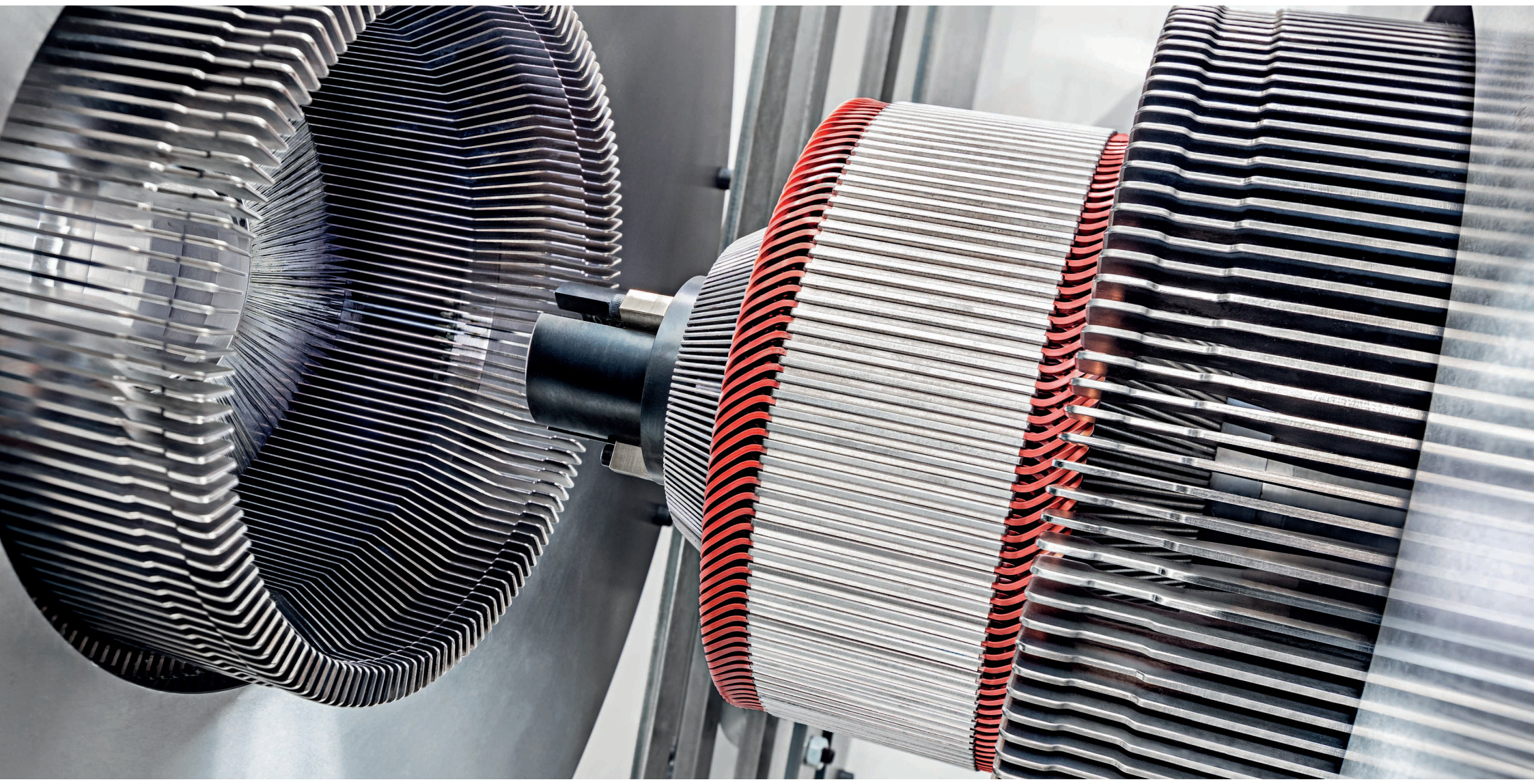
TECHNICAL HIGHLIGHTS

EMO Hannover
16-21·9·2019

GROB

INTERNATIONAL

EMO EDITION



Smart solutions made by GROB – for your production of tomorrow!

DEAR BUSINESS PARTNERS, DEAR FRIENDS OF THE GROB COMPANY,

We at GROB have been able to achieve constant and steady growth for over twelve years now. Many of you know GROB only as a company that races from one record high to another. Yet the framework conditions have fundamentally changed for us all, including our company.

Developments on the global markets are difficult to assess right now. This is partly due to the trade conflict between the USA and China and its impact on all industrial nations, but also the highly divergent approaches to climate policy in the individual countries. Environmental developments in particular are encouraging large-scale investment by the automotive industry, primarily in the drive technology sector.

In light of these developments and to stay abreast of global change, our company has realigned its strategy and will be implementing the new plan step-by-step. Our strategy abides by the existing corporate philosophy of focusing on our employees, while driving investments in the future development and alignment of our company, depending on our resources. However, we will also be pushing the expansion of our company and the corresponding investments, primarily in the new growth markets, which will ensure new orders and capacity utilization for GROB in the future – also and especially for our headquarters in Mindelheim.

The philosophy of any family-owned company like GROB crucially includes a long-term, sustainable focus that offers our employees, our partners, and, above all, our customers a high degree of consistency and predictability. And this will remain our credo for the future.

Your Grob family

DEAR BUSINESS PARTNERS,

Much has been and is still being reported in the media on the paradigm shift in the automotive industry, especially on the changes to the powertrain. In actual fact, the development departments of practically every automobile manufacturer implemented this shift long ago: the technological changes to the powertrain in the global automotive industry are immense. Vehicles powered solely by a combustion engine are on the decrease, and they will soon be a thing of the past.

The development of various electric drives, no matter whether as a hybrid or a purely electric version, is being accompanied by advancements in battery storage technology. It is clear to see that more and more companies are turning to these technologies.

In fact, various projects for the first wave of electric powertrains have been set up. There are also specific development projects and prototype facilities for fuel cell technology that have advanced way beyond the planning status. These will be available for deployment and ready for the market within five to seven years.

We at GROB recognized this shift at an early stage and made all the provisions required to anticipate the technological developments in the automotive industry. As a result, we have been able to participate at every stage.

At the same time, we continue to pursue the strategy of further expanding our core business at high speed, with our product lines for metal cutting machines for the automotive industry, and also for the universal machining center market. Our third foothold, assembly technology, will be continuously updated and advanced during the course of the technology migration. You can get an idea of how we continue to do this by visiting the GROB stand at this year's EMO in Hanover.

As we establish and expand our fifth sector, "e-mobility", our company faces even tougher challenges, but we will continue to compete for market leadership in the system business and universal machining center sector, in assembly and automation, as well as in the software sector with the digitization and networking of production facilities and processes.

CFO Wolfram Weber, CEO German Wankmiller, CSO Christian Müller (left to right)

Just this summer, the Volkswagen Group, the world's largest automobile manufacturer, paid testimony to the fact that GROB has taken the right path by entering the e-mobility market. We received the Volkswagen Group Award in the "Innovative company" category for "e-mobility", a particularly important area for Volkswagen. This is a great honor and a wonderful success for all employees at GROB, and also for our continuing positive development.

