INDUSTRY 4.0
The fourth industrial revolution has begun: On the way to the factory of the future

DEBUT
Saves costs and protects the environment: eHydroCOM, the control system for reciprocating compressors

SUPERB PERFORMER
HOERBIGER TriVAX flex: The electrohydraulic valve actuator proves itself in practical applications
The feature topic of the latest issue of our customer magazine HOERBIGER@MOTION is Industry 4.0.

At first glance, Industry 4.0 can seem problematic for companies with complex workflows. So you may ask yourself why HOERBIGER, as component manufacturer, is focusing on this topic.

By themselves, components, systems and services cannot drive Industry 4.0 – not even when the components define the performance of a machine through their unique features. I am very much convinced, however, that our developments and system solutions must be tailored to the requirements of the factory of the future. We must know which direction technology will take in the coming years if we want to optimally meet our customers’ needs in the oil, gas, and process industries; this is even more true for those in plant and machinery manufacture. So we are keeping a very close eye on the technological trends in our market.

During the summer of 2014, we invited engineers, developers as well as operations and IT experts from all HOERBIGER locations to Stuttgart to share their knowledge and exchange experiences. We were able to recruit several seasoned experts in the topic of Industry 4.0 as speakers for the 2014 HOERBIGER Production Conference. I found their presentations to be very interesting, and so it is of particular importance to me personally to provide an even broader communication platform to these inspiring presentations with HOERBIGER@MOTION.

Reports on the latest innovations and exciting customer stories are a must in HOERBIGER@MOTION. I can assure you that we have once again prepared several extremely engaging topics in this issue of HOERBIGER@MOTION. First, accompany us to the 2014 EuroBLECH held in Hannover. Our electrohydraulic TriVAX® flex valve actuators developed by HOERBIGER for several months now. Wolfgang Leppert and Ralf Baumgarten were on site for HOERBIGER@MOTION to learn about the particular requirements that valves are subjected to in Germany’s largest pipeline network.

As you can see – we have endeavored to again bring you interesting reading material in this issue of HOERBIGER@MOTION. I hope that you find it an enjoyable read.

LADIES AND GENTLEMEN,

WE MUST KNOW WHICH DIRECTION TECHNOLOGY WILL TAKE IN THE COMING YEARS IF WE WANT TO OPTIMALLY MEET OUR CUSTOMERS’ NEEDS.
FEATURE: INDUSTRY 4.0

At this year’s HOERBIGER Production Conference in Stuttgart, employees from 19 HOERBIGER companies exchanged experiences and ideas with renowned production experts from science and industry about the challenges of a competitive and sustainable manufacturing operation.

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News on HOERBIGER projects in Austria, Germany, China—and from the digital world.

HORIZON
Industry 4.0: The future of production, where manufacturing facilities and logistics systems self-organize, is the hot topic in science and industry.

Text: Jens Geisel   Photography: KD Busch, Fotolia, dpa, Getty Images, iStockphoto
DRIVEN BY GLOBALIZATION, PRODUCTION HAS BECOME A CRITICAL FACTOR FOR SUCCESS.

THE FOUR INDUSTRIAL REVOLUTIONS

1. The use of water and steam power enables the introduction of mechanical production equipment. In 1785, Edmund Cartwright invents the power loom.

2. The use of electricity and the division of labor lead to the mass production of goods. Assembly-line type production is initially introduced in Cincinnati’s industrial slaughterhouses around 1845.


4. Based on cyber-physical systems and the Internet of Things, the Smart Factory is created, featuring high agility, resource efficiency and ergonomics.
HOERBIGER recognized this trend early on and launched a variety of initiatives to promote the sharing of knowledge on production-related topics within the Group.

The annual Production Conference is a vital part of this process. This year, host Hannes Hunschofsky, Executive Vice President of Global Operations Compression Technology, opened the conference to participants from the entire Group for the very first time. 86 employees from 19 HOERBIGER companies shared ideas and experiences on the challenges of competitive and sustainable manufacturing during the three-day event held in Stuttgart, the capital of the state of Baden-Württemberg.

Hunschofsky commented: “Extensive exchange of experiences moves us forward on our way toward Operational Excellence. We have made HOERBIGER’s manufacturing operation more flexible and global over the past few years, but are still a long way from our goal. We must not rest on our laurels now, and need to systematically identify and take advantage of optimization potential.”

In trying to overcome challenges, it proves useful at times to move away from a strictly insider perspective and gain inspiration from the outside. HOERBIGER therefore invited renowned operations experts from science and industry to speak at this year’s Production Conference. They have made a name for themselves through trade publications and presentations on issues surrounding Industry 4.0.

After the conference, HOERBIGER asked three keynote speakers to turn their presentations into guest articles to be featured in HOERBIGER@MOTION. With this, HOERBIGER is taking this exciting topic on the future of manufacturing to a broader audience.

In his article “Taming Complexity,” Prof. Dr.-Ing. Werner Bick elaborates on how Lean principles and Industry 4.0 work together to boost the efficiency of the corporate organization and increase effectiveness in satisfying customer demands. In the article entitled “The Human Factor,” Univ. Prof. Dr. Friedrich Bleicher highlights some of the changing expectations of those employees who will increasingly assume the role of system operators. Based on a practical example, Johann Hofmann’s “The Network Principle,” demonstrates how Maschinenfabrik Reinhausen headquartered in Regensburg networked machines, plants and systems, implementing a central concept of Industry 4.0.

Industry 4.0

In academic discourse, the term ‘Industry 4.0’ was coined to denote the Fourth Industrial Revolution. Following the mechanization of manufacturing through hydrodynamic power and the steam engine (first industrial revolution), the introduction of mass production through the assembly line (second industrial revolution), and the automation of manufacturing processes through computers and robots (third industrial revolution), the concept refers to the “informatization” of production.

The factory of the future – as is idealized in Industry 4.0 – is so agile that, like in mechanical manufacturing, each order can vary; however, unlike with highly specialized mass production, this customization would not incur additional cost.

This requires a production environment in which manufacturing facilities and logistics systems organize on their own, without human intervention. The technological foundation is formed by cyber-physical systems that use the “Internet of Things” – where products in various processing stages become data carriers themselves and communicate with each other.

INTELLIGENT INTERCONNECTION AT ALL LEVELS WILL PLAY AN OVERRIDING ROLE.

Kicking off the HOERBIGER 2014 Production Conference: host Hannes Hunschofsky, Executive Vice President of Global Operations Compression Technology, welcomes the attendees and presenters to Stuttgart. “Extensive exchange of experiences moves us forward on our way toward Operational Excellence.”
The most dangerous predator in the globalization jungle is not a company—it is complexity. Fleeing is futile, as complexity reaches companies both at the macro level, for example through the progressive integration of national economies and production networks, and at the micro level, in which each individual factory has to account for time, cost, and quality. So the question is: how do you tame complexity? The latest developments in “Industry 4.0” provide answers. The vision for the “fourth industrial revolution” is of an environment in which people, machines, and production and logistics systems are networked both internally and externally and communicate with each other. While this revolution depends on the development of specific technologies, there are strong indications that this trend will significantly accelerate in the coming years.

Companies should take the time now to examine the maturity of their Industry 4.0 concept including related issues such as technology, organization and staffing. It is also helpful to combine Industry 4.0 with proven, traditional methods of production and value creation control. Lean principles in particular form an excellent basis for a new, digital interconnectedness between companies, customers, suppliers, and partners.

