The wheel disks for wheel sets of railroad cars were previously pressed onto the axis one side at a time, one after the other – with a corresponding time loss. The world’s first hydraulic simultaneous wheel set press to be tried and tested in three-shift operation, manufactured by Hegenscheidt-MFD GmbH & Co. KG, puts an end to this. It delivers a complete wheel set approximately every six minutes – a time savings of three to four minutes compared to previous machines, which means a great increase in productivity in continuous operation.

In order to press the wheel disks against each other at the same time, an extremely powerful controller was needed for highly dynamic control of the hydraulic axes in particular. The developers found it in the PC-based version of the Simotion P350-3 motion control system. “What was particularly convincing was the continuous real-time communication between the controller and the hydraulic and electric drive axes using Profinet with isochronous real time [IRT] and the integration of motion control, control, and HMI functionality in one unit,” explains Jürgen Winnertz from the electrical design team of the machine manufacturer.

**Dynamically regulated**

On both sides of the press, one cylinder sits concentrically in each of the press cylinders. These can be operated both in themselves and laterally independent of each other on a travel- and force-controlled basis. This allows a dynamic and precise pressing...
process that can be exactly reconstructed when used in conjunction with a high-resolution measuring system.

The process calls for the wheels to be centered within the press and the axis to be clamped and centered between the quills (hollow shafts for the transmission of torque) of the centering cylinder. In this clamping process, the wheels are carried along with the centering equipment until just in front of the press fit on the axis. Then the press cylinders press the wheel disks simultaneously into the specified position on the axis.

Various roughness depths and dimension tolerances lead to various press forces that must be recorded continuously and quickly compensated for. A particular challenge was the fast and seamless switching between position and force regulation that was required during the clamping and centering of axes of various lengths.

**Pure performance thanks to Profinet with IRT**

The PC-based Simotion P350-3, complemented by an MCI-PN communication board, functions here as a Profinet I/O controller and enables easy setup of individual bus topologies. With fast peripheral modules from the Simatic ET 200S HS series in the machine, real-time communication is possible via Profinet with IRT with bus and servo cycle times of 250 microseconds. The motion control specialists from the Siemens application center in Cologne developed specific modules for demanding hydraulic regulation and other functions. They also provided support during initial commissioning.

The 1FK7 series servomotors are supplied with power using a converter of the modular Sinamics S120 drive family, which is optimized for operation with Simotion controllers. All components are connected with each other using the fast Drive-Cliq digital system bus and integrated into the Profinet network as Profinet I/O devices using a CBE20 communication board. This allows all components involved in the press process to continuously communicate with each other in real time, something that simplifies the engineering and makes diagnostics easier during operation.

**PLC and HMI functionality included**

The PC-based Simotion variant also integrates the entire process control and the linking of the press with the local periphery and upstream and downstream plant parts. These are connected using interface module IM154-4 PN or DP/DP couplers. Simotion P350 can be used in nearly any software program capable of running under Windows XP and can thus also take on demanding visualization tasks. Hegenscheidt decided to use the Simatic WinCC flexible HMI system and developed a multilanguage user interface for a Simotion panel front with a 15-inch touchscreen. For the process-oriented setup of wheel centering equipment and transport carts, a portable mini handheld control unit from the Sinumerik portfolio is used.

Upon the request of the customer, the machine manufacturer also installs powerful tools for telediagnosis and telemaintenance right into the drive level.

The customer can choose Web functions that are directly integrated into the motion control system and accessible over Industrial Ethernet or Profinet and the WinCC flexible/Sm@rtService option for diagnosis, maintenance, and remote control via the Internet. With this universal accessibility for diagnostics, the machine manufacturer is also making a leap forward in terms of service quality by being able to quickly recognize and rectify faults (or import updates) from a central location. This avoids time and cost-intensive service visits as well as downtime and the associated lost production.

»What was particularly convincing was the continuous real-time communication between the controller and the hydraulic and electric drive axes.«

Jürgen Winnertz, Electrical Design, Hegenscheidt-MFD GmbH & Co. KG

Simotion controls and monitors the pressing process and archives important parameters during the joining of the safety-relevant wheel sets; the press curve shows the deviations at a glance