Backed by this strong alignment and our future-facing strategy, we at GROB feel it's fairly safe to say that we have chartered the right course and that GROB, with its worldwide plants and branches, is optimally poised for the future.

Your Management Board
GROB-WERKE GmbH & Co. KG

GROB INVESTMENTS
GROB boosts its international investments

GROB invested more than 66 million euro in the past fiscal year to secure its technological lead and its presence in key global markets. In addition to strengthening new technologies and developments, important investments in property and real estate were also made. With a new production plant in Italy, as well as new branches in France, Vietnam, and Japan, the GROB group has now grown to five plants and a total of 15 service and sales branches.

As in previous years, the past fiscal year saw a particular focus on the expansion of the e-mobility business area. In total, GROB has invested over 50 million euro in the last three years in the development of this future-oriented technology. At the same time, GROB has strengthened its position as market leader in the traditional system and universal machining center business. Machining will remain GROB's core business for the foreseeable future in the European, American, and Asian markets. With its new machine concepts, such as the access-series and machining centers for frame structure parts, GROB remains fit for the future in traditional mechanical engineering.

INVESTMENTS IN THE PRODUCTION PLANTS

After substantial investments in recent years, especially in Germany and Brazil, GROB is now optimally positioned in terms of buildings and machinery at its plants in Mindelheim and São Paulo. In contrast, there was a need for investment in the production plants in China, Italy, and the USA last year. In Dalian, China, the plant was expanded by 6,700 m², in Italy the foundation stone was laid for a new GROB plant with an area of 6,100 m², and a new office and staff building with an area of 4,266 m² was built in Bluffton, USA.

1. PLANT EXPANSION FOR GROB MACHINE TOOLS (CHINA) CO., LTD. IN DALIAN, CHINA

After starting construction in May 2018, the GROB plant in China was expanded by 6,700 m^2 last year, resulting in an increased production and logistics area with a total of 32,400 m^2. The expansion of the GROB plant in China was executed in a multifunctional design so that all GROB products can be assembled in the new production area. The additional space will mainly be used for pre-assembly and final assembly. After the completion of this second expansion stage, all projects, including automation, linear gantries, and transport systems, can be set up in the plant, and initial acceptance can be completed according to customer requirements, following the example of the Mindelheim plant and meeting the expectations of Chinese customers. This is an important investment that will enable continued realization of major orders in parallel with individual orders from the universal machining center business.

The increase in capacity enables further expansion of the product range and increases production flexibility. GROB's portfolio in China will be initially expanded to include assembly machines and in the medium-term to include e-mobility.

2. NEW PRODUCTION PLANT FOR GROB ITALY S.R.L. IN PIANEZZA (TURIN), ITALY

An important milestone in GROB's e-mobility offensive is the new production plant in Italy. March 12 this year saw the ceremonial laying of the foundation stone for the fifth GROB plant aimed at the development and production of machines and automation solutions for e-mobility. The first stage will involve the construction of a plant with a production area of 4,800 m² and an office space of 3,300 m², on a site of 24,000 m². Combined with an investment of ten million euro, this will create a further 50 to 60 jobs in addition to the current 60 jobs.

2.

3. NEW OFFICE AND STAFF BUILDING FOR GROB SYSTEMS, INC. IN BLUFFTON, USA

The GROB plant in the USA is currently undergoing the construction of an office and staff building with an area of 4,266 m². This construction will include a new cafeteria on the first floor, seating 386 people. The second floor has a total of 45 workstations and seven meeting rooms for the sales department, providing optimal working conditions for those in contact with our customers. A further 73 workstations and two meeting rooms are planned for the third floor, which will be expanded at a later date for mechanical construction. The building will be ready for use in September 2019. The total investment will ultimately amount to around eleven million euro.

EXPANSION OF THE GROB SALES NETWORK

GROB has continued its sales offensive with the establishment and expansion of four branches, which are located in France and the three Asian markets of India, Vietnam, and Japan. GROB Machine Tools India Pvt., Ltd. has acquired a site of 87,000 m², located one hundred kilometers south of Bangalore in southern India, for the construction of a new branch with production hall. Construction is scheduled to begin next year. Upon completion, the Indian branch will be relocated from Hyderabad to Bangalore. In order to ensure reliable and even faster service for customers in Vietnam, Japan, and France, three additional branches were established in these important target markets and opened in January this year:

- **GROB Vietnam L.L.C in Haiphong, Vietnam**
- **GROB France S.A.R.L. in Senlis, France**
- **GROB Japan K.K. in Yokohama, Japan**


1.


3.

EMO 2019 – HIGHLIGHTS

Smart solutions made by GROB – for your production of tomorrow

At the twenty-third EMO, GROB-WERKE is again presenting a host of technical innovations and machine highlights on its stand measuring 1,700 m². In addition to the universal machining centers in the new access series and its expertise in e-mobility, this year GROB will also exhibit machining centers for frame structure and chassis parts, as well as the latest system and automation solutions.

EMO AND GROB – A SUCCESS STORY SPANNING MORE THAN 40 YEARS

After the second EMO exhibition in 1977 in Hanover, which had seen GROB's first appearance, GROB-WERKE has been represented a further 15 times at the world's largest mechanical engineering trade fair – and five times in a row since 2011. During this time, GROB has repeatedly impressed visitors with its technical innovations, including some that have made mechanical engineering history.

Strictly speaking, GROB's trade fair history began in Hanover, before the EMO even existed: Back in 1964, GROB presented a parting and centering machine along with two thread rolling machines at the former mechanical engineering fair.

After EMO was founded in Paris in 1975, the GROB exhibits have gone down in the history of EMO. At its inaugural EMO trade fair appearance in 1977, GROB-WERKE presented the initial predecessor of the GROB machining centers with multiple NC axes, tool magazine, and automatic tool change. A further milestone in GROB's development was presented at the EMO in 1985: the first robot in the gantry version.