**LEAN AND INDUSTRY 4.0—SHORT LEASH FOR COMPLEXITY**

Lean and Industry 4.0 principles share the common trait of searching for ways out of the rapid increase of complexity in global economic cycles. The key difference lies in the approach. Lean reduces complexity by achieving simple solutions with simple means. It strives for a high level of standardization, breaking complexity down into its individual components. Lean follows the guiding theme of continuous improvement—on the one hand, in the continual identification and prevention of waste, and on the other hand, in the optimal interaction of all players such as suppliers and customers. Lean primarily boosts the efficiency of the corporate organization. Industry 4.0 allows a company to not only boost efficiency, but also increase effectiveness in responding to customer demands. Business and production processes are no longer static in Industry 4.0, but are dynamic and optimizeable in real time. This is made possible by networking all levels and digitally mapping all elements of the value chain using IT tools such as cloud solutions, sensors or machine-to-machine (M2M) modules. This interconnectedness is created both at the vertical and horizontal level. Vertical connections are established by production planning and control systems, for example, for superordinate planning. They indicate when the factory is to produce which products or when which orders are to be distributed to which machines. Conversely, horizontal networking improves the operational workflow from product design to production to customer services. It is ascertained in this process who works best with whom and how, and who requires what information from whom at which point of the process.
From the user’s point of view, Industry 4.0 primarily reduces complexity, consequently supporting Lean and providing greater transparency. This can be helpful in further reducing waste or for managing international locations. At the same time, the technological advancements continually provide new approaches for the most efficient use of resources.

**FIVE RULES FOR COMPLEXITY ‘TAMERS’**

Every company must find its own way to combine these two approaches. Keep in mind, however, that the goal should always be to optimally grasp and meet the customers’ needs. Here, data and information are key to success. The more detailed the knowledge is about machine output and the more efficient use of tools or chronological flows at the workplace, the better production can be adapted. Still, lean and stable processes are the prerequisite for, and not the consequence of, Industry 4.0. So anyone who wants to tame “complexity” should observe five rules when integrating Lean and Industry 4.0:

1. **Think long-term and act accordingly.**
   Corporate management should formulate the production strategy and targets with a long-range perspective, and also be willing to make appropriate investments for new technologies in the necessary places. Moreover, management must systematically review and safeguard all targets.

2. **Take one step at a time.**
   Doing things step-by-step makes change processes manageable. For example, manufacturing companies should never network their machines and change their production technology at the same time.

3. **Promote only lean processes.**
   Poor processes remain poor, even when you automate them – in fact they just become more expensive. Lean should form the foundation for all further improvements.

4. **Integrate your employees.**
   In all processes, employees are the most valuable source for improvement chances – after all, they have the greatest flexibility when it comes to implementing changes. IT should support the employees in the best possible way – not vice versa.

5. **Converge the physical world with the digital world.**
   The physical world is represented by products, machines, transport systems, etc., all of which must be able to digitally communicate among themselves. This requires uniform semantics, standardized interfaces, and an IT infrastructure that is tailored to the specific requirements.

**LEAN PRINCIPLES PROVIDE GREATER TRANSPARENCY.**
Manufacturing companies, confronted with globalized markets and fierce competition, feel the pressure of increasing efficiency in the value-adding process chains more than ever. This includes all operational services from receipt of the order to shipment of the products. Products themselves are becoming increasingly individual and tailored to the particular customer’s needs to be able to meet rapidly changing societal demands and requirements of new markets. New products are often marked by steadily growing complexity in terms of the geometric shape or precision specifications; tailored customization leads to diminished lot sizes in production. In addition to the requirements needed for sustainable production, this also poses challenges for reconfigurable, scalable and flexible manufacturing systems.

Future production systems will place more focus on the human factor than in the past. The operation and upkeep of highly complex manufacturing systems, safety-relevant matters, and workplace design – in particular man-machine communication – will become increasingly important. Also important are ergonomics and the efficient use of man power. Employees will be faced with a markedly different range of tasks in the production operation of the future. In addition to process-specific know-how, situational decision-making capability will become ever more crucial.

People in production will more and more assume the role of system operator and move away from handling simple activities. This will necessitate new and significantly changed requirements in regard to the workplace – and consequently education and training. In the form of application-oriented programs in training factories or IT assistance systems for production. Training and continuing education will also continue to gain importance in large part due to longer working lives.

Until just a few years ago, experts were painting the scenario of ever scarcer energy resources and significantly rising energy prices. The exploration of unconventional oil and gas deposits, such as shale gas, and the extensive use of alternative energy sources, such as wind and solar energy, have caused a clear shift in the energy supply situation in a relatively short time. Still, energy demand and the efficient use of resources are still considered among the key success factors. The conditions in the raw materials sector, in contrast, continue to tighten. New efforts for closed material cycles are necessary to counteract the worsening shortage of raw materials.

This challenging scenario demands innovative solutions along the entire chain ranging from product design to the alignment of manufacturing processes. More emphasis will be placed on the development and use of new materials. This will also open up new opportunities and room for innovative solutions in product development as well as in manufacturing.

**THE HUMAN FACTOR**

It is not only technology that is transforming; people will also be faced with significantly changing requirements in regard to the workplace, education and training. In the future, people in production will more and more assume the role of system operator and move away from handling simple activities.

**Text:** Univ. Prof. Dr. Friedrich Bleicher

**PEOPLE IN PRODUCTION WILL MORE AND MORE ASSUME THE ROLE OF SYSTEM OPERATOR.**
example, include the integration of a grinding or laser machining step, in addition to the technological expansion such as tuning, milling, or drilling. Laser machining can be used for material ablation and heat treatment. Some machine manufacturers have recently implemented generative manufacturing processes on conventional machine platforms. The possibility of repurposing machines is changing the structure of manufacturing flows. Whereas previously a component would pass over multiple machines for particular work steps – a division of labor, so-to-speak – in the future, multiple production steps can be combined into one machine, in a single chucking.

Changes in technology prompt the adaptation of the manufacturing flow and with it, of the entire production organization, including logistics. Crucial for success will be the automated loading of machines that take into account different lot sizes, as well as workpiece and product variants. Two aspects will hallmark the new versatile production world: flexibly adaptable solutions that utilize new interface options in the controllers, and safety engineering, which includes a broad deployment of sensors and IT technologies that supplement traditional safety systems. Innovation in manufacturing engineering today is described by the term Industry 4.0 or the Fourth Industrial Revolution. Such a revolution is not be expected any time soon. However, in the short term, there will be intensified use of control signals and measurement values, which will be generated by a broader deployment of sensor systems in manufacturing facilities. The information incurred during the brief time intervals of the interpolation cycle of machine tools yields enormous volumes of data. Considerable development efforts are still needed to be able to purposefully make use of this data in the future. Condensing and using data to monitor the condition of a machine’s capacity, as well as to determine the stability of production processes and manufacturing quality, will be key to the production of the future.

Cross-linking this information is important when the goal is to apply data from one production step to influence a downstream operation. The comprehensive use of networked data for production planning offers the chance to develop new strategies for increasing efficiency and lowering turnaround times. In the future, control systems of digital production environments will use real-time data for detailed planning. This is where we come full circle with virtual production systems, such as simulation tools, which even today enable excellent forecasts on processes to be made. The convergence of data and functions from the real world and the virtual world, also summarized under the umbrella term “cyber-physical production systems,” allows for production optimization, and improves forecasting power. These technologies hold immense potential, especially when the objective is to achieve zero-defect production with a lot size of one, and processes cannot be tested because of a lack of available blanks.

In order to control the complexity of these innovation trends, when it comes to implementation, it is recommended to proceed in defined, incremental steps. It is probable that the next generations will speak of a technological revolution when referring to Industry 4.0.
THE INCREASE IN COMPLEXITY WAS ALMOST IMPOSSIBLE TO MANAGE WITH CONVENTIONAL SYSTEMS.

As a world market leader in the regulation of power transformers, Maschinenfabrik Reinhausen – which was founded in 1868 as a family business and is headquartered in Regensburg – manufactures a wide range of high-quality components with a large number of variants and small lot sizes. To further increase product quality and achieve advantages in NC programming, the company devised the plan to network all its machines, plants and systems as early as 1990. The primary goal, to establish a manufacturing environment in high-wage Germany that would be internationally competitive even in the future. The objective of the interconnection project was to overcome a key obstacle. Between 1980 and 2010, the data complexity in Maschinenfabrik Reinhausen’s machining operation had been steadily increasing. This complexity was almost impossible to manage with conventional systems. A new approach was to deliver decisive improvements. It gave rise to the concept of an intelligent data hub for the shop floor featuring a number of assistance systems that were powerful enough to noticeably increase the efficiency of the manufacturing process, yet implemented in such a way that employees in production can easily handle it. It took an expert team of Maschinenfabrik Reinhausen 25 years of detailed work to develop an in-house Manufacturing Execution System (MES). Right from the start, it was geared toward the requirements of practical environments and included groundbreaking functions for machining: MR-CM®.

