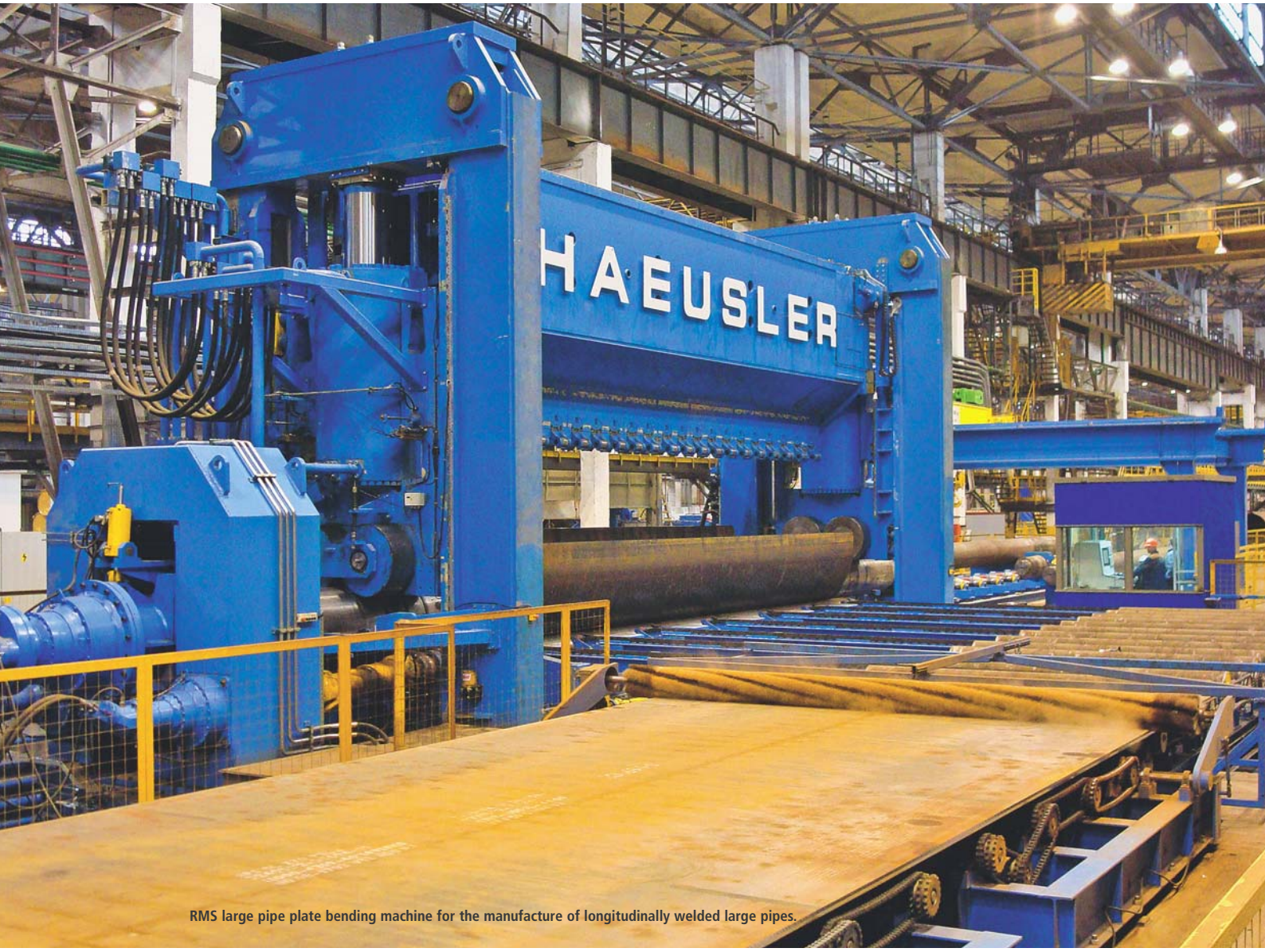
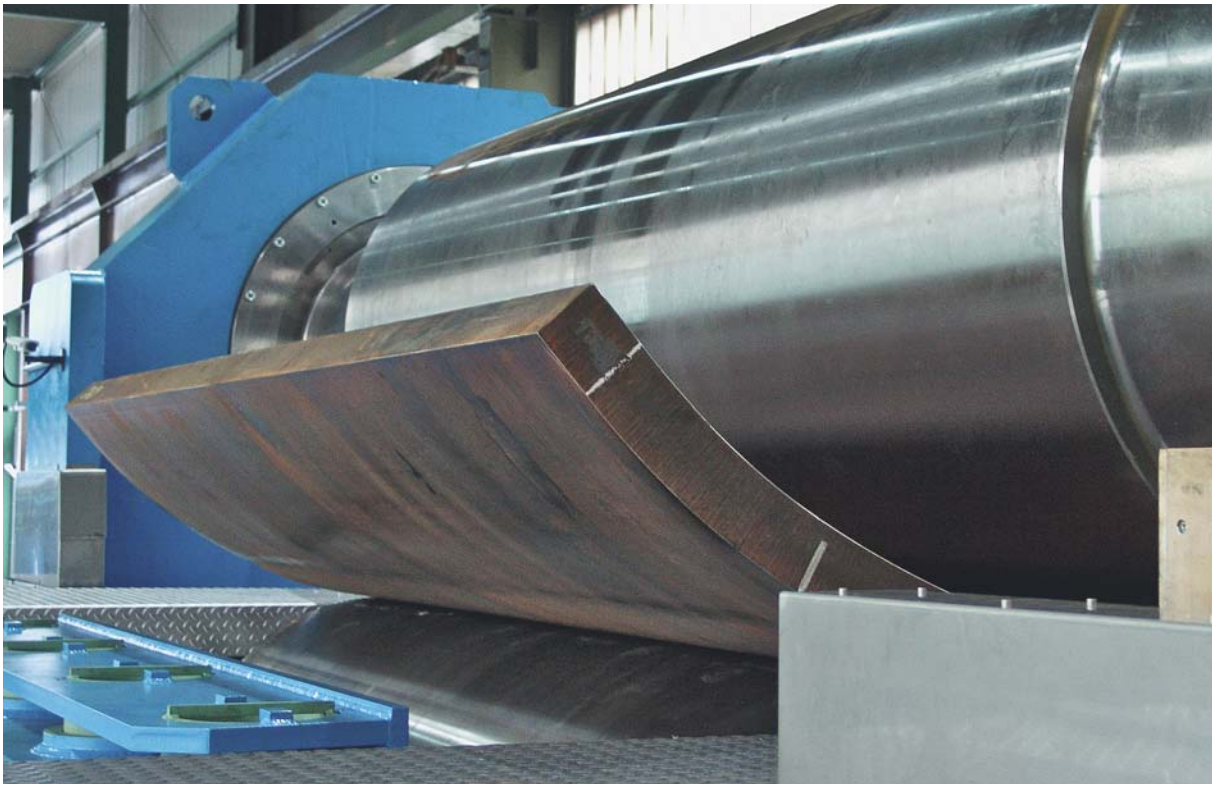
Haeusler AG: new control concept for advanced plate bending machines