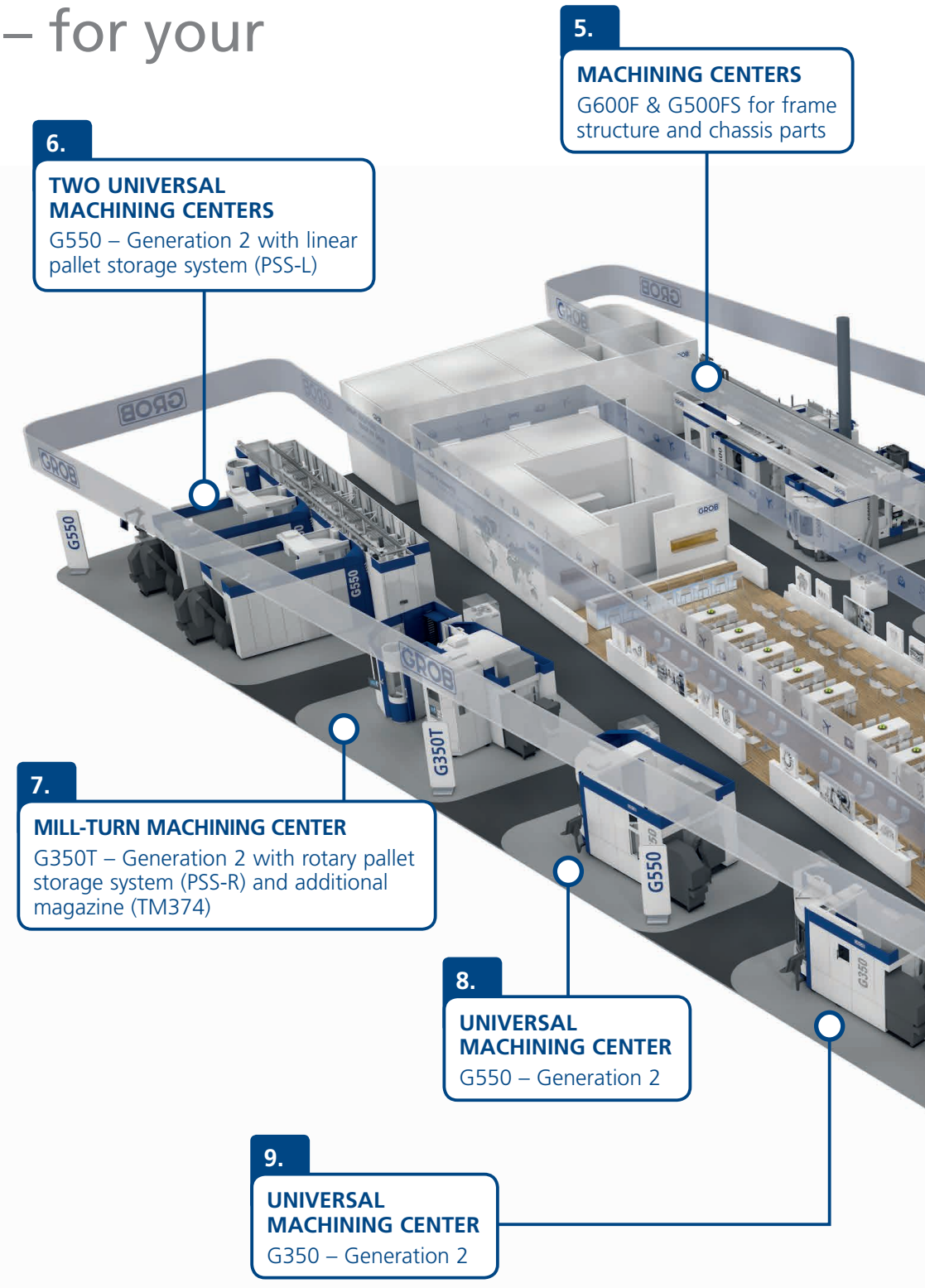
In Paris in 1991, the GROB fast machining center BZ 40 LS with rapid adjustment and feed rates was presented for the first time. In addition, "CMS", a computer-aided machine planning and simulation system developed by GROB, was also shown for the first time. Six years later, GROB presented a BZ 600 with ball screw and a second BZ 600 L with linear motor drive, which was a new drive for the X, Y', Z feed axes at that time. GROB ad thus set in motion the competition for (drive) systems.

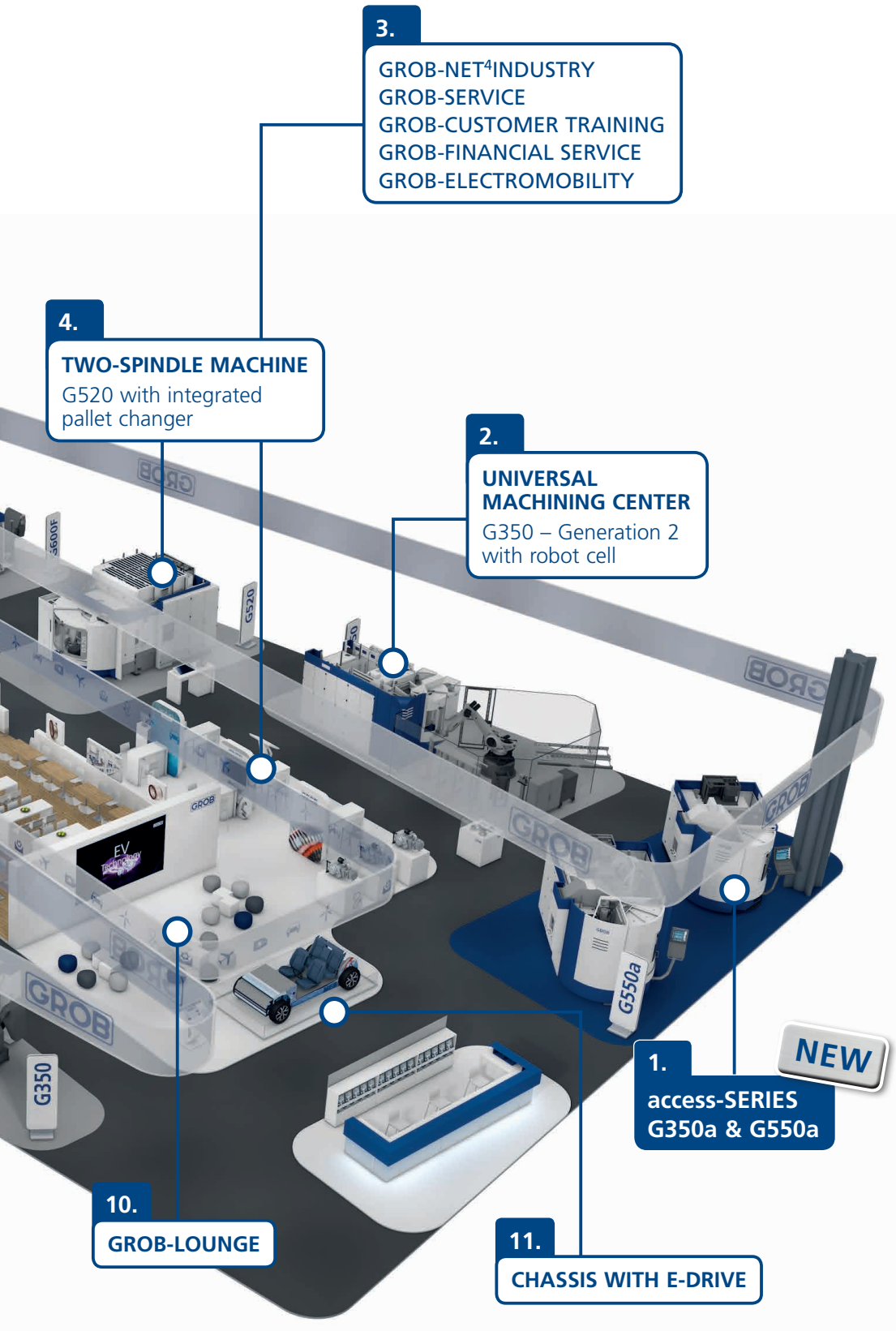
In 2001, the focus was on a flexible manufacturing cell with a BZ 530 and BZ 540, linear gantry, and conveyor belt. EMO 2005 was unforgettable, as the modular G-series marked the beginning of the most successful mechanical engineering series in the history of GROB-WERKE. And in 2007, GROB again rewrote history with its presentation of the first universal machining center G350.