THE NETWORK PRINCIPLE

Over many years of detailed work, Maschinenfabrik Reinhausen developed an in-house Manufacturing Execution System.
Efficiency, reliability and low-noise operation of systems used for sheet metal working machines were the highlight of HOERBIGER’s trade show presentation at the 2014 EuroBLECH in Hanover. Innovative focal points included the latest design of the electrohydraulic ePrAX® actuator for press brakes and the production model of the HOERBIGER Laser Gas Regulator.

Text: Ludwig Schönefeld  Photography: Klaus Fricke

Power and Precision for Sheet Metal Working

EFFICIENT, RELIABLE AND LOW-NOISE

The EuroBLECH is one of the leading international sheet metal working technology exhibitions. In 2014, it drew close to 60,000 visitors. The atmosphere was overwhelmingly positive. “Our eight halls were extremely well attended. The exhibitors reported a great number of international contacts and pleasing sales figures,” explains Nicola Hamann, Managing Director of Mack Brooks Exhibitions, the organizer of the trade show. The newly designed HOERBIGER booth providing over 1700 square feet (160 square meters) of space was also heavily frequented.

HOERBIGER EPRAX®, THE QUIET POWERHOUSE

When it comes to heat and noise development, the EuroBLECH represents a stress test for exhibitors and visitors. From October 21 to 25, 1,573 exhibitors from 38 countries presented their portfolios in the halls on almost 950,000 square feet (86,500 square meters). Every day there were opportunities to experience live demonstrations of any number of machines – stamping, pressing, laser cutting, waterjet cutting and fluid cutting equipment: industrial machinery ambience at its best, except for the attendant waste heat and noise. This was arguably one of the reasons why the HOERBIGER ePrAX® actuator scored well. The noise level was minimized in the latest design of the electrohydraulic press actuator, ensuring a quieter atmosphere in the sheet metal workers’ shops.

INTELLIGENT COMBINATION OF ELECTRICAL AND HYDRAULIC SYSTEMS

Automation technology is about precision, speed and power – especially when working sheet metal. When OEM providers and end users invest in actuator systems for press brakes,
key criteria are simple and fast installation as well as easy maintenance and operation. With the ePrAX®, HOERBIGER offers a compact yet powerful actuator that meets the needs of the market. The electrohydraulic powerhouse paves the way for new possibilities for machine developers. End users benefit from marked productivity increases in manufacturing.

“Two years ago, we surprised the trade audience at the EuroBLECH with our first-generation electric actuator,” explains Daniel Schmitt, Head of the Compact Motion Technology Business Segment of HOERBIGER Automatisierungstechnik GmbH in Altenstadt, Germany. “This year, the reliability of the perfect blend of electric and hydraulic systems takes center stage.” Feedback from the trade show audience and OEM manufacturers shows that decision makers in the sheet metal working industry are willing to rethink their position, following the clear trend toward electric actuators over the past few years, many market players now appreciate electro-hydraulic solutions or even revert entirely to hydraulics.

By developing the ePrAX®, HOERBIGER has made a system solution available that ideally blends the benefits of electrical actuation and hydraulics. Actuator systems are being re-thought – the electrohydraulic system overcomes the weaknesses of electrical and hydraulic systems, and instead combines their strengths.

POWERFUL AND DURABLE TECHNOLOGY

In contrast to an all-electric actuator, the HOERBIGER ePrAX® is powerful and durable, thanks to hydraulics. The compact, closed design features no oil hoses, assuring clean and leak-free operation. Another central advantage of the latest generation of these eDrive actuators is the ease of handling during installation and maintenance. “Eight screws and a few cables – that’s all our customers are required to install for the press brake, for example. It couldn’t be easier,” explains Daniel Schmitt. “The intelligent electrohydraulic system draws its strength from its oil, which is not visible to the user, and its operation is powerful, fast, environmentally sound, energy-efficient as well as highly economical.”

The maintenance interval has also been optimized and extended to more than three years, thanks to the compact, closed construction in conjunction with permanent lubrication.

PASSED THE PRACTICAL TEST

The ePrAX® system, which was unveiled to the expert community for the first time at the EuroBLECH in 2012, has already proven its worth in practice for renowned machine builders. With the ePrAX®, HOERBIGER has already demonstrated its capabilities. “The intelligent electrohydraulic system draws its strength from its oil, which is not visible to the user, and its operation is powerful, fast, environmentally sound, energy-efficient as well as highly economical.”

The maintenance interval has also been optimized and extended to more than three years, thanks to the compact, closed construction in conjunction with permanent lubrication.

The press brakes equipped with the ePrAX® actuator so far use bending forces of up to 110 tons. “We are now working on expanding our drive portfolio for machines with bending forces as high as 250 tons,” Daniel Schmitt explains. “The beam can be moved precisely with strokes of up to 280 mm at speeds of up to 230 mm/s in rapid feed motion. The operation bends sheet metals at approximately 10 mm/s.”

The ePrAX® system, which was unveiled to the expert community for the first time at the EuroBLECH in 2012, has already proven its worth in practice for renowned machine builders in the sheet metal working industry. In addition to the Multi-Press 110, which is made by German provider EHT and has already been on the market for the first time at the EuroBLECH in 2012, has already proven its worth in practice for renowned machine builders. With the ePrAX®, HOERBIGER has already demonstrated its capabilities. “The intelligent electrohydraulic system draws its strength from its oil, which is not visible to the user, and its operation is powerful, fast, environmentally sound, energy-efficient as well as highly economical.”

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The press brakes equipped with the ePrAX® actuator so far use bending forces of up to 110 tons. “We are now working on expanding our drive portfolio for machines with bending forces as high as 250 tons,” Daniel Schmitt explains. “The beam can be moved precisely with strokes of up to 280 mm at speeds of up to 230 mm/s in rapid feed motion. The operation bends sheet metals at approximately 10 mm/s.”

50 percent clearly put the hybrid press brakes unveiled at the EuroBLECH ahead of traditional hydraulic solutions.

The compact, closed design features no oil hoses, assuring clean and leak-free operation. Another central advantage of the latest generation of these eDrive actuators is the ease of handling during installation and maintenance. “Eight screws and a few cables – that’s all our customers are required to install for the press brake, for example. It couldn’t be easier,” explains Daniel Schmitt. “The intelligent electrohydraulic system draws its strength from its oil, which is not visible to the user, and its operation is powerful, fast, environmentally sound, energy-efficient as well as highly economical.”

The maintenance interval has also been optimized and extended to more than three years, thanks to the compact, closed construction in conjunction with permanent lubrication.

THE CORE: EXTREMELY PRECISE PIEZO PROPORTIONAL VALVES

Extremely precise, electrically piloted proportional valves, in conjunction with three integrated gas selection valves, form the core of the Laser Gas Regulator. “Weighing just a few grams, the piezo actuator switches extremely quickly, within fractions of a second, and controls the gas supply with high precision,” explains Dr. Jochen Schaible, Head of the Technical Competence Center of HOERBIGER Automation Technology.

The core of the Laser Gas Regulator (LGR) clearly sets itself apart from conventional control valves by its performance features. Changing the gas with high precision within a few hundred milliseconds, the LGR operates five times more quickly than comparable automation components. The exclusive piezo pneumatic technology provides for stable gas pressure (pressure stability ± 0.03 bar) and ensures precise cutting edges when gas lasers are used to cut materials. The LGR operates five times more quickly than comparable automation components. The exclusive piezo pneumatic technology provides for stable gas pressure (pressure stability ± 0.03 bar) and ensures precise cutting edges when gas lasers are used to cut materials.
INNOVATION WITH HOERBIGER TECHNOLOGY AT THE EUROBLECH 2014

HOERBIGER has been considered a world market leader for hydraulic and electrohydraulic actuators used in press brakes for quite some time. Though for some years it seems as if the market favored electrical actuator systems over traditional hydraulic systems, the sheet metal working technology is currently undergoing a hydraulic renaissance.

