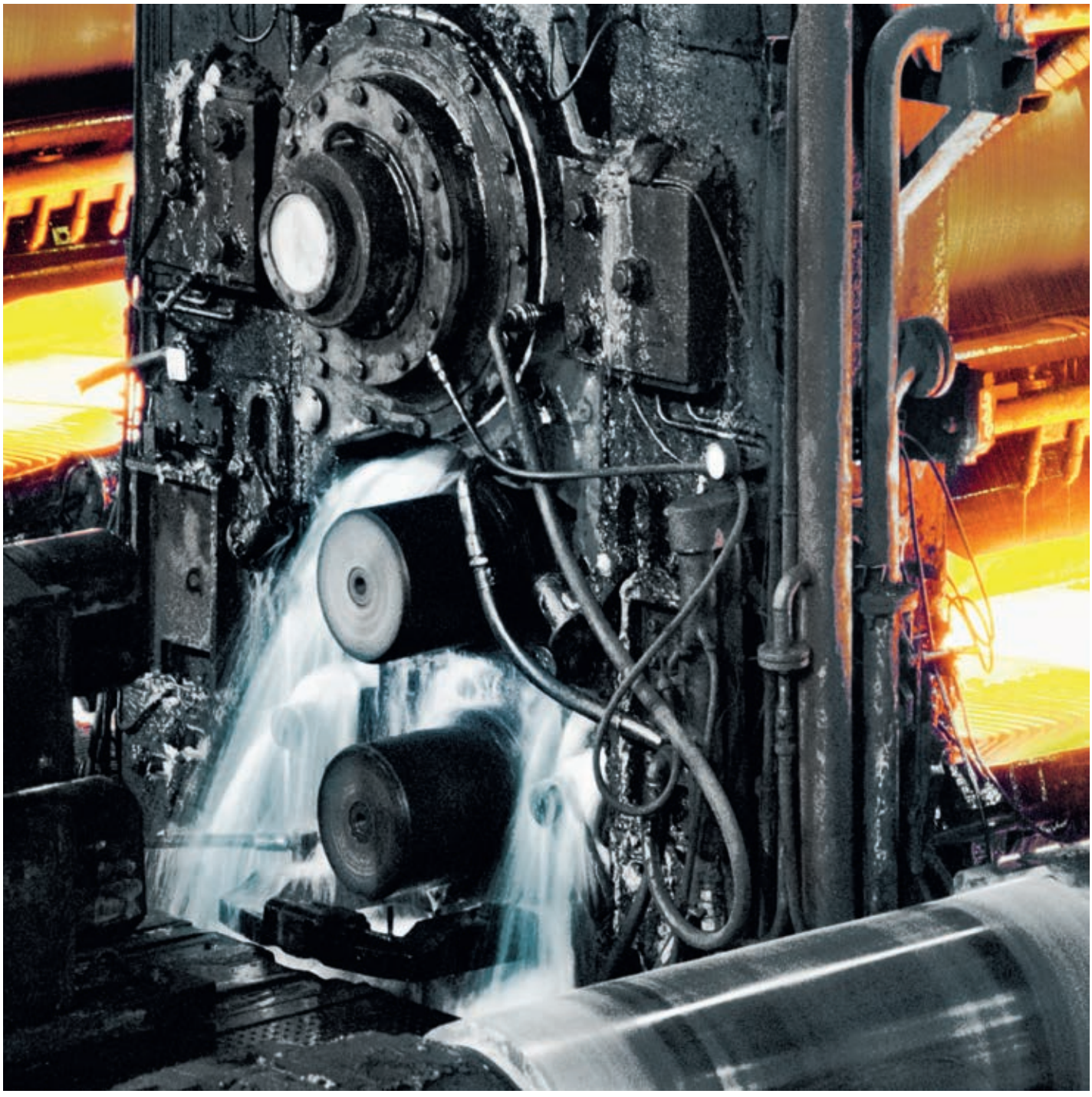