Clever giants bend 320 mm plates in a cold forming process



RMS large pipe plate bending machine for the manufacture of longitudinally welded large pipes.

Haeusler AG has firmly established itself in the plate bending technology market on account of numerous technological innovations. With the new 'BEND-IT Swiss Technology' controller, the Swiss company has developed a new software concept for the control of its plate bending machines. The 'virtual' NC controller combines with automation technology from Beckhoff to form a future-proof and comprehensive control platform. Haeusler has applied this automation concept universally in all of its machines since August 2009.



Maschinenfabrik Haeusler was founded in 1936 in Dornach, Switzerland. The company specializes in plate bending on roller plate and section bending machines and manufactures at two facilities (in Duggingen, Switzerland and Rheinfelden-Herten, Germany). The large-format machines process plate thicknesses of up to 320 mm. "Bending diameters from 16 to 64 inches and lengths of well over 12 m are among the usual formats for us in pipe manufacturing plants," says Michael Fabianek, manager of automation technology, IT and hydraulics at Haeusler. The machines are used, for example, to bend plates for shipbuilding, for the automotive and aerospace industries as well as container construction, for the manufacture of pipes for pipelines and wind farms, for the manufacture of heat exchangers in heating systems, or as section bending machines for steel construction. Haeusler currently manufactures a total of 20 different types of machines.

Relaunch of the controller aims at process optimization and sustainability

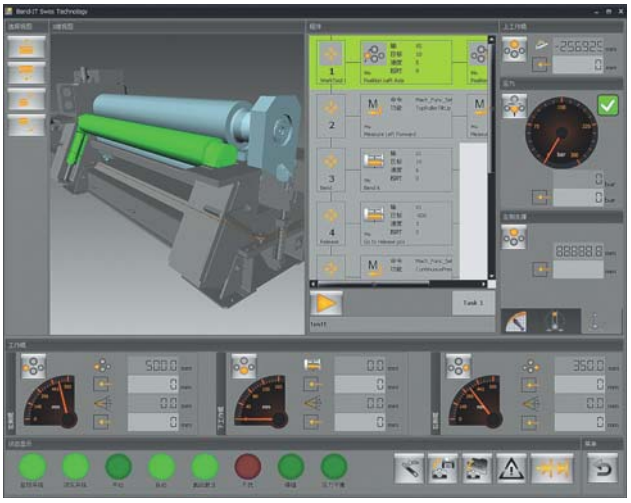
"Control of the forming process is one of the main quality features of our machine concept," stresses Michael Fabianek, manager of automation technology, IT and hydraulics at Haeusler AG. Therefore, the company decided to replace its previous control concept, which consisted of a separate CNC and PLC controller that communicated with one another at the I/O level. Michael Fabianek's expectation was that "the new control solution should integrate CNC and process control on one control platform. Our goal was to reduce maintenance costs and the complexity of the control architecture and at the same time to optimize the process speed and the dimensional accuracy of the machine. The openness of the Beckhoff technology, the fast EtherCAT fieldbus system and also industrial know-how from Beckhoff in forming technology and the company's worldwide presence were crucial factors in our decision in favor of Beckhoff."

Full utilization of multi-core processors

The control platform for the 'BEND-IT Swiss Technology' developed by Haeusler consists of a 19-inch Beckhoff Panel PC from the CP62xx series with Windows XP Embedded operating system, TwinCAT PLC automation software and EtherCAT as the fieldbus system. Haeusler uses a proprietary developed solution for the NC controller. Its core is a modern HMI based on .Net technology and programmed in C# with an integrated 3D visualization. "The so-called 'virtual' machine offers both NC and CNC functionality and covers all axes," explains the automation expert. "We use one processor core of the dual core CPU for the user interface (HMI) and the data management, and the other core for PLC and Motion Control (NC or CNC). The Haeusler CNC is coupled with the TwinCAT Motion Control blocks. The connection of the axes to these functions is programmed with the 'TwinCAT Hydraulic Library' software library."
Furthermore, the multi-core technology enables a three-dimensional animated representation of the machine, which displays all movements and allows the operator to work intuitively, thus significantly reducing the training period for new machine operators.

Michael Fabianek, manager of automation technology, IT and hydraulics

Pipe Mill large pipe making works



The 3D operator interface of the plate bending machines allows intuitive and convenient operation of the machine.