The innovations presented by leading machine builders at the 2014 EuroBLECH reaffirm the trend toward hydraulics and electrohydraulics in every power class:

TRUMPF TruBend Series 3000

In their development of the TruBend Series 3000, TRUMPF Maschinen Austria GmbH + Co. KG from Pasching, Austria, relies on proven HOERBIGER hydraulics. The new press brake is equipped with a traditional HOERBIGER valve block. Reliable technology, tried and tested thousands of times. The new generation of TRUMPF’s TruBend Series 3000 combines high axis speeds with ease of operation and an attractive price-performance ratio, ensuring economical production even at low utilization.

Bystronic Xpert 40

Bystronic’s Xpert 40 press brake was incredibly popular with the audience at the 2014 EuroBLECH, only in part due to its outstanding design. The attraction of the new press brake is primarily its speed. The Xpert 40’s innovative, lightweight design delivers extremely high levels of dynamics at bending speeds of up to 25 millimeters per second. This means that the machine can bend small parts three times faster than larger press brake models. Bystronic’s newly developed ByMotion drive control system ensures a finely tuned interplay between speed, precision, and power. HOERBIGER hydraulics ensure that the press brake is driven with efficiency and precision alike. The control system developed by Bystronic coordinates the precise acceleration of the upper beam and the back gauges, delivering bending results with the highest degree of repetition accuracy.

Vimercati EHSyP 110

Innovation from Italy: the EHSyP 110 made by Vimercati. The family-operated business from Sovico has manufactured press brakes and guillotine shears since 1973. The EHSyP 110, equipped with the electrohydraulic HOERBIGER ePrAX® actuator, is the company’s latest innovation in its mission to produce machines that offer a long service life and low maintenance costs. It’s a promise that the EHSyP 110 will be sure to keep thanks to the low maintenance requirements of the ePrAX®. The machine boasts high dynamics and precision as well as energy efficiency, providing energy savings of up to 50 percent over conventional systems.

Amada HFE3I

Amada also employs proven HOERBIGER technology. The machinery manufacturer from Japan operating internationally has built press brakes since 1955. One of the innovations of the year 2014 is the HFE31 press brake. The model is built in Europe and embodies maximum power density and flexibility in press brake technology. Traditional HOERBIGER actuator technology for press brakes guarantees end users reliability and durability.

Baykal BLS-NEO

The prototype was already featured at the 2012 EuroBLECH. Now the production model is on the market. With its BLS-NEO, Baykal Machine Tools from Bursa, Turkey, presented a well-engineered solution and promoted its high cost efficiency.

Messer FiberBlade 3015

Laser cutting at minimized operating costs is also a crucial selling point for Messer Cutting Systems from Groß-Umstadt, Germany. At the EuroBLECH 2014, the machinery manufacturer unveiled the new FiberBlade 3015 to the trade show audience. Maximum dynamics, optimized cycles, and an extremely compact design are just some of the compelling features of this elegant fiber laser cutting machine, which Messer is positioning in the market as “A new generation in the laser class.”

MVD iLaser

MVD Makina Sanayi A.S. from Konya, Turkey, also uses the HOERBIGER LGR as the laser gas regulator. Having been tried and tested millions of times, the HOERBIGER piezo technology is a good reason to promote the new MVD iLaser as the “Fastest, most economical and maintenance-free technology.”
**CURRENT VEHICLES**

**FEATURING HOERBIGER DRIVE TECHNOLOGY**

Whether used in the AWD for the Jeep Renegade, the sporty Ford Mustang, or the compact van of the Mercedes-Benz B-Class – HOERBIGER friction systems ensure smooth and reliable shifting in all situations.

**JEPP RENEGADE**

With the Jeep Renegade, the brand that enjoys cult-like status among sport utility vehicles is, for the first time, penetrating the segment of compact crossover SUVs. While the smaller engine models come with front-wheel drive, the diesel and gasoline engines putting out up to 170 hp are equipped with a new, very efficient all-wheel drive system: the rear axle, along with the drive shaft, is decoupled for everyday driving – and quickly engages automatically when necessary. That’s when the Renegade shines with the outstanding offroad traits we have come to know from its larger siblings. HOERBIGER worked closely on this project with Fiat Chrysler Automobiles (FCA), of which Jeep is also part. Numerous Renegade models feature the manual C635 6-speed transmission made by Fiat Powertrain. The transmission is always equipped with complete HOERBIGER systems and has been used in Fiat, Alfa Romeo and Lancia cars – at times in a double-clutch variant – since 2009.

**SIMPLY SYNCHRONIZED**

Complex technology often drives up the weight and manufacturing costs. The art therefore lies in reducing complexity.

Text: Melanie Stahr

Photography: HOERBIGER

Blocker Ring Basic with microGROOVE

**USING THE EXAMPLE OF SYNCHRONIZER RINGS, HOERBIGER DEMONSTRATES HOW THIS CAN BE DONE SUCCESSFULLY WITH THE NEW BLOCKER RING BASIC (BRB) AND ITS MICROGROOVE FEATURE. ROBUST, RELIABLE, COST-EFFICIENT AND MADE OF SOLID FORMED STEEL, THIS PRODUCT SETS NEW STANDARDS IN THE ENTRY-LEVEL TRANSMISSION SEGMENT.**

While gears in a passenger car are shifted manually, synchronizers transfer high forces when they match, or synchronize, the rotational speed of the main transmission shaft to that of the gear wheel. The main load is applied to the synchronizer rings, on which lies conical surfaces through which, by way of friction, these forces are transferred. For this purpose, they are provided with special friction linings, which in some respects, are complex to produce. In order to dispense with additional production steps and keep costs low (notably in the high-volume entry-level transmission segment), traditional synchronizer rings are often made of brass. “There are a number of factors, however, that argue against the use of brass in the production of synchronizer rings,” explains Peter Echtler, Head of Advanced Engineering, HOERBIGER Antriebstechnik Holding GmbH. “Certain finished geometries, for example, cannot be implemented with brass using metal forming alone. A second step always becomes necessary, which involves costly secondary machining.” HOERBIGER is a technology leader when it comes to steel synchronizer rings and can demonstrate that innovations are not necessarily shackled to high-priced solutions. In the future, the newly developed BRB made of steel sheet will complement the portfolio for single-cone synchronizer rings, and dispenses with additional friction linings thanks to the novel microGROOVE feature. “We assigned ourselves the complex task of developing a synchronizer ring in the entry-level price segment that has the advantages of brass rings, yet is wear resistant and cost-effective to produce in large volume,” Peter Echtler commented. Thanks to the metal forming production process perfected by HOERBIGER and wear-mitigating heat treatment in the nitriding furnace, all the functional features, final dimensions and the microGROOVE of the BRB are generated in the forming tool, making subsequent machining unnecessary. “Compared to brass rings, we have reduced axial wear by about 90 percent and set a new standard in terms of robustness in this price segment.” Thanks to steel’s lower thermal expansion, clearances can also be optimized, which positively impacts the space constraints encountered in subcompact cars and vehicles in the compact class. The BRB made by HOERBIGER is about to be launched in series production and represents an economical alternative to brass rings, especially for high-volume applications in these vehicle classes.
**FORD MUSTANG**

Unveiled for the first time 50 years ago, the Ford Mustang quickly stole the hearts of sports car enthusiasts around the world. While the latest edition of the “pony car” takes design cues from the legendary body of previous generations, it also boasts ultramodern technology, exemplified by the chassis with complex fully independent suspension, for example. European buyers have their choice of engines of either a 5.0 liter V8 with 307 kW (418 hp) and 524 Nm of torque or a 230 kW (314 hp) turbo four-cylinder with 434 Nm.

