation". Humans play a central role when

it comes to "Industrie 4.0". They are, after all, the ones who ultimately monitor and take over responsibility for the production.

The "Integrated Production System" is a crucial contribution towards achieving the aim of digitalisation, as it provides a platform for meeting the upcoming challenges. It offers support for users and operators of Starrag production systems and machines as they carry out the complex task of using data in a way that adds value in a networked world of production. Starrag IPS allows customers to gradually automate their production process so that they can ultimately take full advantage of all the options provided. ▀



Learning by doing: Practical experience is the priority in the individual training of the Starrag Group for operators, maintenance engineers and programmers.

“Training precisely what you value”

Interview with Daniel Ramm, Head of the Starrag Training Centre in Rorschacherberg, Switzerland



“We build on ‘learning nuggets’ to develop the respective individual training.” Daniel Ramm, Head of the Starrag Training Centre in Rorschacherberg

How do you train newly hired employees in Asia, with no previous specialist knowledge, working in a new plant in the aviation industry, in a short period of time to operate, maintain and program a high-end machining centre? We discuss this challenge and the key focus areas of his day-to-day work with Daniel Ramm, Head of the Starrag Training Centre in Rorschacherberg and Chemnitz.

Mr Ramm, what is the professional background of somebody who heads up the Starrag Training Centre?

Ramm: I am a qualified electrical engineer and I spent a long time working in the Starrag plant in Chemnitz, Germany, as a field service technician. One day, I took over the training of

Asian customers; nobody else wanted to do it but I was intrigued. So, I became a technical trainer and, over a period of ten years, slowly built up the Training Centre in Chemnitz. I have been leading the Training Centre in Rorschacherberg since 2013. It also coordinates the work of colleagues in the plants and regions across the whole of the Starrag Group.

You are a technician by nature, so how do you manage the educational side?

Ramm: To a certain extent, I taught myself the theory of education and the methodology, but I’m now gaining more fundamental expertise at the University of St.Gallen, where I have been studying education management for industry and business for two years now.

“Our goal is to be able to deliver standard training in the language of the respective country, without needing interpreters.”



Who do you have in your team?

Ramm: There are training administrators, training engineers and technical trainers, who also work as field service technicians. That means their knowledge and skills are always up to date. We want to keep expanding the number of technical trainers we have. Starrag is also developing trainers in regions where languages spoken on-site include Russian or Chinese. Our goal is to be able to deliver standard training in the language of the respective country, without needing interpreters.

What services do you offer?

Ramm: In the first instance, we train the employees when a customer acquires a production plant. This almost always focuses on the key areas of operation, programming and maintenance. This is done partly at the customer's premises and partly in the manufacturer's plant for the machine. However, the Training Centre also sells its training; for subsequent training of new employees, for example, or to share new expertise in fields such as programming and maintenance. Most customers prefer individual training for their employees, which they pay for based on the time required. We discuss their training concept with them in detail, so that the training focuses on their specific needs.

Not just for show: In the long term, the showrooms will also offer alternatives to training for customers where production operations would otherwise be interrupted or at least slowed down.

This is in keeping with the Starrag slogan “Engineering precisely what you value”.

Ramm: Exactly. For us, it could also read: “Training precisely what you value.” This is reflected in our sales pitch, where we present our tried-and-tested standardised training blocks. We build on these “learning nuggets” to develop the respective individual training.

But how do you handle smaller customers who cannot afford the individual training for individual employees or small groups?

Ramm: We offer them the more cost-effective group training together with employees of other companies. Participants benefit from a broader view – i.e. the exchange of expertise with colleagues from other companies and industries. They are also in the perfect environment for networking.

But you also train the in-house service team of the Starrag Group?

Ramm: The second most important task of the Training Centre is training the 300 active employees of the Customer Service business unit worldwide. We have designed an internal, modular training program for this purpose. However, we also offer some of the modules from this program to valued customers on request, so that they can learn about service with all our “tips and tricks”. Part of the training takes place during the assembly work in which these components are produced. A typical example is the proper alignment of a tool changer in accordance with the manufacturer's specifications.

But we can't all follow your example and study education management alongside our work, so who teaches your technical trainers?



Without interpreters: Starrag training is not only available in German and English, but can also be customised and delivered in many different languages.

“In the long term, I am focusing on blending learning; combining traditional training with e-learning.”

Ramm: These employees represent Starrag in a particularly important way, because they work closely with the customer and are responsible for the success of the training. They receive very intensive training from an external professional, who shows them in a methodical and theoretical way how to convey technical subjects in the classroom and, crucially, at the machine itself. The training engineers then present our training concepts in detail, diligently coaching the technical trainers using personalised and intensive methods over a longer period of time. Putting together the training contents and managing the translation stage is handled by our training administrators, who always make sure the documents are ready on time. We are all very proud of our well-established team.

Electronic media is increasingly replacing printed manuals and tutorials. What is your strategy?

Ramm: In the long term, I am focusing on “blending learning”; combining traditional training with e-learning. We have already used a document management system to make all the training documents available in electronic form. But another thing that is very important to me is that we are currently working hard with professional translators to create

printed and electronic documentation in the respective customer language.

Is there a recent highlight that was particularly challenging for you?

Ramm: One of our high points was definitely a custom-designed training course lasting several weeks for an aviation company in Malaysia, working on a large STC 10800/170 jet engine housing. Our high-end product is being used in a completely new plant, where newly hired Malaysian specialists are starting to work on the six-axis machining centre, manufacturing complex housings. We have put the 12 employees through an individual program over several weeks, covering operation, maintenance and programming. All in all, the training lasted around two months, with interruptions.

Do you also receive enquiries about current issues, such as “predictive maintenance”?

Ramm: Yes, our training content is already oriented in this direction with “condition-based monitoring” and “fingerprint”, which we deliver within the scope of our training for maintenance engineers and operators. Fingerprint, for example,

is a report on the status of important machine components that an employee can start with a few simple commands on the controller. First, the evaluation is performed in an initial assessment by the technician on-site and then in a detailed analysis by in-house Starrag specialists, taking into consideration the reference measurement created on delivery.

Who is responsible for which training within the Starrag Group?

Ramm: The Chemnitz Training Centre uses training machines to deliver training in programming, operating and maintaining HEC machines with Siemens and Fanuc controls. Fully equipped simulators are available for use in the Training Centre in Mönchengladbach, Germany. The innovative “Advanced Maintenance Training” and “Advanced Application Training” sessions were also developed there. We are currently developing similar learning environments in Rorschacherberg – individually also in Vuadens and St. Etienne. As an alternative to training directly with the customer, our long-term plan is to offer training with a local trainer in our own showrooms – in China and the United States, for example. ▀

Unmachined parts go in – finished parts come out

The latest flexible manufacturing system (FMS) designed and created by Starrag Group is heading to China. A company active in the Chinese aviation industry annually machines 35,000 Inconel or titanium-forged turbine blades right through to completion via a fully automated process. The operator simply inserts the unmachined parts into the magazine and then removes the ready-to-install blades at the other end.

Starrag FMS enables fully automated turbine blade production

The latest flexible manufacturing system (FMS) designed and created by Starrag Group is heading to China. A company active in the Chinese aviation industry annually machines 35,000 Inconel or titanium-forged turbine blades right through to completion via a fully automated process. The operator simply inserts the unmachined parts into the magazine and then removes the ready-to-install blades at the other end.