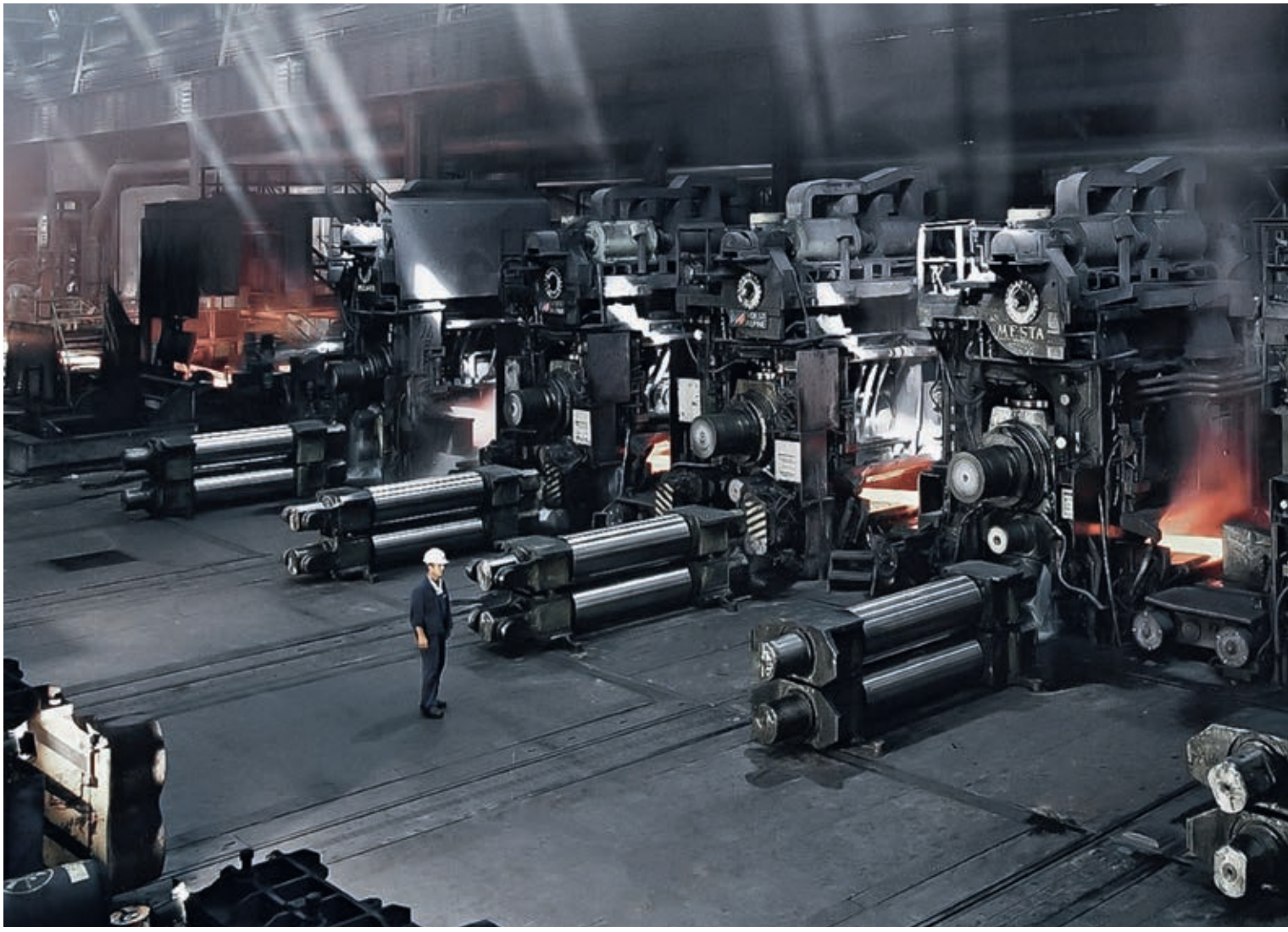
The Drive & Control Company