To get all that power to the rear wheels at the optimal ratio, all model variants – including those for the USA – are shipped with the 6MT1500 6-speed manual transmission made by Getrag Ford Transmissions. Robust friction systems in the complete synchronizer system supplied by HOERBIGER significantly contribute to precise and reliable gear shifts for Mustang riders even when they let their horse run wild in the spirited manner one would expect.

**MERCEDES-BENZ B-CLASS**

Among compact vans in the premium segment, Mercedes-Benz’s B-Class is extremely popular with customers worldwide: the second generation – launched in 2011 – sold more than 380,000 vehicles as of October 2014. A comprehensive facelift now continues this success story. After its revamp, the new B-Class has a clearly more upscale interior and exterior and features enhanced safety and telematics functions.

The broad range of drive options now offers a choice among five gasoline and diesel engines, a natural gas model, as well as the all-electric operated B-Class Electric Drive. As many as seven different types of power plants come standard and work optimally together with the FSG 300 (210) 6-speed manual transmission, which uses a longer gear ratio for the natural gas and Blue Efficiency models. In every instance, it is fitted with friction systems made by HOERBIGER, which are considered one of the prerequisites for achieving the high shifting comfort for which the brand is known.
The Mercedes-Benz Gaggenau plant is recognized as the worldwide competence center for manual and automated transmissions.

Compact, clean and upscale: every detail is functional and in exactly the right place. We are referring to Mercedes-Benz’s Rastatt plant located at the Gaggenau production site. Here, all manual transmissions for the new Mercedes-Benz A- and B-Class and a number of other vehicle series featuring the star emblem roll off the assembly line. A closer look reveals what HOERBIGER has to do with it.

Text: Achim Neuwirth  Photography: David Spaeth, Daimler
Enthusiasts of the history of mobility are bound to take notice when the name Gaggenau comes up: after all, it is the town where “Bergmann Industrie- werke GmbH” was founded in 1894, which has conducted business under the Mercedes-Benz trademark since 1911. For more than half a century – from 1951 to 2003 – a workhorse rolled off of the line here, known best by its acronym UNIMOG, which stands for the German name, Universal-Motor-Gerät. The manufacturing facility drastically expanded starting in 1971. The Rastatt transmission plant was constructed first, followed by a pressing plant for commercial vehicle body parts, as well as a logistics center. Gaggenau advanced to a competence center for manual and automated transmissions in 2001. 14 years earlier, Mercedes-Benz began cultivating a close-knit relationship with HOERBIGER as a supplier for synchronizers. The factory’s now 120-year history make it absolutely unique – it is the oldest continuously operated automotive plant in the world. Visitors can discover many other interesting facts about the factory on site.

MANUAL AND UNIVERSAL

More than ten million transmissions to date have emerged from the Gaggenau site, which measures close to 4.5 million square feet (412,000 square meters) and includes the Rastatt plant covering another 2.5 million square feet (238,000 square meters) of floor space. With a total of 6,600 employees, together they form the manual shifting galaxy in Mercedes-Benz’s automotive cosmos. At present, it is the only factory worldwide for manual and automated transmissions of the historic brand. HOERBIGER also enjoys a unique position in Gaggenau; after all, the company has acquired the status of being the only outside supplier for friction systems here. The two to three million synchronizers produced annually represent a comparatively small, but very important and effective DNA component of many transmission families made by Mercedes-Benz. From single-cone to triple-cone applications, the friction systems ensure smooth shifting – even if the naming might suggest otherwise. The synchronizers are available in custom variants for three series, depending on power requirements: the TSG transmissions (Transporter-Schaltgetriebe, which literally translates as van manual transmissions) are intended for light and cargo vans, such as the V-Class, Sprinter and Vito; the NSGs (Neues Schaltgetriebe, or new manual transmission) are made for rear-wheel drive cars such as the C-, E-, S- and SLK-Classes; and in the compact front-wheel drive models of the latest A- and B-Class generation, the FSGs (Front-Schaltgetriebe, or front-wheel drive manual transmission) translate the engine’s power to the desires of the driver.

FROM WAREHOUSE TO THE “STORE”

Employees of Mercedes-Benz refer to FSGs as the FSG 300/310 transmission family. They roll off the line at the Rastatt plant – presently at some 600 units every day. Erhard Thiel, Manager for Transmission and Axle Production in Gaggenau, describes some interesting facts about the manufacturing line:
Transmission shafts, wheel sets and synchronizers prior to assembly.

“At the beginning of 2010, we switched assembly over to the new transmissions without interrupting operation. We are now the benchmark when it comes to the flow of goods.” From a bird’s eye view, this is more quickly apparent: the layout of the lines is square, compact and effective. “In the first step, we turn and mill the gear wheels from the “soft” blanks, as they are called in transmission assemblers’ parlance, which have no teeth yet,” Thiel explains. Like the shafts, they then move on to the heat treating furnaces, and to the grinding and post-processing stations, until they finally arrive in the “supermarket.” That’s what the FSG team calls their order picking area where the individual components await assembly. This is also where the friction systems made by HOERBIGER have their first major appearance: the “logistics train” arriving from the neighboring high-bay warehouse turns the corner, arriving on time with the components. In the supermarket, the FSG assemblers prepare for their work by filling individual baskets, which contain all the parts for a particular transmission model.

**KNOW-HOW FOR ZERO DEFECTS**

The assembly operation is based on three pillars: short distances, modern equipment, and a well-trained team. “At full utilization, as is the case presently, one colleague operates three stations, so things never get monotonous,” Thiel explains. “Every employee could also manage the entire line though, and theoretically build the transmissions all by himself.” The gear wheels and synchronizers are threaded from above – starting with the first gear and ending with the sixth – onto the vertically positioned left and right output and drive shafts. One can’t help but think of pearl necklaces. Trained eyes, high-tech cameras, and other monitoring tools at the individual stations check to ensure everything is properly seated. One important test, however, continues to be carried out manually: by briefly turning the gear wheels on the shaft to the left and right, the well-versed assembler immediately notices whether the friction systems can move freely enough, as is required for them later in the car. Only when the employees are satisfied that the inner workings of the transmission are complete do they attach the cover – or better, the bottom half of the casing. A robot then flips everything 180 degrees and, after having applied sealing compound, adds the second casing part. Once everything has been firmly screwed together, is tight and filled with oil, things get really serious: the final, fully automatic function check reveals whether the transmission has in fact reached the high bar that Mercedes-Benz sets for function and quality.

This involves shifting all the gears, recording the noise development, and also measuring the synchronization times. Just at this moment, a newly born FSG family member weighing 92.4 pounds (42 kilograms) is undergoing this procedure. The question of how HOERBIGER components typically perform in these tests is answered: “Defects? Zero, nothing; we have yet to find a single HOERBIGER friction system that was not acceptable. From the quality all the way to the quantities, we here in Rastatt can only say: Please keep it up.” Thiel says.
**“SUPPLIERS MUST BE ABLE TO KEEP UP THE PACE”**

**HOERBIGER** friction systems are rated highly by Mercedes-Benz in Gaggenau – the synchronizer specialist is the only outside supplier for these products. But which direction will the shared journey take in the future? Ehrhard Thiel, Manager for Transmission and Axle Production at the site, Rainer Skulimma, Head of Supplier Management for transmissions and axles, and Martin Schetter, Head of Design for inline manual transmissions for cars and vans, provide answers.

**WHAT DO CUSTOMERS EXPECT OF A MODERN MANUAL TRANSMISSION?**

**Schetter:** It has to function for the entire life of the vehicle, that’s a given and the standard in our company. It is also important that large transmissions for powerful engines can be shifted just as comfortably, precisely and easily as the smaller ones. This means a great deal of work in terms of design, but customers simply must not perceive any differences between the model series.

**Thiel:** A decisive factor for comfort is also a low noise level, especially in the vehicles equipped with FSG transmissions, where the engine and transmission are essentially located directly in front of the driver. The driver would immediately hear any unwanted noise, especially at low speed. To ensure low noise levels, we rely primarily on special toothing geometries, which also quiet down our FSGs.