Flexible manufacturing systems are becoming a global trend. The aviation and energy industries in particular capitalize on the qualitative and economic benefits offered by automated series production. Starrag is a premium supplier for these highly demanding systems and has been designing and supplying FMSs for manufacturing turbine parts and structural components for aircraft for over twenty years.

Around 60 automated multi-machine systems have been created during this time, allowing the company to accumulate a wealth of technological experience.

Dr Markus Ess, Head of Development at the Starrag site in Rorschacherberg explains: "In addition to our core competences in the fields of machine tools, tools, fixtures and the CAM system, we have an extensive amount of expertise in turn-key projects. In the FMS, we are supplementing our machining technology with automation components and all other necessary components so that we can provide the customer with a complete, reliable production system."

The benchmarks set by the latest plant are higher than ever before. The FMS ordered by this Chinese aviation company must be able to process 35,000 turbine

blades via automated processes each year. This total volume comprises four different blade types in sizes ranging from 80 mm to 200 mm. These blades are known as "variable guide vanes" and they are positioned in the vertical part of the turbine so that they can be adjusted to allow the flow or thrust to be modified as needed. As the actual batch sizes for the four types equal around 200 parts, the FMS must ensure a high level of precision and the corresponding throughput while also exhibiting a high degree of flexibility.

A demanding production process

Blade production was previously carried out without major automation across various individual machines and turbine blades were still polished by hand as a final stage. This is why the customer had a clear idea of what they wanted



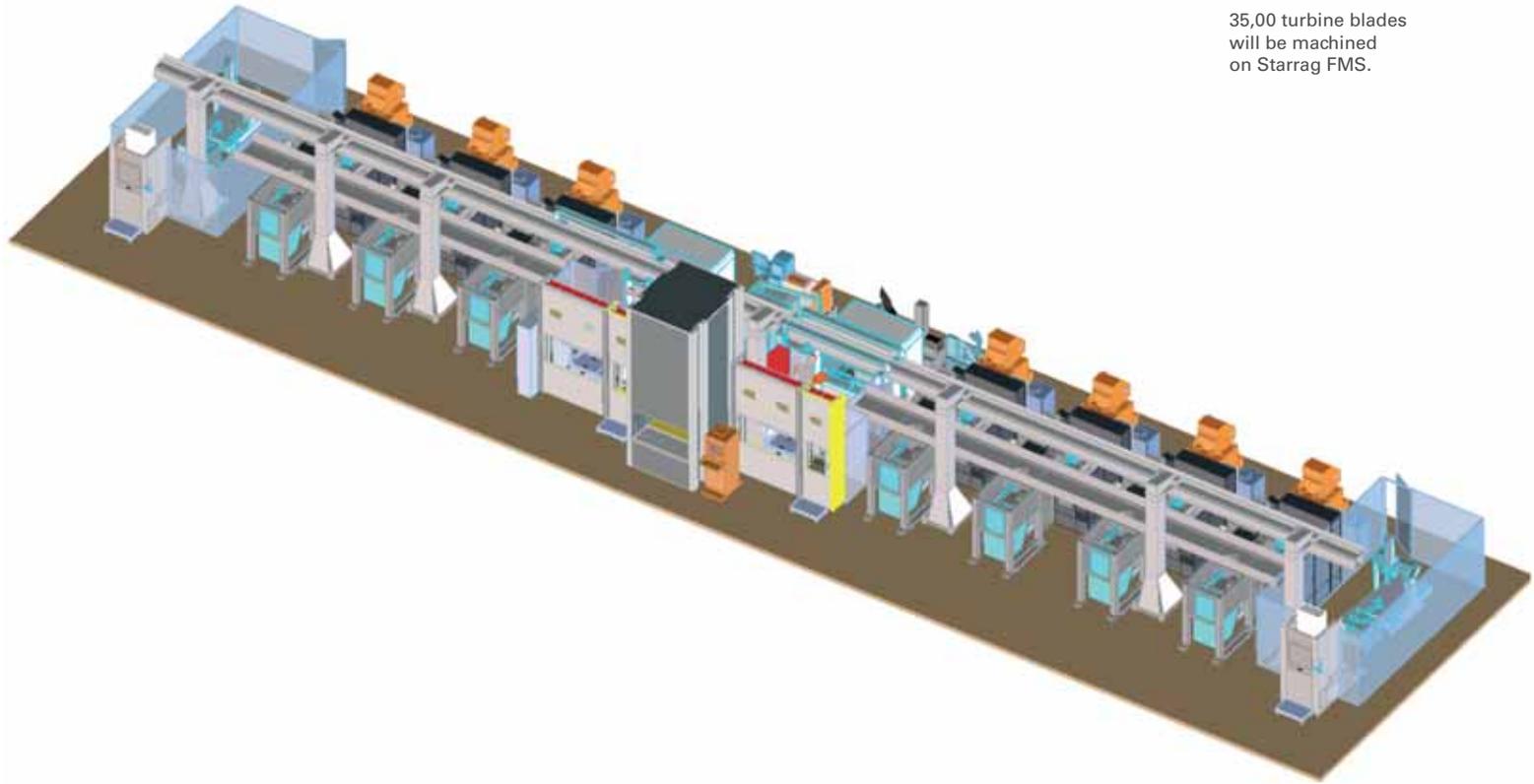
The development particularly focuses on automation.

“Designing the overall process was a major challenge.”



Markus Ess, Head of Engineering Rorschacherberg: “We have an extensive amount of expertise in turn-key projects”.

35,00 turbine blades
will be machined
on Starrag FMS.



35,000

The FMS ordered by this Chinese aviation company must be able to process 35,000 turbine blades via automated processes each year.

from the new Starrag FMS and of the added advantages they wanted to benefit from: The process had to be streamlined through modern production technology, with maximum process reliability and a higher level of quality in the final product. Particular emphasis was placed on automating the system to prevent any errors arising from manual operation.

“To some extent, the FMS should be a black box system in which the operator only loads a magazine with unmachined parts at the start of the process and then removes the ready-to-install turbine blades at the end,” explains Markus Ess. “Designing the overall process was a major challenge. Which sequence of operations is useful? How should handling be performed?”

For example, to prevent the operating company from having to shut down the entire plant when carrying out maintenance work, the development team led by Markus Ess arranged the system into two almost identical, redundant

sections. Each section contains a setup area, a handling robot mounted on a 20-meter-long gantry, a washing system, a polishing robot, a coordinate measuring device and a labelling system. The main task of machining the product is completed by a total of seven Starrag LX 021 machining centres, four of which are assigned to one side while the other three are assigned to the other side.

A robot is responsible for the entire handling process

A material repository that the plant operator loads with unmachined parts serves as the interface for the automated cell to a certain extent. It is from this repository that the gantry robot picks up a forging blank, clamps it in the first fixture and transports it to the machining centre.

The first stage in the machining centre is a measurement process, during which the intended geometry of the finished part is measured against the blade blank. This process takes place in the machining centre itself. This first operation also includes milling the clamping point for the second setup. The robot then clamps the component in another fixture that transports it back to the machine. In doing so, the component is loaded into a pallet system that also acts as a compact means of intermediate storage, thus decoupling the transport mechanism from the machining process.