At the subsequent exhibitions in 2009 and 2011, GROB again wowed visitors with many technical innovations, such as the modular special-purpose machine, the newly designed assembly technology, and the G550, another universal machining center. In 2013 came the first GROB linear gantry with new drive technology and G-modules in a completely hydraulic-free version; in 2015, Generation 2 of the universal machining centers; and in 2017, the start of e-mobility.

GROB'S EXHIBITION HIGHLIGHTS IN DETAIL

This year, at GROB's exhibition stand in Hall 12, Stand B06, visitors can look forward to a total of eleven machines, as well as various presentation areas showcasing the latest service and software products from GROB. A particular highlight is the exhibition of a chassis with e-drive from VW. GROB not only implemented the systems for the production of the hairpin stator and rotor, as well as the final assembly of the e-axle for the MEB (Modularer Elektrifizierungsbaukasten – modular electric drive matrix) from VW, it also delivered all the production lines for machining the elementary housing parts





such as the intermediate, gearbox, and stator frames or the end shield. Alongside its expertise in the business areas of machining and assembly, GROB-WERKE has also demonstrated its successful entry into e-mobility and its ability to deliver the relevant high-volume systems.

1. access-SERIES – UNIVERSAL MACHINING CENTERS G350a & G550a
Machining an aluminum frame structure part from the aerospace sector (G350a) and high-performance cutting of steel (G550a).

2. UNIVERSAL MACHINING CENTER G350 – GENERATION 2 WITH ROBOT CELL
Continuous operation of the complete system incl. demonstration of the robot cell in combination with a G350 – Generation 2.

3. PRESENTATION AREA: GROB-NET4INDUSTRY, GROB SERVICE, GROB CUSTOMER TRAINING, GROB FINANCIAL SERVICE, AND GROB E-MOBILITY
Presentation of the comprehensive GROB service range, such as the specially developed software solutions from GROB-NET4Industry, smart service products, and innovative training concepts. Presentation of GROB's comprehensive expertise in the e-mobility sector.

4. TWO-SPINDLE MACHINE G520 WITH INTEGRATED PALLET CHANGER
2-spindle system machine with pallet changer. Demonstration of pallet changing with one raw and one finished part each of a control arm and turbocharger.

5. MACHINING CENTERS G500FS & G600F FOR FRAME STRUCTURE AND CHASSIS PARTS
Simulated machining of a subframe as well as loading and unloading by a linear gantry on the system machine G500FS. Demonstration of simulated machining of a longitudinal beam (frame structure part) on the system machine G600F.

6. TWO UNIVERSAL MACHINING CENTERS G550 – GENERATION 2 WITH LINEAR PALLET STORAGE SYSTEM (PSS-L):
Continuous operation of the entire system, which is suitable for all industries, including demonstration of the linear pallet storage system.

7. MILL-TURN UNIVERSAL MACHINING CENTER G350T – GENERATION 2 WITH ROTARY PALLET STORAGE SYSTEM (PSS-R) AND ADDITIONAL MAGAZINE (TM374)
Demonstration of gear skiving, including high-performance cutting of steel, during the continuous operation of the complete system. Presentation of threading 3.0 with TAPTOR®-Technology in cooperation with AUDI and EMUGE.

8. UNIVERSAL MACHINING CENTER G550 – GENERATION 2
Machining of a Pelton wheel from the energy technology sector.

9. UNIVERSAL MACHINING CENTER G350 – GENERATION 2
Machining of a mold insert from the tool and mold industries.

10. GROB-LOUNGE
Opportunity for interesting discussions with experts from GROB, as well as presentation of fascinating machining videos and films focusing on the extensive GROB product portfolio on a large highlight LED wall.

11. CHASSIS WITH E-DRIVE
Presentation on GROB's comprehensive expertise in the areas of machining, assembly, and e-mobility based on a VW chassis with components produced and assembled using GROB systems.

access-SERIES – G350a AND G550a
The affordable allrounder in the universal machining center business

Reduced standard equipment makes the access-series the cost-effective version of the GROB universal machining centers. It offers a short payback period with first-class machining quality, providing the most cost-effective entry into GROB's unique technology.

The access-series in its machine variants G350a and G550a is the latest addition to GROB's universal machining center product portfolio, and will be presented to the wider public for the first time at this year's EMO exhibition. Due to the streamlined standard equipment, the investment costs for the "smaller" sister models of the GROB universal machining centers are reduced by about 20 percent, with a correspondingly shorter payback period. Equipment features that are standard with the well-known universal machining centers are offered as optional extras in the access-series. This includes, for example, the chip conveyor, the high-pressure cutting fluid system, the stainless steel interior cladding, and the fluid cabinet doors.

CUSTOMIZED TO THE USER

Since not every user requires two drive units, the access-series machines have only one drive unit in the vertical Y'-axis (= off-center single drive unit, instead of a symmetrical duo-drive unit), making them the ideal, cost-effective solution for high-performance, reliable 5-axis machining centers. The technical parameters of the classic universal machining centers and the access-series are very similar, and the machine variants G350a and G550a work with the exact same precision as their sister versions. Furthermore, the access-series offers a whole range of benefits already familiar to GROB customers from the G-series. These include GROB's renowned 5-axis technology, excellent machining quality for both one-off and series production, superior reliability and productivity, and modular expandability for automation solutions

FLEXIBLE EXPANSION WITH OPTION PACKAGES

A range of option packages make the G350a and G550a extremely flexible and customizable to specific requirements. In addition to the basic machine, which can be equipped with a decentralized work area extraction system and automatic work area door, customers can also select from various options for the tool magazine, cutting fluid systems, software solutions and other accessories. The access-series also offers a number of the same unique features of GROB's well-known universal machining centers – Generation 2:

- **Optional automation solutions, such as a rotary pallet storage system (PSS-R), a part/pallet clamping system, and a pallet changer**
- **Rigid spindle axis**
- **Active cooling of heat-absorbing components/ assemblies**
- **Unique overhead machining with excellent chip fall and reduced thermal load in the part**

Some options, such as an integrated rotary version (mill-turn machining centers) or external magazine expansions are reserved for the well-known G-modules. "We are pleased that we can complement our G-module product range with the access machines, as they enable us to provide a very attractive entry-level version of our 5-axis machining centers," says German Wankmiller, Chairman of the Board & CEO of GROB-WERKE.