**HOW CAN MANUAL TRANSMISSIONS CONTRIBUTE TO A REDUCTION IN CO₂ EMISSIONS?**

**Thiel:** We continually reduce the inner drag losses of transmissions, so that their operation is particularly low in friction. Very little energy is wasted in the powertrain, saving fuel and consequently CO₂.

**Schetter:** Additionally, our transmissions weigh very little, making the vehicles overall more lightweight and economical. The power/weight ratio, however, is equally as important. The entire set-up is important. This ranges from the equipment and material procurement, to efficient manufacturing processes, to committed employees. Working closely with product developers and our suppliers, such as HOERBIGER, is absolutely essential. The time to market for new products is growing ever shorter, so we need reliable partners who are able to keep up the pace.

**IN YOUR VIEW, WHAT SPECIFICALLY DISTINGUISHES HOERBIGER?**

**Schetter:** I would like to cite the NSG project as an example, where HOERBIGER developed the metal synchronizer rings jointly with us. This was not only limited to their core competence, the friction systems, but they also acquired a great deal of new know-how for the overall transmission system. This has been extremely valuable for us to this day, since it makes HOERBIGER a partner who responds flexibly, is on an equal footing with us in transmission issues, and can provide inspiring suggestions for innovations.

**Skulimma:** The requirements that emerge from the manufacturing process and the market are very dynamic. This necessitates a climate in which we openly and directly discuss all topics – that is, successes and challenges. This is working really well with HOERBIGER as a partner.

**Thiel:** Large-scale manufacturers like us need quality parts from suppliers to be consistently 100%. With HOERBIGER, we can be assured of not only this, but also of absolutely reliable processes. While HOERBIGER is not the lowest-cost provider, they make up for it with systems expertise. Being able to receive a well-engineered complete package when it comes to synchronizers is naturally great for us.

**WHAT CHALLENGES, IN YOUR VIEW, WILL HOERBIGER BE FACED WITH IN THE FUTURE?**

**Schetter:** From a purely technical perspective, it would be new transmission fluids. As a result of minimal friction, they will ensure lower drag losses, which is beneficial for fuel efficiency, but is not so good for current friction systems. This is where innovations will be needed.

**Thiel:** Everyone at the site is expected to continuously improve, and we apply the same criteria to our suppliers. Cost pressure – whether it’s due to inflation, commodity prices or wages – is growing steadily. This will have to be compensated for by new, intelligent solutions in every respect.

**Skulimma:** We need partners who are also willing to face all future demands, both with respect to technology and market dynamics. This is a very complex task. But I’m convinced that HOERBIGER will master it.
Czech Republic-based oil company Unipetrol installed the new eHydroCOM capacity control system from HOERBIGER in its Czech industrial gas plant for the first time. With great success: Unipetrol is benefitting from significant cost savings and increased performance in the operation of a nitrogen compressor.
The largest refinery, petrochemical and agrochemical complex in the Czech Republic is located on the outskirts of Litvínov, 50 miles northwest of Prague close to the German border. The plant is owned by Unipetrol, the leading Czech oil and petrochemical company, which is part of the Polish PKN Orlen Group. The Litvínov site also encompasses a complex that produces polymers and other chemical products, such as ammonia as starting material for fertilizers. Nitrogen is required for the production of ammonia and is produced in a local plant operated by industrial gas specialist Air Products.

The installation of the new eHydroCOM capacity control system made by HOERBIGER saves Air Products and Unipetrol approximately 330,000 euros annually in electricity on one nitrogen compressor. What’s more: the ammonia plant runs more smoothly than ever.

ADVANTAGES OF STEPLESS CONTROL

When Air Products and Unipetrol were searching for ways to lower operating costs in Litvínov, HOERBIGER was seeking customers willing to install its new eHydroCOM capacity control system on an experimental basis. In 2013, Pavel Hafner, HOERBIGER Sales Manager in the Czech Republic, drew the two companies’ attention to the new control system. “Unipetrol was interested in savings, and when eHydroCOM was presented to us, we immediately recognized the cost savings opportunities for our customer,” Pekárek comments.

Unipetrol was already using HydroCOM, the stepless capacity control system, made by HOERBIGER in other reciprocating compressors (see HydroCOM: How everything began). They were extremely satisfied with the resulting energy savings and reliability. The idea of an all-electric version of HydroCOM with comparable performance and even lower project costs was therefore highly attractive. “Five years ago, we installed the traditional HydroCOM system on five hydrogen compressors,” Otakar Soukop reports, Technology and Research Specialist at Unipetrol. “Our experience was great, and so we were willing to give the new version a try.” HOERBIGER assumed that Air Products’ compressor would be a suitable candidate for eHydroCOM. The most important criterion for the pilot project was that there had to be a great potential for energy and cost savings. Additionally, Litvínov is easy to reach from the HOERBIGER site in Zandov in the Czech Republic as well as from the Vienna headquarters.

IMPROVEMENTS THROUGH SOPHISTICATED CONTROL

At a rated power of 2300 kilowatts, the nitrogen compressor costs Unipetrol almost 2 million euros a year in electricity alone. It goes without saying that the companies were looking for ways to save energy. Pekárek comments: “Electricity accounts for 70 percent of our variable operating costs, so saving energy is a crucial point.”

In this case, the savings were possible because the original approach to varying compressor throughput to adapt it to the demand of the ammonia plant was not optimized at all. Clearance volumes in the cylinder heads were opened up to operate at 75 percent of nominal capacity. For a capacity of 50 percent, the suction valves were held open to reduce the amount of nitrogen that is compressed.

At a capacity of exactly 75 percent or 50 percent, this stepped process worked well. For any other throughput, however, the nitrogen had to be throttled back, from the outlet side to the intake side of the compressor, via a return valve, which wasted the energy that was consumed for compression. In addition to the unnecessary power consumption, the stepped control also negatively impacted the downstream process.

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PLANDED COST SAVINGS

Based on the information provided by Air Products, the HOERBIGER team calculated that on average, 12 percent of the compressor’s nominal throughput was recirculated through the return valve. At a rated power of 2300 kilowatts under full load, electricity costs of 0.11 euros per kilowatt hour, and 8000 operating hours annually, the team estimated that eHydroCOM’s stepless control would save Unipetrol 228,000 euros a year. And this did not include savings in the cooling water supply system from a corresponding decrease in the thermal load in the intercoolers.
eHydroCOM: fully electric stepless capacity control

The original HydroCOM system has been tried and tested and is reliable and robust. HOERBIGER additionally developed eHydroCOM. This system can do everything its older brother can, but requires no hydraulic lines and no central hydraulic power unit. As a result, installation and maintenance are easier than with HydroCOM, making it ideally suited for smaller compressors with just a few hundred kW. The eHydroCOM system architecture offers extraordinary control dynamics because compressor output can be varied within three revolutions of the crankshaft. Key for this smooth operation of any reciprocating compressor are intermediate and outlet pressure values; they prevent vaults caused by incorrect values. Since the control performance is no longer limited by the slow return valve, problems on upstream or downstream systems are considerably less likely to cause downtime of the compressor.

With its plug and play connections, the eHydroCOM system can be installed or retrofitted quickly and requires no cooling or water or hydraulics. Maintenance is simple to perform. The system is equipped with comprehensive self-diagnosis, and no settings are required after service is performed on valves. eHydroCOM underwent comprehensive field testing in customers’ facilities, including RAG Rohöl-Aufsuchungs Aktiengesellschaft in Haidach, Austria, and the plant of Air Products in Livibov.

Nor the anticipated increase in efficiency of a downstream turbo compressor, since the use of eHydroCOM eliminated the need to move the inlet guide slides out of their optimal position. “We were aware that this involved a pilot project and there were certain elements of risk,” says Ondřej Telecký, Air Products’ Plant Manager. “After prior HydroCOM installations for Unipetrol, however, HOERBIGER’s references were outstanding, and the potential savings looked very interesting. We decided that the potential advantages were worth a small risk.”