Starrag centres take over complete hybrid machining

The next step is the machining of blanks forged from Inconel or titanium.



4,000^{rpm}

Production safety for the customer can be achieved by fully automated machining of different blade types (80–200 mm).

In addition to the turbine blades undergoing a five-axis milling process, two shaft attachments must be rotated to allow the blade to be adjusted during subsequent use. “Our LX 021, a machining centre designed to work on small components – primarily for aircraft engine blades – is well-suited to this complete hybrid machining process,” says Markus Ess.

Starrag developed the LX series specifically with the highly precise, efficient, simultaneous five-axis machining of turbine blades in mind. The smallest version is the LX 021 – “As the first blade machine, the rotation speed of this system is really something,” emphasises the Head of Development. “To make this happen, the LX 021 is equipped with a rapidly rotating circular axis, which reaches speeds of up to 4,000 rpm. This is essential for the complete machining of small blades with shaft attachments of approximately 10 mm.” As far as the milling process is concerned, the LX 021 provides the high level of precision required on the free-formed turbine blade, thanks not only to the high-quality machines, but also the skill of the

machining process: The RCS CAM software developed by Starrag is used to generate the milling programs, while the company’s solid carbide milling tools ensure optimum cutting performance.

Based on the annual quantity of parts to be produced, the Starrag developers calculated that seven of the LX 021 machining centres would need to be integrated into the FMS. All seven of the machining centres have the same features and can perform the same tasks.

High-quality components complement the automated production cell

After machining, the gantry robot transports the components to the washing station. Once all coolant residue has been removed from the components, they undergo a polishing process. A robot programmed especially for this task ensures that the stringent surface requirements are met. The final check is then carried out in a 3D coordinate measuring cell, where all features specified by the customer are checked. Next, the turbine blade is labelled with a unique identification number so that each production step

can be traced at a later stage. Finally, the gantry robot takes the completely manufactured component from the final fixture and places it back in the material repository, where the operator can then remove the finished part.

The entire plant is controlled by a cell controller with a PPC system. All of the system’s necessary functions and strategies were defined by the development team led by Markus Ess. The Head of Development points out that it is not just the cell that is included in the order – Starrag Group is also responsible for coupled auxiliary processes, such as setting up the tools. “We supply suitable equipment for shrinking and measuring and ensure that data is transferred reliably to the FMS, thus ensuring that the machining centre controls are always provided with the correct tool geometries.”

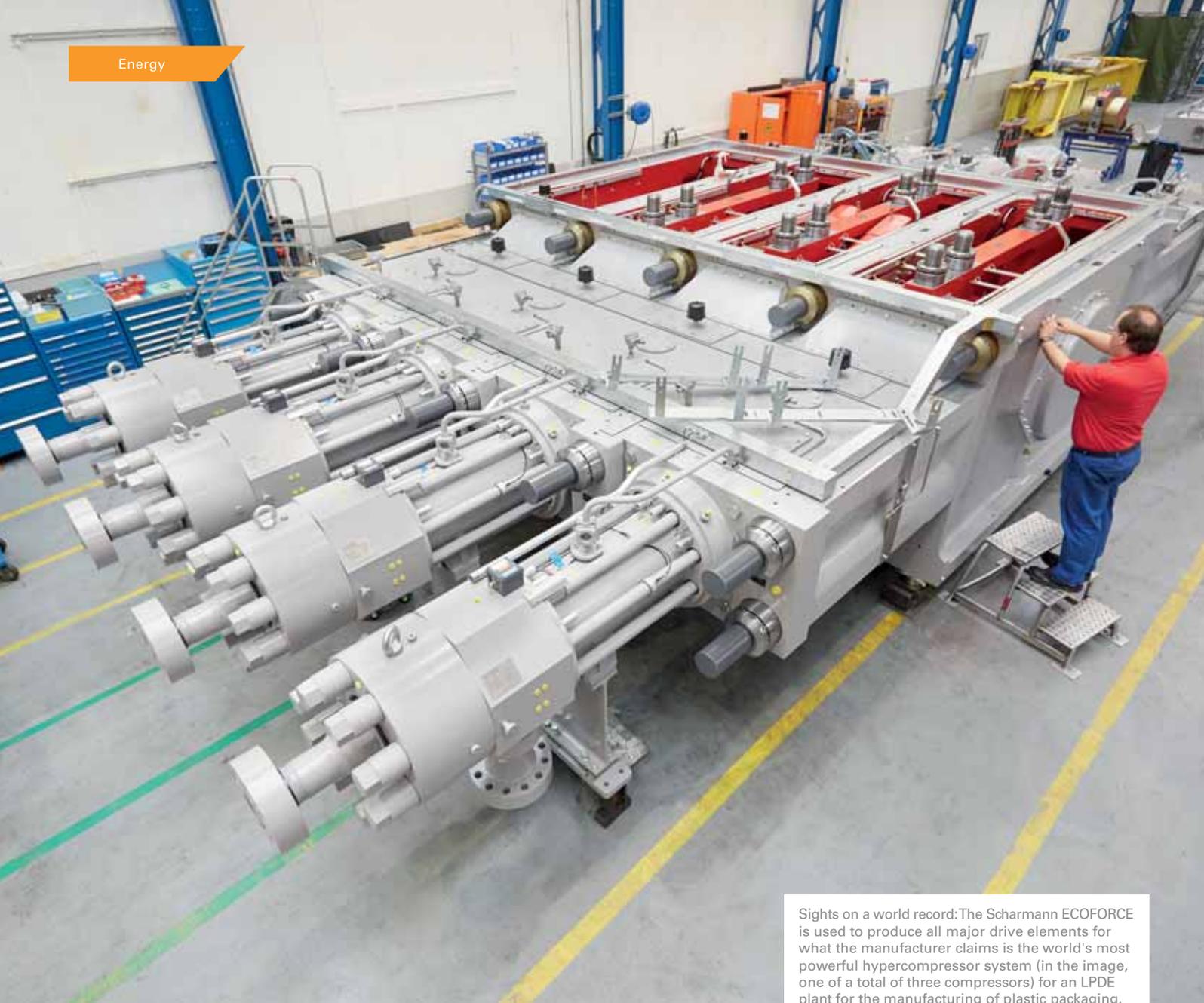
As Starrag usually acts as a general contractor in the deployment of such manufacturing systems and assumes complete responsibility for the process – from the design of the plant to the delivery of the turn-key system – the company closely monitors the associated partners and suppliers involved with any additional components. From the customer’s perspective, Markus Ess believes that the following is a “must”: “We work exclusively with leading companies that are able to match our high level of performance and availability.” ▀



Sights on a **world record**

Burckhardt Compression: Four large machining centres in twelve years

Any company that has used machining centres from one manufacturer to successfully produce numerous important components with high productivity, precision, and reliability for over a decade, will tend to return to the same supplier for their next purchase: This is why Burckhardt Compression ordered their fourth machine directly from Starrag – a Scharmann ECOFORCE in the maximum expansion level.



Sights on a world record: The Scharmann ECOFORCE is used to produce all major drive elements for what the manufacturer claims is the world's most powerful hypercompressor system (in the image, one of a total of three compressors) for an LPDE plant for the manufacturing of plastic packaging.



Universal angular drilling heads are also used.