LINEAR PALLET STORAGE SYSTEM (PSS-L)
The new automation solution in the GROB product range

Automation solutions from GROB ensure efficient production processes and ensure optimal part handling. Fully automated technologies, such as the new linear pallet storage system, are produced in-house and can be optimally adapted to customers' specific requirements.

GROB's system machines, universal machining centers, assembly lines, and automation solutions are among the best in the world. Components, such as the pallet changer system and rotary pallet storage system (PSS-R), are all produced in-house.

Also new in the GROB production program this year is the linear pallet storage system (PSS-L), which is ideally suited as a modular system designed for stand-alone machines or for linking identical machining centers. It can be used to connect up to five machine tools to pallet storage racking with a maximum of 87 pallet storage areas. Significantly increased machine utilization results in economical production and a longer unmanned production period. Other advantages of the linear pallet storage system include high storage density with a small footprint, cost-effective initial investment, and excellent view into the work area and to the pallet storage areas.

G600F
The XXL machine in the F-series

With its compact design, spacious work area, and high machine dynamics, the G600F machining center is ideal for a broad range of automation solutions: as a stand-alone machine with manual or robot loading, through to installation in an interlinked system with direct loading via a gantry. At EMO, the G600F will be presented in an automated interlinked system or linked with a G500FS.

The introduction of the F-series in 2017 also saw the presentation of the G600F for the first time, currently GROB's largest machine variant for machining frame structure and chassis parts, as well as battery housings. It was developed for part sizes that do not fit into a G500F due to their component dimensions and machining steps. The 1,550 mm interference diameter (up to 1,750 mm with restrictions), large travel paths, a swivel head with a range of 180 degrees, optimized chip transport to the rear of the machine, and high machine dynamics make the G600F the ideal solution for complete 5-sided machining in an automated manufacturing facility. The basic version of the machine is designed for both wet and minimum quantity lubrication (MQL) machining. It can be loaded either with top loading via a GROB linear gantry or front loading by a pallet changer, swiveling changer or part pusher, and by a robot. This makes the G600F one of the proven assemblies from the G-module system.

A G600F linked with a pallet changer and a G500FS via a linear gantry will be displayed at the EMO exhibition. The G500FS will be loaded and unloaded from above by a telescopic gripper with a subframe part. With this presentation, GROB will demonstrate that the F machining centers are suitable not only for machining frame structure parts, but also as complete systemsolutions with interlinked machines.The types of subframe parts shown at EMO are becoming

increasingly important, for example in lightweight construction for newly developed automobiles. However, they pose a challenge, because they have to be machined initially as a single component on a smaller machine and then as a much larger assembly on a G600F (or G500FS).

G500FS
For heavy machining of large components

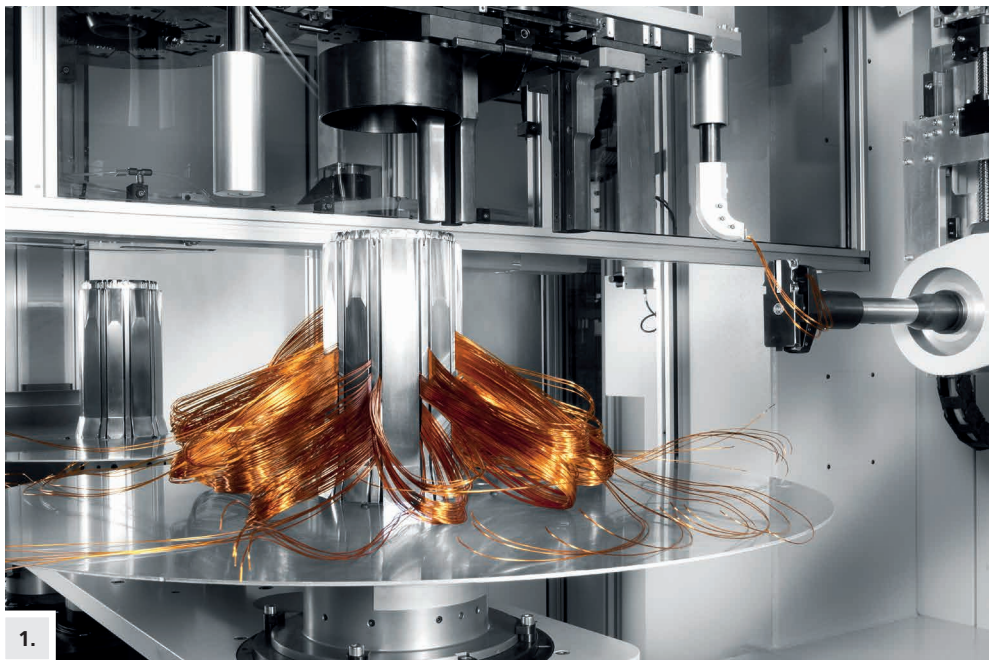
The successful machine series for frame structures and chassis parts with the "F" in the product designation has been extended with a new machine variant, the G500FS. This complements the G-module system for parts at the upper end, as it can be used to machine components up to a size of 1,500 x 900 mm.

The G500FS is a new machine variant of GROB machining centers for frame structure and chassis parts, and will be presented for the first time at the EMO 2019 exhibition. With its extra large working area and an A-axis interference diameter of 1,500 mm, it is ideally suited for machining large frame structure parts, such as subframes that require special processing with the advent of e-mobility. Parts that require 5-axis machining, in some cases long cantilevered tools, and powerful metal-cutting capacity – which can only be guaranteed by using the HSK-A100 tool interface. This makes the G500FS, a single-spindle machine that was developed on the basis of the G520, the only machine in the F-series that enables not only an extra large working area but also the use of an HSK-A100.

As the G500FS is based on the components of the G-series, it enables optimal chip fall for comprehensive machining. Its narrow bridge ensures the best possible accessibility to the underside of the part, even during 6-sided machining. A second A-axis drive makes the machine particularly rigid. It can be set up in an interlinked system for direct or indirect loading from above and from the front, as usual in the system business. Loading with robots or other loading equipment from the GROB automation portfolio is also possible.

ELECTROMOBILITY
Successful paradigm shift – established as a solid player in the e-mobility market

After more than four years of intensive research and development, GROB has established itself as the market leader in the manufacture of electrical powertrain equipment. Its product portfolio ranges from complex assembly systems for stators, rotors, and electric machines, through to assembly of the complete e-axle. The range also includes battery module assembly, the construction of a laboratory system for battery cells, and the further development of assembly systems for fuel cells. Particular focus is placed on in-house prototype production of an electric motor with hairpin technology, continuous hairpin, or insertion technology.



1.