Rexroth
Bosch Group

Systematic Precision: Hydraulic Automatic Gauge Control HAGC





Continuously Efficient Automation for Steel and Aluminum

Thin sheet thicknesses and dimensional accuracies down to a few hundredths of a millimeter: Customers, for example, the automotive industry make increasingly stringent demands on the production of steel and aluminum sheets and foils. Rolling mills meet these requirements with hydraulic gauge controls from Rexroth. These complete systems with high-precision control combine precision with robustness and highest efficiency.

Slabs and sheet metal made of steel
Industrial users only buy steel when it is processed to form an intermediate product. For these products the requirements of customers have continuously become more stringent over the last few years. High-tensile steels for ever thinner sheet metals reduce the weight of vehicles and lower their fuel consumption. At the same time, quality requirements, especially with regard to dimensional accuracy, have enormously increased. Automotive manufacturers specify tolerances of only a few hundredths of a millimeter.

Foils made from aluminum sheets
Today, the rolling of aluminum foils has a very high market share. Aluminum foils are mostly made of pure aluminum (Al content 99 to 99.9 %). In this process, so-called strips having a thickness of 0.6 to 1.5 mm are cold-rolled to the desired thickness in several rolling steps (passes). When very thin foils are to be produced, two layers are rolled (double rolling).

To achieve narrowest thickness tolerances, the finishing stands of aluminum strip processing lines are equipped with hydraulic actuating systems, which operate at oil pressures of up to 300 bar and allow, with the aid of servo valves, adjustments of the rolling gap with an accuracy of only a few thousandths of a millimeter. Crown adjustment systems are used to influence the thickness distribution over the strip width. They allow the rolling gap form to be changed from concave to convex during rolling operation.

Cold rolling mills for high productivity consist of up to six single-pass stands connected in series (tandem cold rolling mill). They allow for a further reduction of the strip thickness down to 0.2 mm. Foil rolling mills comprise quarto single-pass stands for a further reduction in the strip thickness, in particular for aluminum, down to 0.008 mm (household foil).

Rolling mill operators meet these requirements in a continuous rolling process. They are looking for wear-free and low-maintenance solutions that feature highest availability. The technology must permanently withstand the harsh ambient conditions in rolling mills with vapor, dust and high temperatures.

In order to reliably achieve the required accuracies also at high rolling speeds, the solutions require extremely fast and efficient controls, which compensate for differences in the material thickness with high dynamics. Operators want to flexibly set different sheet thicknesses with the click of a mouse and thus minimize process changeover times.

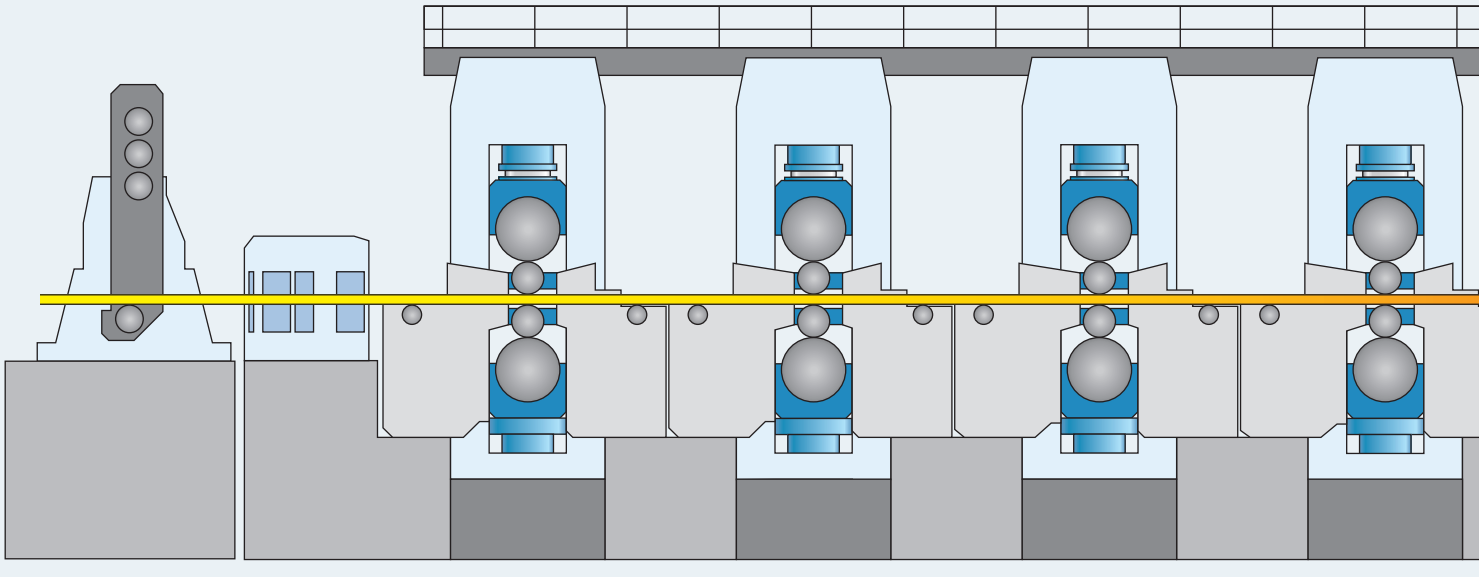
For fast service reaction and preventive maintenance concepts with economic fluid management, but also for retrofitting older systems, customers are looking for complete solutions from a single source. This reduces complexity and ensures a clear assignment of responsibility.