PROFESSIONALISM

“The project was very professional right from the start,” notes Peřárek, “the HOERBIGER technicians and engineers were extremely committed and delivered an outstanding performance,” remarks Telecký. “The project partners carried out a detailed risk assessment, and very precise planning of the start-up work, test cycles, and incremental offline and online testing mitigated the risks. In addition, they provided supporting solutions for individual crisis scenarios such as alternative supply, resources for fine tuning, and material replacement, just to name a few. All these precautions gave us confidence, and we implemented the project with maximum control over the limited risks,” Pekárek adds.

OUTSTANDING RESULTS

The eHydroCOM system was commissioned in May 2014. The energy savings realized since then have been as planned. “Shortly after implementation, we compared the specific output before and after the eHydroCOM installation and found energy savings of 22 percent,” Soukup explains. “This met our initial expectations,” Pekárek adds. “Estimates of the annual savings were approximately 3,000 megawatt hours, including a safety margin, which has meanwhile been confirmed. In the overall assessment of all the savings, however, we will have to consider the installation costs for the project, as well as a minor increase in maintenance costs for the compressor.”

The improved control performance also produced remarkable advantages. “This is particularly beneficial because of late, Unipetrol has been varying throughput through the ammonia plant more strongly than in the past, which was more difficult with the stepped control,” Telecký explains.

Now, the output pressure of the compressor is more stable and the “surges” that they were experiencing with the stepped capacity control system are gone. In the future, the downstream turbo compressor will be operated more closely to its pressure increase limit, further increasing efficiency. According to Peřárek, they also appreciate the faster control behavior with eHydroCOM. “Before installing the eHydroCOM system, we only supplied a certain amount of gas at a predefined pressure. The process now is more flexible and we can respond to production demand. Since eHydroCOM responds especially quickly, the behavior is very sensitive.”

Telecký adds: “The first, and critical, priority was to achieve the energy savings and the proper control behavior. Now, it is important to maintain this efficiency. We will monitor how reliable the system is, and in the very near future we will begin to think about maintenance programs and replacement parts.”

“We continue to strive for efficiency, energy savings, lower maintenance and operating costs and, naturally, greater reliability,” Telecký explains, adding: “The people here are talking about this project. So when we achieve the expected reliability, the name eHydroCOM will invoke very positive associations at Air Products.”
Accounting for a share of approximately 21 percent, natural gas is one of the three primary energy sources in Germany, along with petroleum and coal. Open Grid Europe GmbH operates and markets Germany’s largest gas pipeline network with a total length of over 12,000 kilometers (almost 7500 miles). Compressor stations ensure that this gas reaches the consumer reliably and in the best quality. Electrohydraulic valve actuators made by HOERBIGER have now successfully completed a one-year trial operation at the Cologne-Porz station.

Text: Wolfgang Leppert  Photography: Ralf Baumgarten
We believe in two things: Europe and natural gas.” The Chairman of the Management Board, Stephan Kamphues, succinctly summarizes Open Grid Europe’s philosophy. The company specializes in the transport of natural gas across Germany – planning, constructing, operating, monitoring and maintaining the country’s largest gas transmission system, which at approximately 12,000 kilometers (almost 7,500 miles) rivals the autobahn network. In addition, Open Grid Europe supplies more than 450 national and international long-distance gas companies, municipal utilities, industrial customers and gas traders. The annual output volume is approximately 725 billion kilowatt hours, accounting for some two thirds of Germany’s entire natural gas consumption.

The pipeline system of Open Grid Europe is also a central element of the European natural gas network, which covers 200,000 kilometers (125,000 miles) extending from the North and Baltic Seas to the Mediterranean, and from the Atlantic to Eastern Europe. This is the route that natural gas takes on its way from the Netherlands, Great Britain, Scandinavia and Russia to the 11.4 million households and 2.1 million industrial customers in Germany. After all, 89 percent of the country’s demand for natural gas is covered by imports, of which 38 percent comes from Russia. Of the largest gateways for Russian natural gas is Open Grid Europe’s compressor station in Waidhaus on Germany’s border with the Czech Republic.

The company has only been around since September 2010 in its present structure, but can proudly look back on close to 90 years of tradition and history. In 1926, the idea of utilizing coke oven gas for long-distance gas supply resulted in the founding of Aktiengesellschaft für Kohleverwertung, which would later become Ruhrgas. It took the company only five years to evolve into Germany’s biggest gas supplier – with 26 mines feeding almost 800 million cubic meters of coke oven gas into a transmission line network which encompassed already 933 kilometers (580 miles) at that time. 1938 marked the start of industrial use after the company started supplying Chemische Werke Hüls. In 1964, it began to convert to natural gas operation, eleven percent of which is supplied from domestic sources even today. Additional corner stones in the company’s history include the completion of the European natural gas network (1981), the merger of Ruhrgas and E.ON (2003), the spin-off of the gas transport business into an independent subsidiary (2004), the renaming into E.ON GasTransport (2006), the acquisition of ownership of E.ON Ruhrgas’ networks in Germany (2008), as well as the last change of name into Open Grid Europe (2010). The company has been owned by a consortium of infrastructure funds since July 2012.

**OPEN GRID EUROPE – THEIR NAME IS THEIR MISSION**

As the company emphasizes, their name is their mission: “Openness and transparency (Open) are our guiding principles for access to our gas pipeline network (Grid) within a European pipeline system (Europe) where we also act as a hub (The Gas Wheel).” The company’s 1,650 employees nationwide at the head office in Essen as well as at numerous additional sites between Krummhörn on the North Sea and Wadhaus in Upper Palatinate ensure that these principles are implemented.

On its way to key customers, the gas reaches a peak pressure of up to 100 bar in the pipelines, this decreases steadily during transport as a result of friction and gas withdrawals. Compressor stations are positioned at intervals of 150 to 200 kilometers (100 to 125 miles), where the pressure is raised again for continued transport, and the gas is filtered, measured, dried, compressed and cooled. The oldest of the 27 compressor stations in total has been located in Cologne-Porz since 1954, where eight compressors with a capacity totaling 100 megawatts process as much as two million cubic meters of natural gas per hour. The station offers 27 flow direction configurations in the pipeline network, allowing for very flexible operation, including a reversal of the transport direction with compression from north-to-south to south-to-north.

**ELECTRIC ACTUATOR WITH SAFETY FUNCTION**

This business segment is highly sensitive when it comes to safety: “We invest in the safety of our transportation network, and we are as extremely conscientious about protecting the environment as we are about our employees and equipment.” is the motto of Open Grid Europe. In the quest for innovation, they came across an electrohydraulic actuator, which HOERBIGER developed specifically for the process industry starting in 2009. Its name is TrIVAX, denoting the three combined technologies that it encompasses – hydraulics, mechanics and electronics – as well as the intended purpose: valve actuators. The actuator blends the strengths of hydraulics – high power density and rigidity, yet simple integration of safety functions – with the ease of installation of electric actuators. This prompted the experts in the Porz compressor station to comprehensively and extensively test this new technology. Previously, electric, gas- or compressed air-controlled solutions were used. “Our safety concept demands that valves be operated independently of the electrical supply,” explains Plant Engineer Frank Schumacher. “Additionally, we require extremely dependable actuators, which can be operated with the existing control units.” The site tested the TrIVAX flex model, where the components can be individually configured and designed, wherein the standard TrIVAX unit features an integrated controller unit for traditional standard applications.

The test installation was launched during the summer months, when demand for gas supply is low; they then comprehensively tested all the functionalities during the peak period in the winter. After the one-year test operation was completed, the electrohydraulic valve actuator proved “to pose no problems in terms of connecting to our control unit and delivering flawless performance,” Frank Schumacher sums up. Open Grid Europe is now deliberating to “switch actuators that need replacement, with and without valves, to the HOERBIGER system”.

The compact electrohydraulic actuator TrIVAX flex combines the strengths of hydraulics with the ease of installation of electric actuators.
Barnoldswick in north-west England: this small town that around 10,000 residents call home was shaped for decades by the textile industry. In the 19th and 20th centuries, Barnoldswick had 13 weaving and spinning mills. Bancroft Mill, the last one to be built, was commissioned in 1920. 58 years later it closed its doors for the last time. For two mighty steam engines that powered Bancroft and another mill nearby, however, that was not the end of the story.