A glimpse at just a few of the key figures tells us more: This company's products and production processes are often subjected to high pressure. Burckhardt Compression AG, based in Winterthur (Switzerland) is one of the world's largest manufacturers of piston compressors and holds the world record in this sector with a unit that has an operating pressure of 3,600 bar.

The company's customers are usually companies in the processing industry who highly value long-term collaboration and rapid, consistently reliable service. And the Swiss company also expects the same from their machine supplier.

Starrag Technology GmbH from Mönchengladbach (Germany) is one of these trusted suppliers, and has supplied Burckhardt Compression with four machining centres in twelve years. Roman Dünner, Technical Supervisor CNC – Large Parts Manufacturing: "We particularly value the friendly nature of this collaboration, from the first evaluation of a new machine through to commissioning."

Burckhardt, a former Sulzer subsidiary, has already purchased a Scharmann ALPHA 1250 M, a Scharmann HEAVY-SPEED 2 girder machining centre and a Dörries CONTUMAT VC 2400 MC-V



More efficient machining: An RTM 220 robot tool magazine (for 196 tools) and an automatic pickup magazine for head attachments reduce downtimes.

vertical turning lathe. These machines are used to manufacture cylinders, cylinder blocks, frames, valve heads and steering rods for compressors from castings and forgings with a high degree of automation. The largest individual parts are up to six metres long and weigh a maximum of 30 tonnes. Not absolute, but relative precision is needed here in the micrometre range (20 µm), because the parts must fit each other exactly during later assembly. A further important trend in Winterthur is also: Heavy-duty cutting in a clamping device with maximum precision.

A Scharmann ECOFORCE 2 HT4 machining centre, which serves as a replacement for an old Wotan machine tool, closes the machining gap between the Scharmann ALPHA and the Scharmann HEAVYSPEED. Number four is again a stand-alone machine developed according to customer request, which differs from its predecessors in one

Reduced downtimes thanks to the use of automatic magazines for tools and head attachments

respect: This time there was no invitation to tender among multiple suppliers, not least of all because of the good experiences with the first three machines. The Swiss company also chose Starrag due to their service level, in which they rate Starrag remote maintenance and diagnostics services particularly highly. Dünner: "The service, with its rapid response times—usually within one day—has really proved its worth."

The Scharmann ECOFORCE 2 HT4 is designed with a very powerful 54 kW spindle (torque: 3,000 Nm in S1 continuous operation) for medium-sized parts of up to 24 tonnes (X: 3,500 mm, Y: 2,500 mm, Z: 3,500 mm, W: 800 mm). The combination of head attachments and flexible tool magazine with automatic changes enables the use of large two-blade tools. An RTM 220 Kuka robot tool magazine (for 196 tools) and an automatic pickup magazine for head attachments reduce downtimes. In addition, a facing head (diameter: 500 mm), attachment spindle (length: 1,000 mm, diameter: 180 mm) and a spindle-driven angled milling head are used. An adapter plate enables the use of existing machining heads on both the HEAVYSPEED and the Scharmann ECOFORCE. Ergonomics is also an important factor in the new machine. It has a mobile and accessible platform, which covers the chip fall shafts against accidents.

Remote maintenance and diagnostics enable rapid response times for service work.



Protective chamber: Full enclosures are very important for Burckhardt Compression, as the company machines a large number of cast parts that produce a lot of metal dust. The employees are also protected against coolant vapours.



Good accessibility: The operators can quickly monitor, measure, and readjust any parts as necessary.

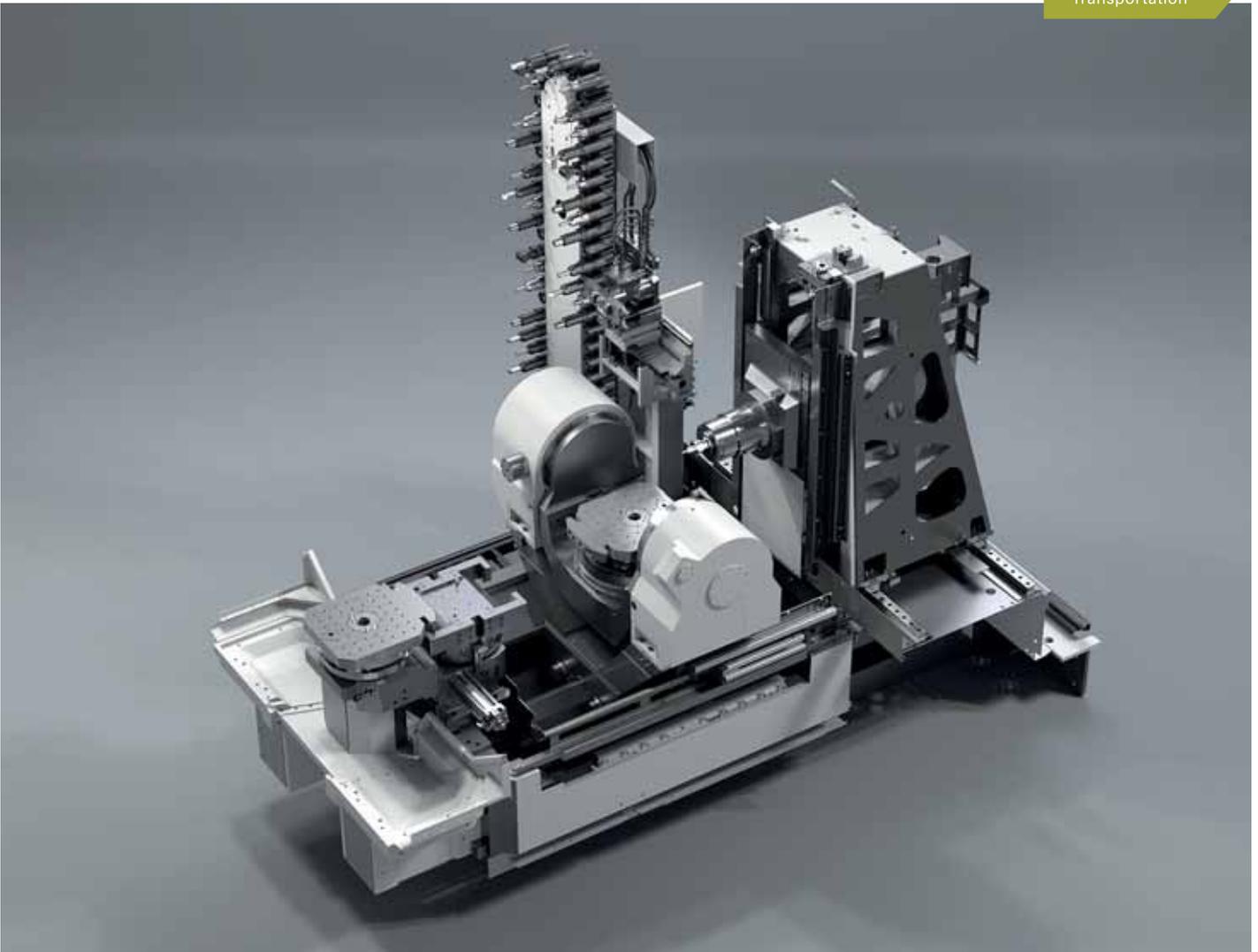
Special extra features include a technology package that describes the processing of typical customer workpieces in detail, including indications of parameters, tools and processing times. This data serves as test criteria during the approval process.