Highly Dynamic Automatic Gauge Control: Our Experience for Your Productivity

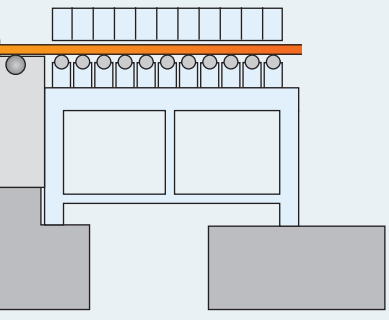
Rexroth has developed and installed highly dynamic automatic gauge controls for decades and has always set the current state of the art. Our branch experts know the requirements of the harsh conditions in everyday operation and perfectly combine the advantages of robust hydraulics with advanced control technology.

On all continents automatic gauge controls from Bosch Rexroth ensure high efficiency and accuracy for processing steel. We have optimized all components specifically for many years of operation in rolling mills. We offer thought-out detailed solutions without losing the focus on the complete system.

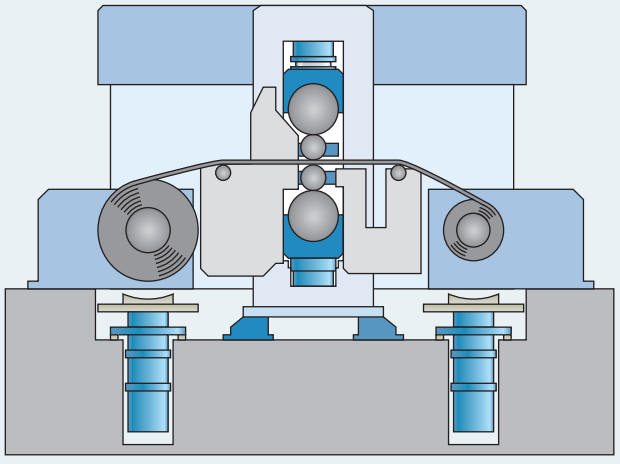
The hydraulic gauge control operates wear-free, because it generates linear movements directly without mechanical transmission elements. Moreover, the hydraulic fluid assumes lubrication function. Our system solution requires only a minimum of maintenance and is designed for the ambient conditions in rolling mills. It compensates for differences in thicknesses of the rolled material with high dynamics – also at high rolling speeds.



To this end, the Motion Logic system IndraMotion MLC closes the control loops in real time. The multi-axis control has been proven in many ten thousands of industrial applications. What is of particular importance: We implemented our application know-how in the field of automatic gauge controls in our software. The pre-programmed controllers take into account the specialties of fluid power technology, and the IndraMotion MLC communicates via open interfaces with the higher-level master control of the plant.

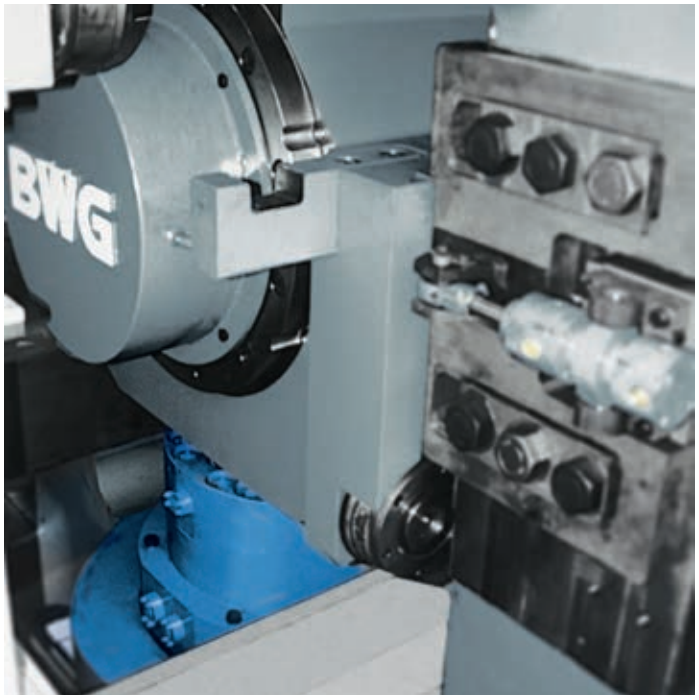


◄ **Rolling mill**
► **Reversing mill stand**



A Package Tailored Exactly to Your Requirements

Don’t burden yourself with details: The Hydraulic Automatic Gauge Control (HAGC) comprises all the necessary hydraulic components. We combine power units, cylinders and control blocks for you, commission the entire system and ensure high availability over the entire lifecycle.