What was regarded as simply a trend or novelty up until a few years ago has now become an established part of the automotive industry. Almost all automobile manufacturers are shifting the focus of their development work onto e-mobility, thus confirming the GROB corporate strategy defined six years ago, namely to pay special attention to the topic of e-mobility and to create a new business unit with this focus within the company. In the meantime, numerous inquiries for complete production and assembly lines for e-drive components for the automotive industry have already been implemented. These include seven assembly lines with hairpin technology, one assembly system with continuous hairpin technology, and several assembly systems for the rotor, including assembly of rotor, stator, and gear, with a total of seven lines.

Since the establishment of GROB Italy in 2016, ten systems with inserting technology (1.) have already been implemented and five systems were acquired for battery module assembly (2.). These successes show that GROB has established itself as a reliable partner for the automotive industry, offering versatile solutions in e-mobility. Another integral part of the product portfolio and, at the same time, clear proof of continuous further development of e-mobility at GROB, is the assembly system for stator production with hairpin technology in its third generation of development. For this development stage, the size of the bending system was halved to a total length of six meters, and the widening and twisting processes were combined in the system. This not only reduced the footprint, it also achieved considerable optimizations in price.

POWERFUL RESULTS FROM PROTOTYPE PRODUCTION

The successful development work is demonstrated by the early establishment of a technical application center for e-mobility, where all systems are set up at the GROB plant in Mindelheim for prototype production of stators for customers. While customer interest in hairpin technology is currently still dominant, a growing trend in stator production with continuous hairpin technology can be observed. This development is also underlined by the prototypes produced to date: GROB has approximately 1,600 units with hairpin technology, versus around 50 units with continuous hairpin technology.

FROM PRODUCTION SYSTEMS FOR E-MACHINES THROUGH TO ASSEMBLY SYSTEMS FOR ENERGY STORAGE SYSTEMS

In addition to production systems for e-machines, GROB is also increasingly concentrating on assembly systems for energy storage systems. The high demands on quality and safety intensify the technically demanding conditions of the production steps that had to be undertaken by GROB. The extremely good market response and the current confirmed orders for battery module assembly prove that GROB has successfully mastered these challenges. A technical laboratory for battery cell production is currently under construction, which will provide the basis for technical implementation and enable the timely provision of additional large-scale systems for manufacturing battery cells for the European market.

SPOTLIGHT ON OTHER INNOVATIONS

GROB continues to invest heavily in fuel cell technology and other new innovations, based on its many years of experience in production and assembly lines for e-mobility in the automotive sector. This is evidenced by its investment in an in-house testing laboratory with an electrical test stand, a geometric measuring laboratory, a CT machine, a laser welding system, and an X-ray machine. This enables GROB to undertake tests for processes with the highest technical requirements and to make immediate optimizations.

STRATEGIC REALIGNMENT OF THE COMPANY STRUCTURE

The importance attached by GROB to the paradigm shift in the automotive industry towards e-mobility is especially evident in the establishment of the "New Technologies" business unit. This unit combines GROB's complete technological expertise in the field of e-mobility, allowing it to compete in the market with maximum impact.

For an effective combination of its technical know-how, GROB-WERKE in Mindelheim is concentrating on hairpin technology and continuous hairpin with rectangular wire, while the subsidiary GROB Italy is focusing on processing round wire with the help of insertion and needle winding technology. GROB is investing a total of ten million euro in a new production plant in Pianezza, Italy, setting a major milestone for successful e-mobility. All with a targeted focus: "Shaping the future together".

2.

UNIVERSAL MACHINING CENTERS G350 AND G550
Strong market position

GROB's Generation 2 universal machining centers are recognized as high-end machining centers on the global market thanks to their compact size, axis dynamics, tool magazine capacity, and software compensation possibilities. Continuous further development has enabled GROB technicians to further improve the G350 and G550 – Generation 2 and strengthen their competitiveness.

"Pure technology in the smallest space" was its slogan for the launch at EMO 2015 in Milan. The machine width has been reduced by 18.5 percent to "the smallest space", thanks to the intelligent re-arrangement of the integrated tool magazine. "Pure technology" refers to the significantly improved dynamics, a 30 percent reduction in the idle and chip-to-chip times owing to a newly developed tool changer arm, and the increased tool capacity. The tool length has also been increased by 50 percent to 550 mm, due to a double disk magazine, which was not available in this form in the first generation. Accordingly, it is not surprising that all compensation methods and software versions for high-precision machining of different technologies, such as in the tool and mold-making or aviation industries, or for demanding machining in automotive engineering, are available on request for these machines. Furthermore, the entire GROB product range of additional components, such as rotary pallet storage systems, linear pallet storage systems, and additional tool magazines, is available to customers for the universal machining centers. In the four years since their market launch, the universal machining centers G350 and G550 – Generation 2 have not only established themselves as market leaders, but have also become trendsetters in the machine engineering industry, thanks to their unique machine concept.

UNIVERSAL MACHINING CENTER G350T WITH PSS-R AND TM374
Mill-turn machining center with high-end equipment

The mill-turn machining center with rotary pallet storage system and additional tool magazine is the ultimate high-end variant in machine tool engineering, enabling virtually any type of part machining.

The G350T mill-turn machining center – Generation 2 enables machining of parts from practically any material in just one setup. Thanks to a comprehensive range of configuration options, the 5-axis universal machining center can be perfectly adapted to the requirements of many different industries and configured for various automation solutions.

Three linear and two rotary axes permit 5-sided machining, 5-axis simultaneous interpolation, as well as GROB TRAORI Turning. The latter dynamically aligns the tool cutting edge to the contour of the turned part, taking tool length and radius into account. Consequently, a significantly longer service life is achieved and short tools can be used. With its swivel range of 230 degrees in the A'-axis and 360 degrees in the B'-axis, the machine offers the greatest possible positioning flexibility. The unique arrangement of the three linear axes minimizes the distance between the guides and the machining point (TCP), lending the machine considerable stability. GROB offers mill-turn machining centers in three machine sizes: G350T, G550T, and G750T.

INCREASED TOOL CAPACITY WITH ADDITIONAL TOOL MAGAZINE

Combined with the highly flexible additional tool magazine TM374, which can be used with both the G350T – Generation 2 and the G550T – Generation 2 for complex machining tasks, the tool capacity of the basic machine can be increased to over 500 HSK-A63 tools. As a further plus, the additional magazine can be loaded during machining.

Tool and machine management is carried out via an industrial control system with screen and keyboard. And because the mechanical, fluid, and electrical interfaces on the machine are included as standard, the TM374 can be retrofitted on site.

ROTARY PALLET STORAGE SYSTEM FOR OPTIMIZED MACHINE UTILIZATION

By adding GROB's proprietary rotary pallet storage system, the universal machining center can be expanded into a flexible production cell, offering an ideal introduction to automated and highly efficient production. An innovative pallet changing device enables fast double change when using two pallets. The rotary pallet storage system offers numerous benefits, such as a significant increase in machine utilization, a longer unmanned production period, simultaneous loading and unloading of the pallets during machining, high storage density with a small footprint, and simple retrofitting to existing machines.

