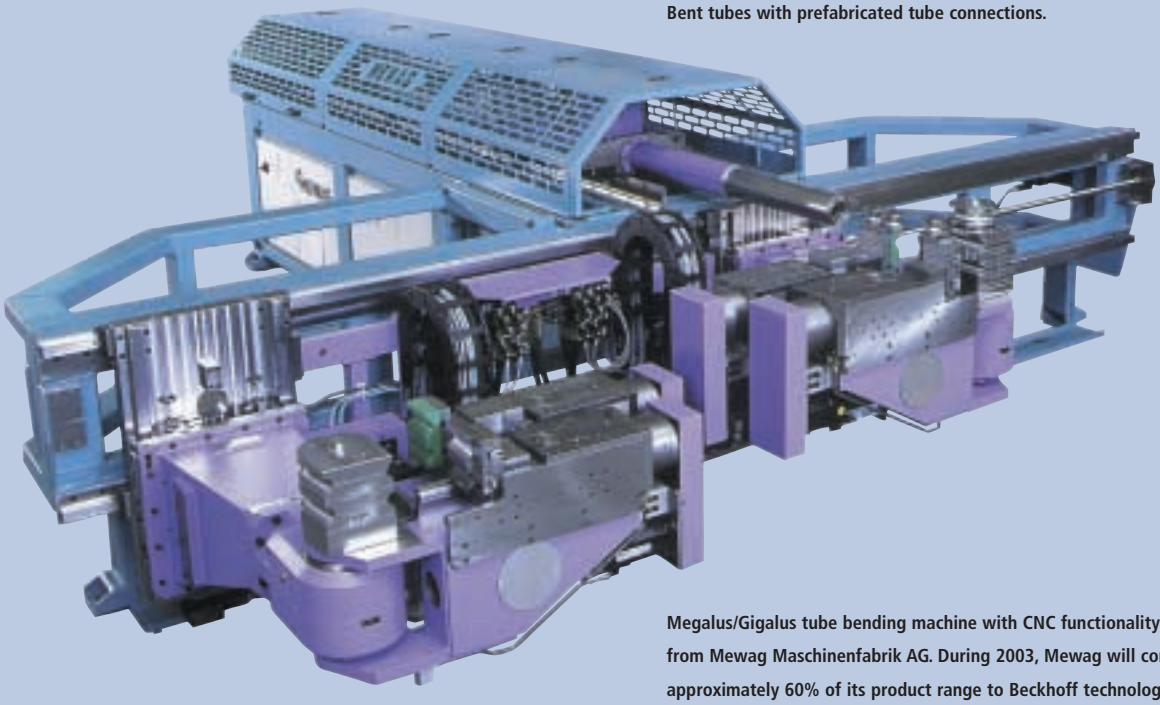
PC-based control concept for new tube bending machine from Mewag Maschinenfabrik AG

A new era for tubes and profiles

The new Megalus/Gigalus series tube bending machines with CNC functionality enable maximum productivity through very short retooling times and unlimited flexibility. The company plans to produce about 30 machines per year, all of which will be equipped with PC-based control technology from Beckhoff.

Bent tubes with prefabricated tube connections.

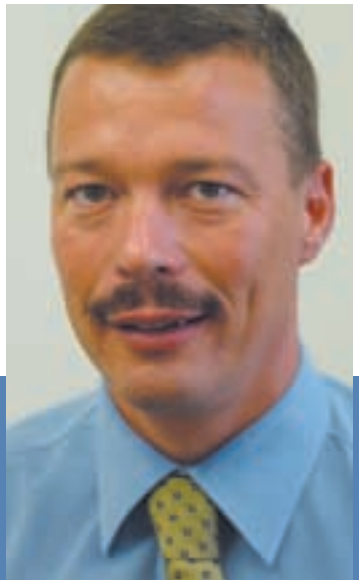


Megalus/Gigalus tube bending machine with CNC functionality from Mewag Maschinenfabrik AG. During 2003, Mewag will convert approximately 60% of its product range to Beckhoff technology.