The Schermann ECOFORCE has been tried and tested in the workplace, and is now also supporting Burckhardt Compression in achieving a world record. It is used to produce all major drive elements for what the manufacturer claims is the world's most powerful hyper-compressor system (operating pressure: 3,100 bar;

motor power: 99 Megawatt) that has ever been constructed for an LDPE plant for the manufacturing of plastic packaging (LDPE: low-density polyethylene). The system, weighing a total of 1,000 tonnes and consisting of three compressors, will be used in the USA in the near future in a plant with a production output of around 400,000 tonnes per year. Dünner: "The production output also included the largest component manufactured on the machining centre so far, with a total length of over three metres: It just about fits on the 2.3 metre pallets and takes up almost the entire possible interference range of the machine." ▀



Roman Dünner, Technical Supervisor CNC – Large Parts Manufacturing, Burckhardt Compression AG, Winterthur: "Thanks to the large number of additional heads, we are highly flexible and can also easily machine the narrowest spaces in the components."



In a modular design for **optimum profitability**

Up to 30 % smaller footprint and 15 % higher productivity – with these convincing figures, Starrag has launched the newly developed Heckert L40 and Heckert H50 machining centres. The modular design of the horizontal five-axis centres with 400-mm or 500-mm pallet size allows for custom configuration in operations ranging from light metal machining to heavy-duty cutting.

Cutters with the highest quality standards have long valued the strengths of the Heckert horizontal machining centres: They are powerful and highly accurate for a very long time. Every detail of this series has been meticulously enhanced to meet the requirements of the market. The Starrag management was determined that the small Heckert machines for pallets of 400 mm and 500 mm would achieve a large increase in productivity. The result is the completely redeveloped

centres Heckert L40 and Heckert H50. They are designed for five-axis simultaneous machining, but are also available in the four-axis variant.

Dr Marcus Otto, Managing Director of the Starrag plant in Chemnitz, explains: “In the development of the new Heckert machines we have looked at exactly what our customers need: optimized operation, speed and a small footprint. A redesigned user interface extends the user’s possibilities enormously and

simplifies operation. The traverse paths have been optimized and downtime minimised. We have intelligently integrated the peripheral equipment into the engineering room, maintaining good accessibility and ease of service.

The two machines are based on a modular kit, which allows us to have the machines configured to the specific needs of our customers and to deliver an individually configured machine in just ten weeks.”



“Industrie 4.0’ benefits from networking, not from individual Starrag machines or production cells.”

“Up to 30% smaller footprint and 15% higher productivity”





“From the circular tool magazine with 20 slots to the linear magazine, the machine can be individually equipped with 320 tools.”



Development and production — an insight

At the beginning of a new development you are always trying to satisfy current and especially future demands so as to meet market requirements. However, the idea for a new approach at product level begins a complex process in the company as a whole. At Starrag, Dr Markus Richter and Dr Stefan Thurner are responsible for two fundamental sub-projects as part of the redevelopment of the Heckert machining centre.

Dr Richter, Director Development at the Starrag factory in Chemnitz, guided his team of more than 50 staff through all phases of the development and ensured that the focus never wavered from the objectives. Namely, implement customer's individual needs quickly and efficiently. In other words: Engineering precisely what you value!

When asked how this had been achieved with the new machines, Dr Richter said: “Consistent modularisation is the key. The new machines allow us to find the appropriate configuration and therefore the ideal processing solution for our customers. For example, we implement heavy-duty cutting from pallet size 400 in exactly the same way as five-axis simultaneous machining or solutions for turning.”

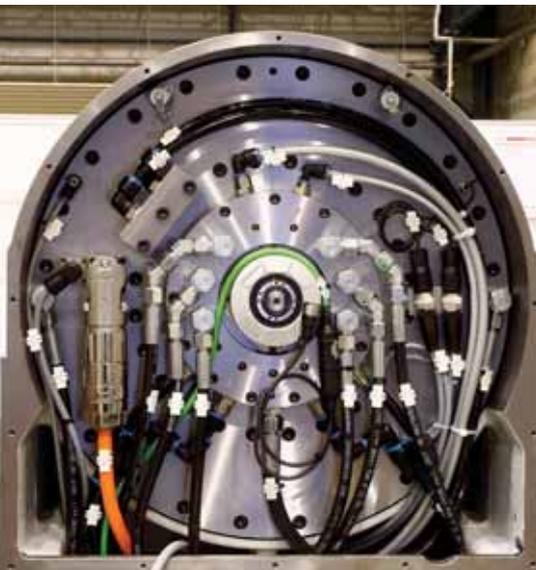
Dr Stefan Thurner, Director Production in Chemnitz, was tasked with implementing this modularisation in production and is therefore responsible for ensuring the necessary flexibility in the manufacturing process. When asked about this, he said: “We have been working hand-in-hand with the development department since the start of the project and have simultaneously reviewed our value chain and adjusted it accordingly. Thanks to these ideal prerequisites we can facilitate all manner of product diversity, despite some extremely short delivery times. We know that our customers have to react ever quicker and see it as our duty as a future-oriented partner to help them in this aspect.”

In the new development of the “small” Heckert machines, Starrag has taken the utmost care to ensure that the well-known long-term precision of Heckert machines is maintained. Jonny Lippmann, Project Manager at Starrag, explains: “We place great value on being extremely precise in mechanical engineering, so the electronic compensation *is just the icing on the cake*. This way we can ensure a high level of precision and process reliability for many years.”

Minimised space requirements

A newly designed mineral cast machine bed provides temperature and vibration resistance with a centrally positioned swarf conveyor. The cooling unit is easily accessible in the machine cube. With this space-saving approach, the new Heckert H50 has enabled the employees in Chemnitz to reduce their footprint by 30% when compared with the predecessor model HEC 500D. The increased area productivity makes the machine a genuine alternative to multispindle centres.

“By means of subsequent fingerprints we can compare the respective status, detect any change and introduce preventive maintenance measures.”



While large parts of the assemblies of all machine variations are the same, the columns have options for variation: For highly dynamic machining, a weight-optimised version is available. By contrast, a more solid column is used for heavy-duty cutting as this ensures optimised damping.

At the heart of the machine is the spindle, available in many different versions. The customer can choose between universal HSK63 spindles, high-speed spindles for dynamic aluminium machining and high-torque HSK100 spindles, which are required for machining titanium. No matter which spindle the customer chooses, it comes from Starrag's own production.

Maximised flexibility

These is also a choice in tool magazine. From the circular tool magazine with 20 slots to the linear magazine, the machine can be individually equipped with 320 tools. Flexibility through tool diversity is one aspect of the enhancements, but an increase in productivity, for example in the contract manufacturing, cannot be achieved only in machining. Tool change is an important factor for downtime. This is why Starrag has reduced the chip-to-chip time for its customers to 2.2 seconds. Developers have also been able to shorten downtimes for workpiece change with a new two-pallet changer. This means the customer is free to order new

Heckert centres without a workpiece changing device, if they are intended for linked production lines. For entry into flexible automation the Chemnitz-based specialists have developed a space-saving solution consisting of six pallets and a set-up station. This allows a small, flexible production cell to be developed.