THERMAL SPRAYING
GROB improves thermal spraying technology

The recently developed atmospheric plasma spraying (APS 2) technology has taken thermal spraying at GROB to new heights. The application rate for the spraying process has been increased almost 2.4-fold. This spraying technology has significantly improved the friction values of the piston inside the cylinder bore.

Although the mainstream has opted for e-mobility, combustion engine technologies have not dropped by the wayside. On the contrary, the additional requirements have in fact continued to increase. While the discussion about particulate emissions from vehicles has indeed been slightly overshadowed by the issue of NOX emissions from diesel engines, particulate emissions from combustion engines, tire wear and braking abrasion remain in the limelight. This is one of the main reasons why, several years ago GROB, began its research into how the piston/cylinder friction and hence the microstructure of the cylinder faces in the combustion engine can be tribologically improved.

In collaboration with Volkswagen and Switzerland's Oerlikon Metco, the engineers at GROB have taken another important step in the development of the APS 2 process. APS 2 is a technology for atmospheric plasma spraying that involves applying an extremely thin layer of steel onto the cylinder face.

This layer has excellent thermo-mechanical characteristics, is wear-resistant and low friction and creates the ideal basis for low-consumption petrol and diesel engines. GROB has successfully investigated the prerequisites to be fulfilled by the layer microstructure in order to meet the future requirements for harmful particle emissions caused by the engine's oil consumption. The APS 2 process is already employed by renowned automobile manufacturers in the production of 4- and 8-cylinder engines.

GROB SERVICE
PCU retrofit: The cost-efficient control system upgrade

In addition to traditional GROB service products, the PCU retrofit (Power Control Unit – machine control system) is becoming increasingly important. Generally, it involves extending the service lives of older machines with PowerLine control systems. The installation of an industrial PC upgrades these machines to the latest standard.

GROB's customer service will present its PCU retrofit at the EMO exhibition, in addition to a wide range of new and improved service products. The PCU retrofit replaces the old control system with a new industrial PC running the Windows 10 operating system, to prepare the GROB machine for the coming years and increase IT security. The PCU retrofit is suitable for all GROB machining centers, linear gantries, and transfer lines with PowerLine control system, and offers customers a number of benefits:

- **Significantly less expensive than a complete upgrade from a PowerLine to a SolutionLine control system**
- **Maximum IT security thanks to the Windows 10 operating system**
- **Can be combined with the "10-year spare parts availability" service**

- **Complete software preparation with a test bench performance check before delivery**
- **Implementation of the PCU retrofit at the customer's site within one day**

But what happens if an electrical component fails in one of the older machines, or the electrical spare parts, most of which have been discontinued by the manufacturer, are no longer available or only at extremely high cost? In these cases, GROB guarantees its customers that the appropriate spare part can be supplied as part of the "10-year spare parts availability" service. The basis for this is a list of relevant electrical spare parts agreed between the customer and GROB, which are then held by GROB for the desired time period. Furthermore, GROB guarantees the customer fixed prices for replacements and a warranty period of eighteen months, for the entire term. If an electrical component fails, the customer will receive a spare part that has been tested right before shipping, EU-wide and within 24 hours.

EXPRESS DELIVERY – THE NEW DELIVERY SERVICE FROM GROB

In the event of machine outages, the new express parts delivery from GROB ensures unbeatably short delivery times and reduces downtime to a minimum. With GROB's flexible express production, any required spare parts can be manufactured with top priority and delivered within the shortest possible timeframe, subject to an express surcharge. The specific delivery time depends on the complexity of the individual component.

NEW SERVICE FOR PREVENTIVE MAINTENANCE AND INSPECTION

The "preventive maintenance and inspection" services for universal machining center customers have been completely redesigned and now offer the greatest possible flexibility and customer focus. Conventional standard preventive maintenance has been replaced by four different modules (inspection, wear part replacement, motorized spindle geometry, machine geometry), to be able to respond to individual customer requirements. Customers can then select specific modules to compile their own tailored preventive maintenance solution.

GROB[4]CARE ONLINE SHOP GAINING POPULARITY

The GROB[4]Care online shop is a tried-and-tested service that enables interactive spare parts research and ordering using a convenient online portal for maintenance, scheduling, and purchasing. Customers can use the online shop to check the availability of spare and wear parts in real time using stock queries, and reserve them for 48 hours. GROB[4]Care can be easily integrated into the customer's ERP system. In addition, individual authorization and approval processes can be mapped, and different rights and budgets can be assigned. Several new functions in GROB[4]Care will be presented at the EMO exhibition. This includes "My Stock", a platform geared toward customers with individual spare parts stocking (SPS), who can now view their specific spare parts inventory in the online shop.

GROB-NET4INDUSTRY
Committed to connectivity and integration

GROB-WERKE has been working intensively on the digitalization and development of new solutions for production optimization for several years. In this age of Industry 4.0, the modular GROB-NET4Industry software applications are ideal to network and digitalize production processes across all plants, making manufacturing even more efficient.

The GROB-NET4Industry product range has been continuously expanded over the years. The applications allow the areas linked directly and indirectly to machining operations to be organized in a way that optimizes the capacity utilization of top-quality and high-precision machine tools. They link all areas of production, from production planning, monitoring, and analysis, to visualizing processes during part machining, through to proactive service and maintenance. Some of the current highlights of the portfolio include the new functions and enhancements of the GROB4Pilot, GROB4Track, GROB4Analyze Advanced, and GROB4Line applications.
The interactive and multifunctional **GROB4Pilot** machine control system makes everyday operation intuitive and convenient for the user, and is available as standard with control systems from SIEMENS and HEIDENHAIN.

GROB4Track can be used to monitor ball screws, which are subject to particularly heavy loads. These components take a long time to replace in the event of a defect, which results in a downtime of several hours for the machine or system. Thanks to the automated analysis function in GROB4Track, the machine status is known at all times and unscheduled downtimes can be avoided. This allows you to precisely plan preventive maintenance work and initiate spare part orders at the right time. Enhancements for monitoring the motorized spindle that detect tool wear during ongoing processes and enable appropriate quality control will be presented for the first time at this year's EMO; as a result, this control function can now also be used for other machine components.

The **GROB4Analyze Advanced** application – a tool for evaluating and displaying historical data for the continuous improvement process (CIP) – has been enhanced with the addition of many new functions. As well as the machine report for use on the shop floor, up to ten machines can now be compared in different views, redefining transparency in production.

The functions of remote machine control and acknowledgment of simple error messages have been added to the **GROB4Line** module – an application for the live display of machine status and notification of downtimes on a smartphone. A gateway is used to secure the transmission of data and its regulation. Customers can specify exactly which data should be transmitted and when, and which data should not be transmitted. This ensures maximum security and enables the use of cloud-based services for every industry. Customers from all industries and sectors can view the entire range of software solutions at EMO. All possibilities will be presented, from a small universal machining center for every purpose, to a cell supported by a robot, to an interlinked system with the highest degree of automation.

