Bent – Not Welded

The precise control of hydraulic and electric drive axles is crucial for quality when induction bending thick-walled pipes. AWS Schäfer Technologie GmbH coordinates the interaction of the two axles using a programmable logic controller (PLC) with both integrated motion control and hydraulic functions. This results in an exact and cost-effective process, making a separate hydraulic control system unnecessary.

AWS Schäfer Technologie GmbH, headquartered in Wilnsdorf, Germany, is one of the world’s leading manufacturers of induction bending machines, with which it is possible to bend steel pipes of up to 1.60 m in diameter, 120 mm in wall thickness, and 18 m in length. These dimensions place special demands on processing: in addition to extremely small angular tolerances, a high degree of repetition precision is required.

Precise advance with hydraulics

The AWS bending principle is implemented using a sturdy machine bed that can be moved lengthwise hydraulically and transversely by motor. The feed trolley is mounted on this bed and features a rotatable collet for three-dimensional bending. Depending on the required advance force, one or two hydraulic cylinders move the feed trolley. The combination of the resulting forces and movements then produces the desired bend. With the Simatic S7-317T Technology CPU (T-CPU), the machine manufacturer has found a reliable control system for the machines, since it is possible to control both the hydraulic and electric axles with high precision. The recently updated firmware Version 4.2 also enables expanded hydraulic functionalities, such as the regulation or limitation of the pressure. This way, the machine manufacturer does not need a separate hydraulic control even in the hydraulically demanding hydroforming machines, simultaneously reducing installation and programming expenditure. “The T-CPU is exactly the right control for our induction bending and hydroforming machines: cost-effective, not too complex, easy to operate, and also absolutely resistant to high inductive power,” says Winfried Heinemann, marketing director at AWS.

AWS uses the hydraulic functionality for precise control of the feed velocity and of the clamping forces during induction bending in order to create the necessary bending torques, using a servo-valve with the aid of the technology function block. The actual values are continuously being recorded by 25-bit SSI sensors connected through a Simatic ET 200S SSI technology module. The regulating technology controller also includes a comprehensive package with function blocks conforming to

Advantages of induction bending

- Bending with smallest R/D ratio, bending angles from 1° to 183°, complex three-dimensional bending geometries, low wall weakening and ovality, bending radii from 75 mm to infinite as well as helical bends
- Multiple bending with fewer welding joints – therefore less inspection effort
- Bending of ferritic, austenitic, demanding duplex materials and materials for power plant technology, such as P91/P92
- Maintenance-optimized operation and high availability
- Short changeover and handling times
PLC open, which are interconnected under Simatic Step 7 like ordinary standard function blocks. The engineering platform can be expanded by the S7 Technology option package. This way, it is not necessary to learn a new motion control language, making it significantly easier for the application programmer of the bending machine to become familiar with the new subject matter. To create and monitor the bending programs, AWS uses a Simatic Panel PC 677B suitable for industry, with an operator interface using Simatic WinCC flexible. The panel PC also serves as an engineering station and gateway for remote access. The GetCharacteristics technology template for automated recording has also proven to be straightforward and easy to use. It records the nonlinear characteristic curve of the controlled system, and the information compensates for the nonlinear areas and dead zones. “With it we achieve exactly the accuracy we need,” explains Dietmar Otte, technical director at AWS.

In order to exactly position and coordinate the axles to each other, AWS uses the modular Sinamics S120 drive system together with Simotics S-1FK7 servomotors. For this, the control supplies different motion control functions with which it is possible to control the position of individual axles as well as to easily synchronize complex movements of several individual axles.

Noncontact bending impresses users

More and more users are impressed by the machines made by AWS. “Among other things, this is because – unlike the better-known technologies – practically noncontact bending is possible, and without the costly use of tools,” says Otte. However, in his opinion, one of the most important decision criteria for customers is the preferred, integrated control and drive technology made by Siemens. Heinemann adds: “In addition to the technical and economic benefits of the T-CPU, widespread use of Siemens components throughout the world proves to be a true selling point, since the users know that all the components are certified for use around the globe and that they have quick access to spare parts and, if needed, also comprehensive support.” The conclusion of AWS: the overall package is simply a perfect fit.