The trend towards automated production cells and lines is not limited to mechanical solutions; it continues in the digitisation of production. Starrag supports the path to "Industrie 4.0" in many ways. Dr Marcus Otto explains: "Our developments cover the spectrum from digital integration of the individual machine through to the entire shop floor." Accordingly, the new Heckert machines



“At the heart of the machine is the spindle, available in many different versions.”



are equipped with PROFINET and IO-Link technology, providing a suitable basis for networks and digitisation. A new control panel with 24" multi-touch screen enables the integration and display of other use elements besides information related to the machine, such as cameras, tool monitoring systems, documentation, drawings, maintenance instructions etc.

“Industrie 4.0” modules increase productivity

Regarding software, Starrag uses different modules to ensure higher productivity in machining and to simplify service and maintenance. This includes “chattering control”, which intervenes based on

the parameters detected in the control loop and optimises cutting parameters. According to Jonny Lippmann, Starrag customers already use the “fingerprint today”. The current status of a machine is recorded on the basis of several parameters. This is done for the first time when leaving the production facility. “By means of subsequent fingerprints we can compare the respective status, detect any change and introduce preventive maintenance measures.”

Starrag combines the “Industrie 4.0” activities in the Starrag IPS (integrated production system), which is used across all brands and machines in the group. SIPS consists, in principle, of three shells around the machine. The interior

contains functions which have a direct impact on the machine and the cutting process. This includes the monitoring of cutting forces and vibrations. The second shell concerns the machine’s communication with the outside world. It also includes the tool and workpiece management. The third level is used for networking the production and its integration into general systems such as ERP software. “‘Industrie 4.0’ benefits from networking, not from individual Starrag machines or production cells,” explains Managing Director Marcus Otto. “Therefore, we want to use our systems to capture the entire shop floor and to be a fully supportive partner for the customer.” ▀



Screw compressor manufacturing in the GEA refrigeration plant, Berlin: Three new Heckert HEC centres reduce processing time for housing units by around 40%.

Increased capacity without increased space

GEA Refrigeration Germany GmbH in Berlin has replaced three somewhat ageing milling machines with new Heckert HEC 630 Athletic and Heckert HEC 800 Athletic machining centres for the machining of screw compressor housings. In doing so, they have been able to reduce processing times by around 40 % while generating additional manufacturing capacity in the same amount of space.

What do a wind tunnel in Vienna, an indoor ski resort in Dubai and the Stuttgart trade fairs have in common? They all contain cooling equipment from GEA. The international technology group also supplies refrigeration and air-conditioning solutions suitable for many other industrial applications, such as for engine test benches and spray booths, warehouses and cold chains for food products like yoghurt or ice cream.

At the heart of these units is the GEA Grasso screw compressor, manufactured at the company's Berlin site. In 2016, a total of around 1,500 compressors left the factory, in 28 different models with flow volumes ranging from 280 m³ to 1,100 m³. Their special features: high efficiency and long service life.

Such a screw compressor essentially consists of rotors and housings. Each manufacturer keeps the rotor profile a particularly closely-guarded secret, as it



Important advantages of the Heckert HEC 630 and HEC 800 machining centres: large working area and quills for creating deep bore holes with high process reliability.



Ronny Kolbe (left) and Burghardt Krüger jointly create and optimise the CNC programs for the new machining centres. They were essential to the successful introduction of the machines.

“Investment in the new machining centres increases the production capacity to such an extent that previously outsourced housing machining can now be brought back into their own factory.”

lays the foundation stone for efficiency. But suction, pressure and rotor housings also have a marked effect on quality. Strict shape and position tolerances have to be adhered to, from the flange faces up to the mating holes for the rotor bearings. Production Manager Hanno Heim explains: “Axis parallelism is particularly important to guarantee years of trouble-free service from the rotors. We are therefore moving in areas of higher than 20 µm accuracy for position, and higher than 10 µm in terms of concentricity and angularity.”

Pressure to modernise machining

Processing housing units places high demands on the machines. As well as the aforementioned precision, high levels of reliability and large travel paths are required. Not least for the extra-large screw compressors, whose housings have a volume of around a cubic metre and a weight of roughly 1.5 tonnes.

In order to ensure economic housing machining for the entire product range, GEA took the decision to make their facility in Berlin state of the art. Since numbers have grown so much recently that part of the production had to be moved out, returning to entirely in-house production required additional capacity.

The plan was to replace two ageing horizontal machining centres. This came with the need to dramatically reduce machining times (especially downtimes), to increase machining accuracy and to devote particular attention to high-precision depth machining of bore holes. A high level of machine availability was also in the list of requirements along with the latest Siemens 840 D sl controller and a switch to HSK-100 tool holders. “We considered every detail in terms of optimising the machining process”, stresses Production Manager Hanno Heim. “Then we thoroughly compared the relevant machines from various manufacturers.

This included time studies for a reference component, involving all the necessary machining processes.”

HEC 630 Athletic collects the most plus points

After evaluation using a sophisticated points system, GEA managers decided to make their purchase from Starrag, a global technological leader in the manufacturing of precision machine tools. A Heckert HEC 630 Athletic horizontal machining centre was ordered first, followed a few months later by a Heckert HEC 800 Athletic for the machining of large parts.

Several factors swayed this decision. For one, the HEC 630 promised a calculated time saving of 36 % over their previous machining process. In comparison, the closest competitors only offered between 30 and 32 %. The Heckert machining centre came out on top in

the technical machine evaluation, and what's more, previous good experiences made a new partnership with the Chemnitz-based machine manufacturer very appealing.

From a technical point of view, the Heckert HEC 630 triumphed with its overall design. Its axle configuration makes it extremely stable: X and Y-axes in the tool, with the Z-axis in the machining table. This is supported by the rigid and thermo-symmetrically designed main components. Together with the digital AC feed drives, complex profile rail guides and ball screw spindles in all linear axes, these provide a solid basis for a reliable machining process.

Burghardt Krüger, a process engineer involved in machining housing for many years at GEA, was involved in the decision. He emphasises a strength which other manufacturers aren't able to provide: "Starrag offers a quill even

on its mid-sized 630 and 800 Heckert HEC machining centres. For our deep bore holes, this is an enormous advantage because it enables us to use short, compact tools which bring high precision and process reliability." The alternative to a quill (125 mm in diameter and 500 mm extension length) is to use long, heavy tools. These are more expensive and also tend to vibrate and bend, increasing the likelihood of machining inaccuracies.

Large working area and convenient chip collection

Burghardt Krüger also mentioned the working area, another important detail: "With the Heckert HEC machining centres, we have been able to considerably increase the interference range and traversing paths compared to previous models. This means we can go one machine smaller than in the past, which really helps when installation space is limited."

The working area is also designed in such a way that the chips fall freely into the centrally-positioned swarf conveyor. This prevents chips from piling up in the working area and endangering process reliability. Krüger also rates the use of fixed plates instead of telescopic covers positively, as they provide the functional elements with optimal protection from chips and coolant. This enables higher acceleration and rapid traverses, as the plates do not need to be carried along with the linear axes.

After the successful benchmark set by the Heckert HEC 630, GEA decided on a second machine in the same range: a Heckert HEC 800 Athletic, which is equipped specifically for processing large housings with its extended Z-axis and machining table capable of supporting up to 2.5 tonnes.

Ronny Kolbe works particularly intensively with the new Heckert HEC

Machine operator Sascha Sagert enjoys working with the new HEC centres. The new control panel and the latest Siemens CNC 840 D sl provide a clear overview of the work.