SERVICE – „E-LEARNING@GROB“
GROB4Pilot operator training – first digital lighthouse project

The requirements for vocational training and further education have changed significantly in the course of digitalization and Industry 4.0. As part of the "e-Learning@GROB" project, GROB developed digital, job-specific training programs to train both its own employees and its customers for Industry 4.0.

The customer training business area at GROB has been focusing on qualification and professional development since the foundation of the company. Each year, more than 2,000 customers around the world are trained in numerical control programming, machine operation, and mechanical and electrical maintenance. In the past, the sessions were held exclusively in the training rooms at GROB-WERKE, or at the customer's premises in the form of face-to-face training. However, due to changing conditions, such as ever more complex products, globalization, shortened product life cycles, and market dynamics, the need for customer training, and its importance, have increased dramatically in the past few years. As a result, GROB approached digital learning in a systematic and structured way. With the aim of being able to offer each customer attractive and appropriate training with optimum quality and effectiveness, the idea of preliminary preparation courses, "e-Learning@GROB", was born.

It offers the significant benefit that workplace learning is possible in the "moment of need", as well as a great deal of flexibility through learning that can be completed at anytime, anywhere. Digital learning is one of the decisive factors for GROB's success in the future.

PREPARING FOR FACE-TO-FACE TRAINING SESSIONS WITH "E-LEARNING@GROB"

"e-Learning@GROB" is a central training portal where digital learning content is disseminated to customers and employees. This scalable learning content serves to create a central knowledge base and gives customers and employees the opportunity to prepare themselves independently for subsequent face-to-face training sessions (module 2) and to deepen their knowledge as required.

This is then followed by module 2, a training session at GROB's premises that lasts several days and aims to deepen basic knowledge.

LIGHTHOUSE PROJECT GROB4PILOT OPERATOR TRAINING INSTALLED

As an innovative lighthouse project, GROB customer training has now implemented the first digital learning unit in the machine operation business area, the GROB4Pilot operator training, into the learning portal. This blended learning concept is considered to be both crucial training for creating a homogenous level of knowledge for participants by imparting basic knowledge, and theoretical preparation for the face-to-face training session.

"In the past, we have always received good feedback on our high level of professional competence and our willingness to impart this specialist knowledge to our customers," explains GROB customer training leader, Walter Tuch. "With the 'e-Learning@GROB' project, we have opened a whole new chapter in learning, which not only puts us in a good position in relation our competition, it also proves our leadership in terms of customer training and customer relations."

Following the successful evaluation of the experiences gained in this pilot project, the digital learning content will be rolled out successively to all GROB locations worldwide, while simultaneously expanding the high-quality digital training concepts for GROB customers.

GROB-WERKE GmbH & Co. KG
Mindelheim, GERMANY
Tel.: +49 8261 996-0
E-mail: info@de.grobgroup.com

GROB SYSTEMS, Inc.
Detroit, Michigan, USA
Tel.: +1 419 358 9015
E-mail: info@us.grobgroup.com

GROB SCHWEIZ AG
Steinhausen, SWITZERLAND
Tel.: +41 7986 92941
E-mail: info@ch.grobgroup.com

GROB MACHINE TOOLS (CHINA) Co., Ltd. Shanghai Branch
Shanghai, P.R. CHINA
Tel.: +86 213 763 3018
E-mail: shanghai@cn.grobgroup.com

B. GROB DO BRASIL S.A.
São Paulo, BRAZIL
Tel.: +55 11 4367 9100
E-mail: info@grob.com.br

GROB MEXICO S.A. de C.V.
Querétaro, MEXICO
Tel.: +52 442 713 6600
E-mail: info@mx.grobgroup.com

GROB POLSKA Sp. z o.o.
Poznań, POLAND
Tel.: +48 72 864 6000
E-mail: info@pl.grobgroup.com

GROB JAPAN K.K.
Yokohama, Kanagawa, JAPAN
Tel.: +81 454 143 390
E-mail: info@jp.grobgroup.com

GROB SYSTEMS, Inc.
Bluffton, Ohio, USA
Tel.: +1 419 358 9015
E-mail: info@us.grobgroup.com

GROB MACHINE TOOLS U.K., Ltd.
Birmingham, GREAT BRITAIN
Tel.: +44 121 366 9848
E-mail: info@uk.grobgroup.com

GROB HUNGARIA Kft.
Győr, HUNGARY
Tel.: +36 96 517 229
E-mail: info@hu.grobgroup.com

GROB KOREA Co., Ltd.
Seoul, SOUTH KOREA
Tel.: +82 318 064 1880
E-mail: info@kr.grobgroup.com

GROB MACHINE TOOLS (CHINA) Co., Ltd.
Dalian, P.R. CHINA
Tel.: +86 411 3926 6488
E-mail: dalian@cn.grobgroup.com

GROB BENELUX BV
Hengelo, NETHERLANDS
Tel.: +31 74 349 0207
E-mail: info@nl.grobgroup.com

GROB RUSS-MASCH GmbH
Moscow, RUSSIA
Tel.: +7 495 795 0285
E-mail: info@ru.grobgroup.com

GROB VIETNAM L.L.C.
Haiphong, VIETNAM
E-mail: info@vn.grobgroup.com

GROB ITALY S.r.l.
Buttigliera Alta (TO), ITALY
Tel.: +39 11 934 8292
E-mail: info@it.grobgroup.com

GROB FRANCE S.A.R.L
Senlis, FRANCE
Tel.: +33 375 290 470
E-mail: info@fr.grobgroup.com

GROB MACHINE TOOLS (CHINA) Co., Ltd. Beijing Branch
Beijing, P.R. CHINA
Tel.: +86 106 480 3711
E-mail: beijing@cn.grobgroup.com

GROB MACHINE TOOLS INDIA Pvt., Ltd.
Hyderabad, INDIA
Tel.: +91 404 202 3336
E-mail: info@in.grobgroup.com

www.grobgroup.com

PUBLICATION DETAILS – GROB INTERNATIONAL

PUBLISHED BY
GROB-WERKE GmbH & Co. KG, Mindelheim

RESPONSIBLE FOR CONTENT
MARKETING & PR, Telephone +49 8261 996-0,
info@de.grobgroup.com

TEXT
Robert A. Thiem, Agentur T M E, www.tme.at

DESIGN AND IMPLEMENTATION
GROB-WERKE GmbH & Co. KG, Mindelheim

PHOTOS
GROB-WERKE GmbH & Co. KG, Mindelheim
Christian Schneider Photography
Ulrich Wagner
Robert A. Thiem, Agentur T M E
Shutterstock Inc.

TRANSLATION
Transline Gruppe GmbH, www.transline.de

PRINTED BY
Holzer Druck und Medien
Druckerei und Zeitungsverlag GmbH + CO. KG, Weiler im Allgäu
www.druckerei-holzer.de

Note regarding gender: We place great value on diversity and equal treatment. For the purpose of readability, reference to both genders has been omitted.