The HAGC cylinders designed specifically for the automatic gauge control are based on thigh-tensile forged parts to ensure a long service life. With cylinder diameters of up to 1500 mm they cover all performance requirements. Thanks to their extremely compact design they fit perfectly into any system concept. Internally installed position measuring systems avert the risk of breakage and increase the availability. To provide highest hydraulic stiffness, an essential quality parameter for your rolling mill, we mounted the manifold directly to the cylinder.

Integrated, highly dynamic servo-valves assume the exact control of position, force or pressure and velocity. Two 3-stage servo valves are fitted to provide redundancy. In the event of a fault, the reserve component assumes the task without the necessity of any complicated conversions. To prevent the ingress of vapors and dirt, protective hoods encapsulate the manifolds. As with bellows, we generate a permanent overpressure to protect the assemblies.

- **HAGC cylinders for highest positioning velocities and accelerations**
- **Highly dynamic 1-, 2- and 3-stage servo-valves – ideal for the closed-loop control of position, force or velocity**

◄ **For highest hydraulic stiffness the manifold is mounted directly to the cylinder together with the servo-valves**

▼ **Perfectly compatible power units to always ensure optimum pressure supply**

▼ **A filtration system with separate circulation and cooling station provides the necessary cleanliness class for the pressure medium**

We design and manufacture, of course, also tailored hydraulic power units for automatic gauge control. And we can also realize large systems with tank capacities of up to 60,000 liters. We rely on the worldwide best-selling variable displacement pumps, which have also been proven in the field of rolling mills and steelworks. Moreover, our portfolio comprises of all the required filtration components and consumables for a long service life of the fluid medium.

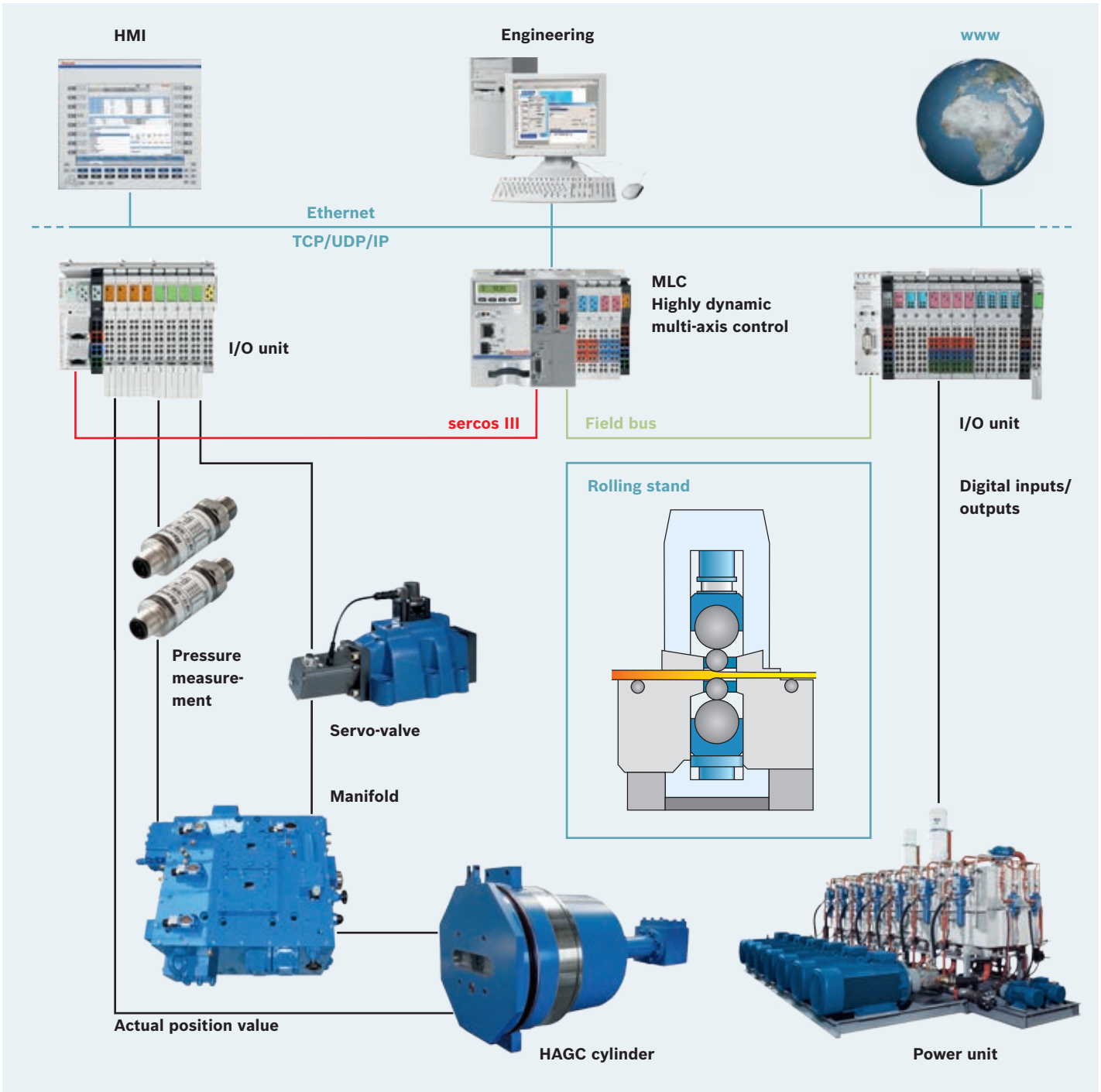
Open High-performance Control for Real-time Closed Loop Control