Automated tube and profile bending is anything but trivial: The specialized machines operate with up to 13 axes and are able to carry out simple bending procedures or deal with complex geometries with high precision and repeat accuracy, and very cost-effectively. Such machines require innovative engineering and they need state of the art automation technology in order to be able to carry out the highly complex bending functions. This was the guiding premise for the Swiss company Mewag Maschinenfabrik AG. In order to maintain their leading market position and continue to be successful among international competitors, the Swiss tube bending experts had to revise and re-position their range of machines. A new machine generation appeared to be the way forward, as manager Urs Kühni explained.

The preconditions were good, because with Hans Morgenthaler, a consummate tube bending expert, technical manager Samuel Gerber, electrical engineer Simon Bucher and automation expert Matthias Krähenbühl, a motivated team was available to tackle this important task. Additional experts for automation concepts, Jürg Eggimann, Martin Thöni and Beat Fund from TAS Engineering AG, were called in to complement the Mewag team. The team did not have to start from scratch, since the existing machines already featured electronic control, although it was a proprietary system and therefore less flexible. Another disadvantage was that the old control no longer met the requirements in terms of operating comfort, and it offered insufficient flexibility with regard to technology and costs.

The fact that Mewag builds both production machines and customer-specific bending machines, including complete solutions, had to be considered for the design of the new machine and control concept. An additional factor was the fact that Mewag machines are used in a diverse range of applications, including vehicle manufacturing, machine construction and engineering, small and large



Urs Kühni, General Manager,
Mewag Maschinenfabrik AG.

appliance industry, air-conditioning and ventilation, building services and furniture industry. The modular Megalus/Gigalus machine concept was defined to cater for this wide range of applications. In the vehicle manufacturing industry, for example, exhaust pipes, structural and hydroform components, and profiles are manufactured. Due to their high flexibility, the machines can be used for building prototypes or in job shops that require machines offering a wide range of options.

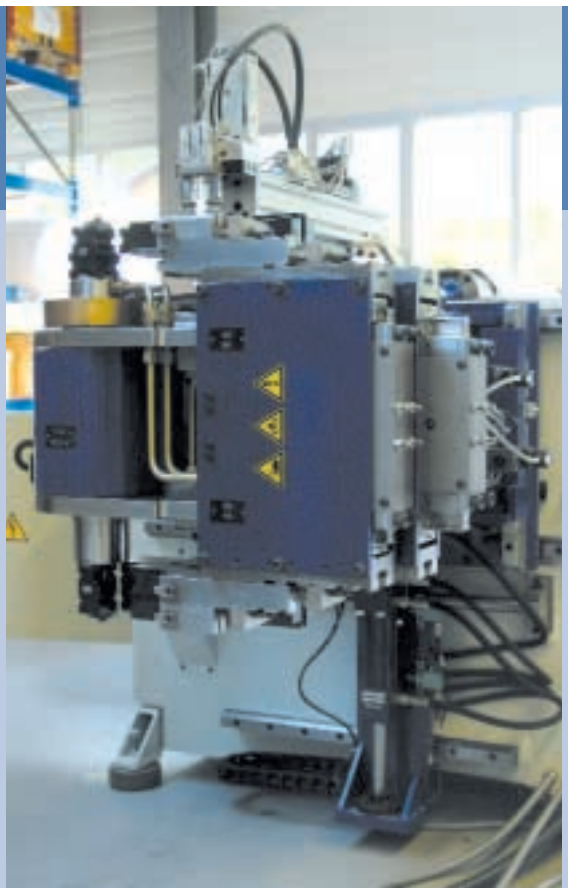
Megalus/Gigalus machines are used to bend workpieces in a single clamping that have different bending radii, short clamping sections (bend to bend), free-form radii or parts requiring left and right bending. Tubes with machined ends, flanges, rings, nuts, etc. can also be processed without problem.