Production Manager Hanno Heim is pleased about the additional production capacity brought by the modernisation measures. Now all the housings can be machined in GEA's own factory again.



With an extended Z-axis and a machine table capable of supporting up to 2.5 tonnes, the Heckert HEC 800 Athletic is ideal even for the largest GEA Grasso housing.



Successful teamwork: The GEA employees (from left) Ronny Kolbe, Sascha Sagert, Burghardt Krüger and Hanno Heim thank Ulrich Seidel, representing all involved Starrag and Heckert employees, for a professional, reliable and co-operative partnership.

machining centres. The specialist in production planning and control works together with Burghardt Krüger to create and optimise the CNC programs that are run on it. He also mentions another plus point which has already been proven in practice—the tool magazine with 255 pockets that can automatically accommodate tools of up to 340 mm in diameter and up to 800 mm in length: “This capacity makes us very flexible and means we don’t have to constantly re-tool, even for the smallest series runs. We were also able to reduce clamping operations per housing from three to two.” Despite its large tool wealth, the tower magazine requires only a small footprint in comparison to other solutions, which is a key argument in cases where space is confined.

Over 40% savings

The results of the modernisation measures are pleasing: In practice, processing times for housings in the GEA Grasso M series have been reduced by around 45% on the Heckert HEC 630. The savings for the XL screw compressors in the GEA Grasso LT range, machined on the Heckert HEC 800, are of a similar

40 %

Reduction of machining times

magnitude. It was proven practical successes such as these which convinced management to replace another machine sooner than planned. In December 2016, the Heckert CWK 1000 made way for an additional Heckert HEC 800 in the Berlin GEA factory. The shorter processing times not only reduce manufacturing costs. They increase production capacity to such an extent that previously outsourced housing machining can now be brought back into their own factory.

The new investment also means that the Berlin GEA plant is well equipped for the future and “Industrie 4.0”. This is why Head of Maintenance, Manuel Marks, is delighted to be looking after the three new machines: “These machines can be monitored remotely with Starrag Conect. This means I can find out about

the current operating parameters of individual machines, such as parts program, axle position, spindle speed, NC block, tool etc., at any time from anywhere with a tablet and an internet connection. Preventive maintenance is therefore replaced by situation-specific maintenance, because I can monitor the condition of the machine constantly by means of temperature and vibration sensors. The software detects increasing wear or failing lubrication so that I can respond at exactly the right time.” The software also reports faults and error messages, and offers direct access to the complete machine documentation when required. If GEA later decides to enhance its manufacturing with further machines from the Starrag, these can be integrated easily into the Starrag Connect system. ▀



Luxury Goods

During our presence at EPHJ, specializing in the supply of the luxury market and more precisely watchmaking, we have challenged our customers and visitors by providing answers to the problems often encountered by players in this field.

What will the watchmaking industry look like in 10 years?

We don't claim to have the answer to this question. However, we are currently providing answers to the concrete questions being asked day-to-day across the industry as a whole, with production solutions offering flexibility and productivity.

Adapting to market developments is an absolute priority. To do this, we need efficient, effective and flexible production solutions.

Here, in answer to the question: "Can you further optimise your productivity?" are three concrete cases that illustrate our capacity for innovation in meeting your needs.

Reducing the number of passes to increase productivity and competitiveness

Benefits:

- > Simplify the manufacturing process.
- > Produce components in a single cycle, thus reducing the throughput time.
- > Reduce the risk of rejects during production throughout the entire production process.

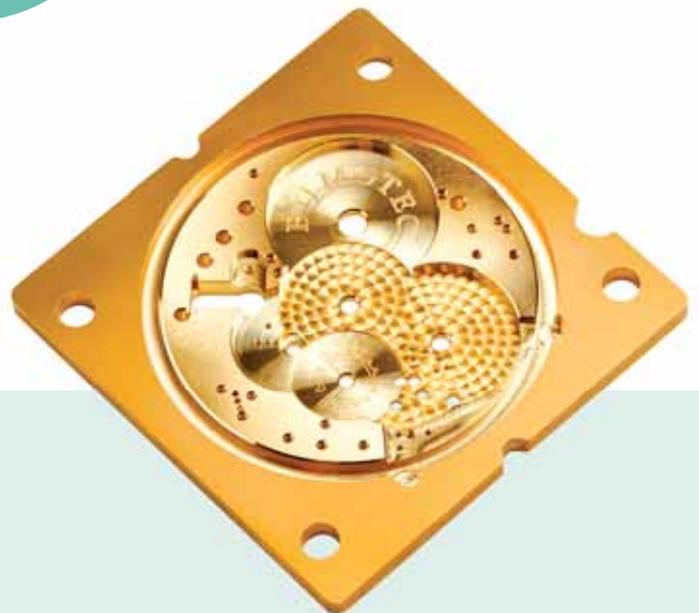
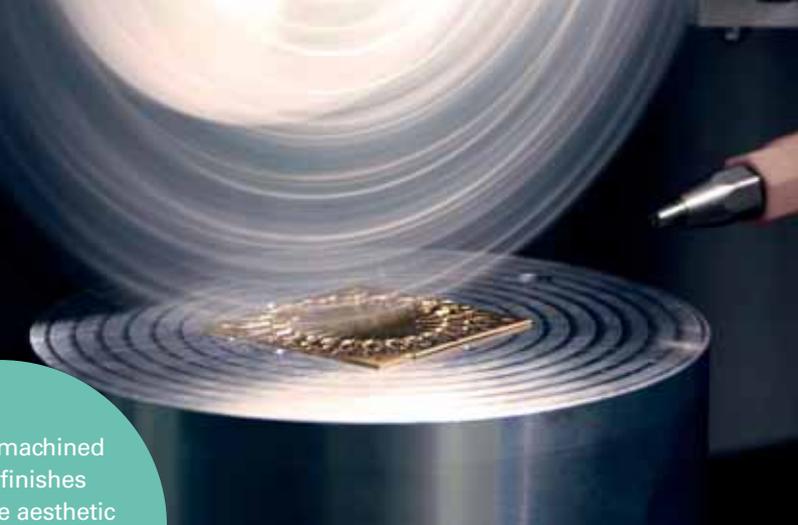
Our solutions:

For main plate manufacture, the s100^{mono} and s100^{multi} ranges enable continuous production of movement blanks thanks to integrated automation which automates the feeding, storage and turning of blanks on both sides of the workpiece being machined (top/bottom). Integrated automation includes the positioning check, as well as the deburring and cleaning functions for the parts produced.

In addition, on the s100 range, the blanks are fixed to mobile pallets to enable them to be either transferred between the 4 machining stations or machined alternately on their faces (top/bottom). This technical solution drastically reduces the complexity of the precision of the fixtures, since the origin of the workpieces is measured at each loading operation. Through

The Bumotec s181 produces a bracelet link in a single production cycle, **reducing the cycle time by up to 40 %.**

Flawless machined surface finishes to meet the aesthetic requirements of the luxury goods sector.



automation, the entire main plate can be produced in a single production cycle, with unrivalled precision.

Added to this, programming makes it possible to transfer production programmed on a single-station s100 to a multi-station s100, automatically optimising and adjusting the cycle times for each station. The operation takes just a few minutes. This means the production capacities can be quickly, easily and effectively increased.