Haeusler's decision to use Compact Flash as the storage medium was also far-sighted considering operational reliability. As Peter Reinstadler, Area Sales Manager of Beckhoff Switzerland, says: "That means there are no moving parts in the data storage system. As a result, Haeusler can guarantee its customers high security and availability, in particular with respect to the vibrations and shocks that are unavoidable in the harsh machine environment. In addition, the memory is remanent and buffered via a UPS, so that the data are always protected."

EtherCAT delivers fast communication

The hydraulically moved bending axes of the Haeusler machines are embedded in a multitude of digital and analog sensors and actuators. These are distributed in the large machine units and their signals are coupled to the Beckhoff Bus Terminal station. Connection to the central Panel PC takes place via EtherCAT. "The variety within the EtherCAT terminal system is impressive," says Michael Fabianek: "In the pipe bending presses currently being manufactured in our facility, for example, we use a new rotary encoder with a hall sensor that senses the teeth on the axial piston unit. This function used to be fulfilled with an absolute encoder, which measured the rotation in a very complex manner by conversion with disks. This functionality is now performed by the Beckhoff EL5151 and EL5152 EtherCAT terminals."

The PC and EtherCAT controlled hydraulic pipe bending press from Haeusler works with a pressing force of 6,000 tons. It enables the bending of pipes from 16 to 64 inches in diameter. The machine can be converted to a different pipe diameter within just two hours.

EtherCAT is one of the incisive features of the new controller, to which Haeusler attached particular importance. In this respect, the Beckhoff automation platform scores in several ways: On the one hand, the Industrial PC features the classic Ethernet interfaces without additional fieldbus cards, and on the other, EtherCAT offers high performance for I/Os and drive technology. In addition to that, there are gateways to other bus systems in the EtherCAT terminal system. "The extremely short cycle time of 1,000 I/O signals in only 50 µs fits perfectly with our concept," says Michael Fabianek contentedly: "The quicker the positional data is available to us, the more precisely we can control the machine."

Condition Monitoring for increased machine availability

Machine safety is ensured by Condition Monitoring, which is implemented in the controller. "The monitoring of critical moments, such as the temperature of the motherboard, the CPU and RAM or the charge level of the UPS, can be implemented via standard software function blocks. The exact monitoring of the operating resource systems, including the oil temperature and the hydraulic oil level as well as the oil quality, are essential for the machine availability," comments Michael Fabianek. "The automatically generated and predicted maintenance scheduling on the basis of the digital operating resource inspection is a further highlight of the controller. The implementation was very much assisted by the open control platform as well as the real-time communication between the HMI and Motion Control via ADS," says Michael Fabianek.

Universal automation platform for all types of machines

Following a six month evaluation phase, Haeusler chose Beckhoff as its future control supplier. "A short while after that, in December 2008, we started the first project, which was already implemented five months later," recalls Michael Fabianek: "Then in August 2009 we began with the complete changeover of our control technology to the Beckhoff platform."
The scalable automation platform can be used for the company's entire range of machines. "Not only do we gain as machine manufacturers, our customers gain too," says Michael Fabianek says, "because they get a modern and powerful production system with optimal availability. Our customers also very much welcome the proprietary developed remote maintenance concept based on Ethernet technology and VPN."
Currently, the first pipe manufacturing plants are being implemented entirely with Beckhoff control technology. "In plant manufacturing in particular, the openness of the Beckhoff system to the Windows world, with the acquisition of operating data via RFID, networking, the implementation of control centers, etc. is a great advantage," explains the automation specialist Fabianek.
If the customer should need support from the machine manufacturer, despite the extensive error and information messages that have been implemented, the manufacturer can dial into the machine controller via the Ethernet interface and remotely analyze the cause of the fault.
Thanks to EtherCAT, XFC (eXtreme Fast Control) technology and TwinCAT 3, and with Beckhoff as system partner, Haeusler considers itself to be equipped in the best possible way for future and current developments, which are aimed toward adaptive controllers, artificial intelligence or Condition Monitoring.

Haeusler AG **www.haeusler.com**
Beckhoff Switzerland **www.beckhoff.ch**