The brain of the automatic gauge control is the Motion Logic system IndraMotion MLC. This high-performance control is optimized for the closed-loop control of hydraulic drives and, thanks to it's open interfaces, fits seamlessly into any system master control.

These are the ingredients for highest productivity and availability: Pre-programmed functions for standard electronics, which have proven in practice in many thousands of plants and machines. We already predefined all of the basic functions for gauge control and adapt them to your individual system by fast parameterization. This shortens project processing times and reduces possible sources of faults. You can change parameters during operation simply by the click of a mouse or upload predefined settings to the system.

The IndraMotion MLC closes the control loop in real time using the position measuring systems in the HAGC cylinders and adjusts actual values to command values within a few milliseconds. This ensures highest dimensional accuracy during rolling. Several IndraMotion MLCs can be connected to form a network and can control a nearly unlimited number of drives. For this, the control electronics synchronize with each other in real time. This provides you with transparent automation, even with large rolling stands, and you can utilize all advantages of standardization for several lines of different sizes.

The Motion Logic system offers you all degrees of freedom. It's up to you, whether the motion control is to work as subsystem under your higher-level plant control or whether we are to create a complete system solution, visualization included.


HMI
Engineering
www
Ethernet
TCP/UDP/IP
I/O unit
MLC
Highly dynamic
multi-axis control
I/O unit
sercos III
Field bus
Digital inputs/
outputs
Rolling stand
Pressure
measure-
ment
Servo-valve
Manifold
Actual position value
HAGC cylinder
Power unit

Rexroth Service – Your Key to Higher Productivity

Maximum equipment availability and high efficiency throughout the entire lifecycle of your machines and plants: These are key factors that determine the productivity of your manufacturing processes. Rexroth offers a comprehensive spectrum of services to maximize the availability of your machines. Your benefit: a higher productivity.

Spare Parts | **Repairs** | **Field Service** | **Modern-ization/ Retrofit** | **Preven-tive/ Predictive Services**

Our complete service portfolio is reducing the complexity and costs for maintaining and repairing your production equipment. We guarantee quick access to qualified technicians who solve problems at the root, thanks to their comprehensive knowledge of all drive and control technologies. Besides we ensure fast diagnosis and quick delivery of spare parts while minimizing costs by standardized processes and test procedures. All carried out by uniformly high qualified personnel, covered by our network extended to more than 80 countries.

In addition, we keep your machines fit throughout their entire lifecycle with our preventive/predictive services like e.g. fitness checks and oil analysis. Our offer also includes upgrading their efficiency to the latest state of the art as well as analyzing the benefits of modernization/retrofit measures, taking over the implementation in a practical manner – working together with you. Summarized, we combine higher productivity with better energy efficiency and defined safety standards – reducing your total cost of ownership significantly. Rexroth – your one-stop service partner: Just configure our services to your specific needs.

One Partner Worldwide

Electrohydraulic systems from Rexroth haven proven themselves in metallurgical plants all over the world for decades. In complete new plants just as in specific moderniza-tions. Rexroth specialists support operators and system integrators as a partner over the entire lifecycle of the plant.

The Drive & Control Company

Rexroth
Bosch Group

Bosch Rexroth AG
Zum Eisengießer 1
97816 Lohr, Germany
www.boschrexroth.com

Find your local contact person here:
www.boschrexroth.com/contact

R999000251 (2013-09)