The Megalus/Gigalus range comprises single-head machines (S) and dual-head machines (D) for tube diameters up to 150 mm. Megalus is an innovative, robust tube and profile bending machine with modular design, featuring identical functional units and components, and interchangeable parts. The machines are very powerful and versatile. Highly dynamic servo drives are used for all axes. By selecting an appropriate program, a machine can automatically be adjusted to new tools. This advantage optimizes bending processes and increases machine performance. It is also possible to program the machine during operation in such a way that it automatically adapts itself to new workpieces.

Automation offers added value

For the automation and operation of the machine, Mewag intended to use an advanced concept that should match the modular design of the machines and at the same time be future-proof. This prompted the Mewag team to have a closer look at the IPC concept from Beckhoff. The Mewag team engineers and general manager Kühni were quickly convinced by this solution: The real-time control concept offers the required flexibility and furthermore meets the economic expectations due to its scalability for customer-specific machine concepts and in terms of the significantly lower expenses for control cabinets and commissioning. In addition, it offers convenient operator guidance and machine programming, with software based on industrial standards such as Windows XP, or IEC 61131-3 for PLC applications. On this basis, the Mewag team went ahead with the design of the new MTC XP (Mewag Touch Control) control for tube bending machines. The hardware platform of the MTC XP includes the following Beckhoff system components:

Samuel Gerber, Technical Manager,
Mewag Maschinenfabrik AG.



The control: control cabinet PC C6240
and Bus Terminals with SERCOS coupler.

Development Manager Morgenthaler
at the tube bending machine.

- The central control of the MTC is based on the Industrial PC series C62xx from Beckhoff, or on the Embedded PC CX1000 for smaller machines.
- The Industrial PC controls the machine axes via servo amplifiers with SERCOS interface.
- The complete sensor and actuator technology, including hydraulic valves, relays, sensors, limit switches, switches and signal lamps, is connected via Beckhoff Bus Terminals with SERCOS couplers.
- The HMI is realized via a 15" Beckhoff Control Panel and a touchscreen. The touchscreen is used for programming and operation, based on a special graphical user interface. It features integrated additional function keys for regularly used functions.

A system for control, operation and monitoring

A particular advantage of the Beckhoff automation solution is the fact that the control software, including fast axis control, and the operating and visualization software run on a common IPC hardware, without detrimental effect on the real-time tasks.

The software platform comprises Windows XP as the operating system and the TwinCAT NC PTP software system including a PLC module. The complete programming of the machine control – from axis control to the integration of peripherals – could be realized with TwinCAT. Special hardware is therefore no longer required. All machine variants and options are included within a project in order to make software maintenance easier. Particular attention was paid to the design of the user interface and the integration of additional features such as a CAM interface, the link to a measuring machine or tool database, program administration and other features.

The result is a clear and intuitive interface for controlling the operation of the tube and profile bending machines in either manual or automatic mode. The system provides intelligent end user guidance for the programming of bending programs – only the parameters required for the respective task, e. g. clamping pressure per

Beckhoff Control Panel with touch screen.

bend or workpiece data, have to be entered via number or text pads displayed on the screen. The inputs are checked for plausibility, and programmed parts can visually be checked as 3D tube graphics on the touchscreen.

Unlimited flexibility

The new CNC tube and profile bending machines from Mewag Maschinenfabrik AG in single-head or dual-head design with up to 13 axes are characterized by high dynamics and state of the art automation technology. Bending speeds of 180°/s, tube feed speeds of up to 70 m/min and tube rotation speeds of up to 500°/s demonstrate the performance required from the highly dynamic servo drives. The scalable automation technology from Beckhoff ideally complements the modular Megalus/Gigalus machine concept. Mewag Maschinenfabrik is therefore able to realize both customer-specific and industry-oriented machines, and machines meeting the requirements of international markets. The acceptance of the solution is convincing: The new machine concept and the automation technology were integrated within a very short space of time. After only six months of design and programming effort, four machines featuring the new Mewag MTC XP control technology have already been delivered since early August 2003.

→ Mewag Maschinenfabrik AG www.mewag.com
→ TAS Engineering AG www.tasag.ch
→ Beckhoff Switzerland www.beckhoff.ch