Another example of a reduction in the number of passes uses a Bumotec s191H to produce a wedding ring, from the bar to the finished product, including finishes, incorporating diamond finishing processes over the entire surface or even satin-finishing. Thanks to the re-taking unit, only one

production cycle is required to obtain the end result in automatic mode.

Even more impressive in terms of improved productivity, is the production of a bracelet link on a Bumotec s181, whose 90-position tool magazine, its re-taking unit and its five "Front Live Tools" enable back working operations on a second station operating simultaneously. Once again, the s181 produces a bracelet link in a single production cycle, reducing the cycle time by up to 40 %.

The variety of materials that can be machined, coupled with flawless surface finishes – essential capabilities enabling you to grow your business

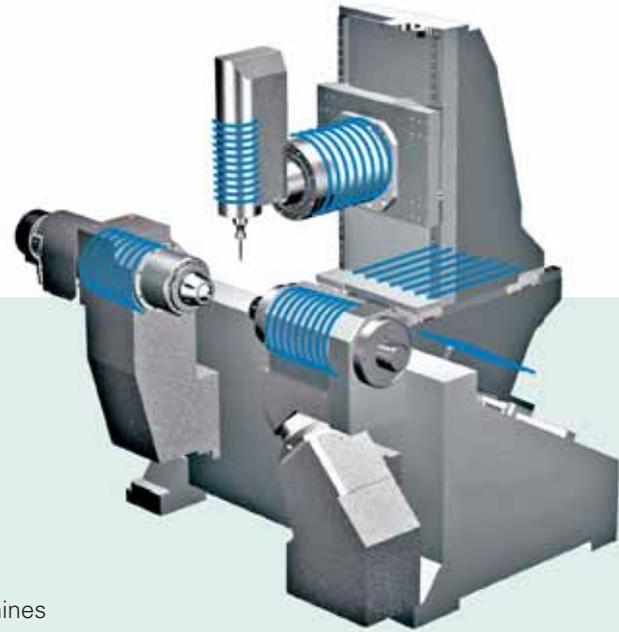
The ability to machine precious materials is an essential condition in the world of luxury goods. The important aspects can be summarised in three points:

- > Precision machining to prevent production rejects and reprocessing of precious materials.
- > Flawless machined surface finishes to meet the aesthetic requirements of the luxury goods sector.
- > The ability to machine original and often highly complex materials to remain innovative in a highly demanding market.

One of the arguments for “Industrie 4.0” is in-production monitoring to enable automated parameter adjustments or tool corrections without interrupting production.



Adapting to market developments is an absolute priority.



Our production solutions:

Watchmaking requires the production of a wide variety of small parts which must display exemplary precision to ensure perfect operation when these high-profile products are offered for sale.

From watch exterior parts such as bracelets, clasps, dials and indexes to movement parts such as main plates, bridges and oscillating weights, and including jewellery, which also encompasses all of these applications, the production solutions must be flexible in order to manage the full range of demands in the materials most widely used in the luxury goods and high-tech industries:

- > Gold
- > Platinum
- > Pure titanium and its alloys
- > Stainless steels

Also:

- > Soft and hard ceramics
- > Hardened steels
- > Sapphire
- > Chrome cobalt
- > Aluminium
- > composite materials
- > Shape-memory materials

Swarf collection, particularly for precious materials, is also a source of optimisation and profitability.

The ergonomics of Bumotec machines range and our recovery systems meet the strictest requirements.

Swarf removal and filtration

An oil curtain flows permanently from the top of the machines into the machining area in order to carry the swarf as quickly as possible to the chosen filtration system. Inclined surfaces also prevent it from accumulating.

Finish quality

The renowned rigidity of Bumotec machines range guarantees near-perfect surface finishes. Embedded functions specific to the luxury sector guarantee flawless surface finishes that facilitate complex polishing operations.

Special materials

The capability of Bumotec machines range to process hard, abrasive or even cutting edge materials means they can keep up with current and future innovations in the watchmaking industry.

How do you consistently guarantee high-quality production with no interruptions?

While automated functions enable round the clock production 7 days a week thanks to solutions integrated in the machines, it must also be possible to guarantee production of consistently high quality within strict tolerances.

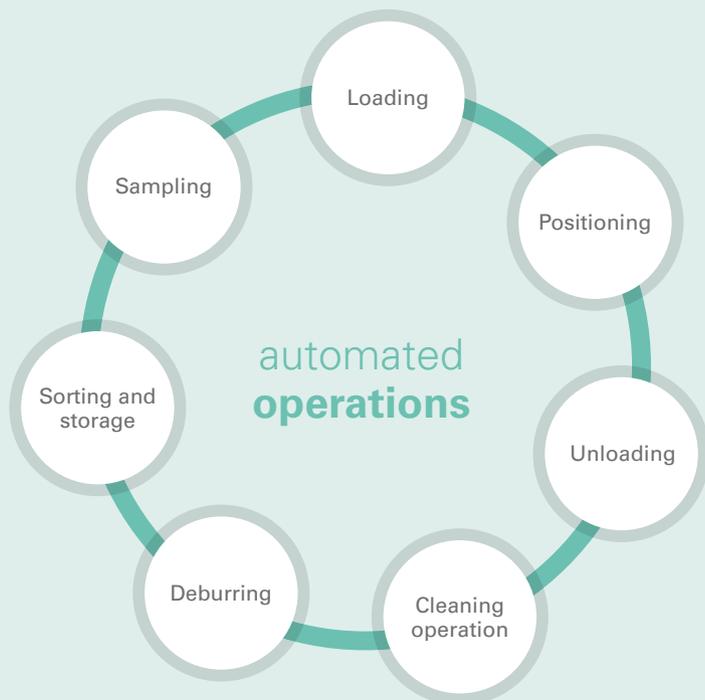
This is what marks out a machine manufacturer from a supplier of integrated solutions:

- > Machine manufacturing quality.
- > Automated systems.
- > Dimensional checks during production.
- > Machine maintenance schedule to prevent interruptions not programmed in the production plan.



We have installed numerous robotised production solutions which offer our customers a range of functions.

Which operations can be automated?



Our machine base frames are made from stabilised cast iron or mineral casting, guaranteeing perfect stability. Moreover, the efficient cooling systems on our machines guarantee thermal stability in order to consistently produce parts of flawless quality.

One of the arguments for “Industrie 4.0” is in-production monitoring to enable automated parameter adjustments or tool corrections without interrupting production.

In collaboration with ESPI, we offer custom-developed in-production monitoring solutions. The aim is to adapt the solution based on the configuration of the customer’s production model. Measuring systems integrated in our machines ensure micron-degree precision.

Machine maintenance is a key factor in managing production. To prevent unexpected machine stoppages, it is advisable to choose a maintenance schedule that plans for preventive and corrective maintenance operations via the relevant checks. This means no unpleasant surprises, and your productivity reaches the expected planning level. Our after-sales service offers different maintenance schedule levels based on your requirements and production rate. ▾

starrag

Engineering precisely what you value

New: Heckert X40 5-axis-productivity in compact form



30%

less floor space
requirement

through module compact design

15%

increase in productivity

through highest possible machine dynamics,
reduction in idle times and most rigid 5-axis
horizontal machining centre in the market


EMO
Hannover
18-23.9.2017

We are looking forward to your visit.
Hall 12, Booth B 60

www.starrag.com