In the textile cities of the British counties of Lancashire and Yorkshire, hundreds of thousands of workers toiled under the worst of conditions. Since the start of the Industrial Revolution, they worked in soot-blackened and poorly ventilated factory halls. They spun raw fibers, predominantly wool and cotton, and wove fine but affordable fabrics.

Left: The original Bancroft Mill steam engine dated 1920 can drive 1200 looms with its two cylinders that produce 500 horsepower. The cast iron flywheel weighs 30 tons.

Right: Bancroft Mill’s engine house, made of local stone, stands out with a loving attention to detail that is rare in industrial buildings today.

While Bancroft Mill’s weaving shed no longer exists, the engine house and a 500-horsepower engine were preserved. A group of around 15 technology aficionados operates and maintains the leviathan — in a voluntary capacity, and out of sheer enthusiasm for historic technology. But that’s not all: the team members are already tackling their next project. They are in the process of restoring a second steam engine that was recovered in a disassembled state from a factory nearby. HOERBIGER is supporting this project.

At Bancroft Mill, a total of 1200 looms were driven by a single steam engine. The engine still runs today, nearly 100 years after it was first started, and has evolved into a tourist attract-
tion. During the holiday season, the team of volunteers fires up the boiler every three weeks, turning the engine’s 30-ton flywheel at a stately speed of 68 revolutions per minute.

The engine built by William Roberts, a local firm, features all the bells and whistles of steam technology at that time. In addition to the ingenious valve gear and speed control, the piston rod packings of the two cylinders are a special technical feature. The manufacturer of the packings was the Universal Metallic Packing Company (UMP Co.) of Bradford, located 40 kilometers (25 miles) away. HOERBIGER acquired the company in 1994, and today it remains part of the HOERBIGER Group as HOERBIGER UK LTD.

A second steam engine at Bancroft Mill is also equipped with packings made by UMP Co. The so-called Bradley engine dates back to 1901. The volunteers at Bancroft Mill set themselves an ambitious goal: they want to reassemble the Bradley engine in a separate building next to the main engine house. This is a time-consuming undertaking that required pouring a foundation of several tons of concrete. The engine is scheduled to be operational again within the next couple of years.

THE ORIGIN OF MODERN PACKING TECHNOLOGY

The patented Universal Duplex Metallic Packing, which is fitted to both engines now at Bancroft Mill, marks a historical starting point for present-day sealing technology. Compared to the hemp and cotton packings used previously, the packing system developed in 1901 was a ground-breaking technical innovation that assured reliable sealing, even at high steam pressure. The metallic packing system, which was revolutionary at that time, consisted of two pairs of brass blocks, which fit precisely on the shaft and were held in position by annular springs and a set of conical sealing rings made of soft metal.

UMP Co. began the manufacture of packings in 1901. The Bradley engine was built in the same year, and the packings it used came from one of the first production runs. They bear the numbers 284, 285 and 286. These numbers can be found in the old order book of UMP Co., which is now kept in the HOERBIGER archive. They are testimony to the first products of a company that would produce many thousands of packings over the decades.

As the steam era came to an end, UMP Co. focused on sealing systems for reciprocating compressors. The fundamental design and functional principles of these systems remained unchanged well into the 1970s. It was not until later that high-performance polymers and graphite delivered decisive innovations in sealing technology.

While the design of the current HOERBIGER BCD sealing ring for reciprocating compressors still bears some similarity to the original block ring packings, crucial developments have taken place when it comes to materials. Product developers today have advanced composite materials at their disposal. In addition to improved materials, computer-assisted models and fundamental research play a crucial role in the significantly improved performance of these systems. This has allowed HOERBIGER to create leak-free sealing systems. The engineers who designed the Bancroft Mill engines would have been thrilled.
SHORTCUTS

CTI SYMPOSIUM: HOERBIGER PRESENTS CompactLINE IN CHINA

Avid interest among visitors, lively discussions and informative lectures on all aspects of the automotive industry proved the success of the 3rd International CTI Symposium held in China from September 17 to 19. The Strategic Business Unit Drive Technology was also on site, showcasing new products such as the CompactLINE and Blocker Ring Basic (BRB).

A crucial milestone was reached: the contract defines all the planning and financial details and cements the date for handing over the keys in April 2016.

The attendees used the exhibition, which was held in conjunction with the EFRC Conference, to learn about new products and exchange ideas.

COMPRESSOR INDUSTRY MEETS AT THE 9TH EFRC CONFERENCE IN VIENNA

The European Forum for Reciprocating Compressors (EFRC) Conference is the most important industry event in Europe and the meeting place for who’s who in the reciprocating compressor industry. On September 11 and 12, operators and manufacturers as well as engineering firms and universities presented state-of-the-art technologies and new developments and trends. This year, the conference drew 354 attendees.

The primary objective of the EFRC Conference and associated exhibition is for experts to gather and create a think tank to address future challenges.

SUPPLIER PORTAL ONLINE

Since July 17, procurement.hoerbiger.com has provided a central go-to place and information platform for suppliers of the HOERBIGER Group. The new portal, which was integrated into the HOERBIGER website, enables corporate-wide supplier relations management.

The supplier portal pools the purchasing activities of all Strategic Business Units and Business Divisions of the HOERBIGER Group. Existing and future suppliers have an opportunity to learn about the procurement strategy, product group management, as well as about the HOERBIGER Group and its product and service portfolio.

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Under the motto “Innovative Automotive Transmissions, Hybrid & Electric Drives China”, 420 industry representatives exchanged ideas and experiences in Suzhou, in Jiangsu Province, about the use of modern drive technology as well as megatrends in transmission technology.

HOERBIGER WEBSITE FOR SMART PHONES

As of May 19, the HOERBIGER Corporate Website is available in a full-fledged smartphone version. The design was systematically optimized for the small screen of mobile devices. The mobile variant offers the same content and technology as the desktop version. A dedicated mobile front end was developed, which utilizes all of the content of the existing website and scales it for optimum display on mobile devices.

The optimization of the HOERBIGER website for smartphones was well-received among international marketing experts: at the MARCOM Awards held in Texas in early November, HOERBIGER garnered one platinum and three gold awards: Platinum and Gold for the website, and two Gold award for the mobile version. Additionally, on October 2, the judging panel of the MerComm Galaxy Awards in New York recognized mobile.hoerbiger.com with Bronze and Honorable Mention awards.

HOERBIGER DRIVE TECHNOLOGY CHANGZHOU: FIRST ENGAGEMENT BODIES AND RINGS

Since the beginning of August 2014, HOERBIGER Drive Technology Changzhou is producing engagement bodies (EBO) and engagement rings (ERI) for the Chinese market. Four years ago, production of the first sleeves in China started. HDC has since performed outstandingly in the market and gained numerous new projects. Customers not only have high expectations in terms of quality, but also demand fast response times. This prompted the Strategic Business Unit Drive Technology to install a production facility for EBOs and ERIs in China, as a supplement to the Oberstenfeld plant. Two machines, which were relocated from Oberstenfeld to Changzhou, form the core of the production site.
On July 25, the management and employees of HOERBIGER Penzberg GmbH celebrated its 50th anniversary at the restaurant Gut Hub with a ceremony and family festivities. The company, which was founded at the Seeshaupter Street in Penzberg on June 22, 1964, manufactures components for the automotive industry. The Penzberg plant currently produces circa 65 million automobile parts annually.

The factory's premises in Penzberg at the beginning of the 60s.

50 YEARS OF HOERBIGER IN PENZBERG

The Association of Compressor Factories (AKZ) head-quartered in Moscow met in Austria during the week of September 22 to 26 to exchange information and ideas. The headquarters of the 17 executives from Russia and the Ukraine was HOERBIGER Ventilwerke GmbH & Co KG (HVW) in Vienna. It also served as the venue of an official meeting of the AKZ.

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SUPERB PERFORMER

HOERBIGER TriVAX flex: The electrohydraulic valve actuator proves itself in practical applications