PC-based motion control and coupled torque motors bring dynamics and flexibility to two servo-progressive forming presses operating either separately or in combination, achieving significantly higher output.

For the development of a new press solution for complex drawn parts, machine manufacturer Raster-Zeulenroda Werkzeugmaschinen GmbH had to meet the demand of forming at the same speed and quality as a conventional press at 15 strokes per minute – but now at 45 strokes per minute. The Thuringia-based company achieved this by means of a special gearbox and powerful torque motors from Siemens, resulting in an unprecedented combination of two PAUSt 800s servo-progressive forming machines with 8,000 kN of force and two HRM 250 circular blank punches with a nominal press force of 2,500 kN. The seven-stage forming machines can be operated individually or in combination, with variable flow directions and paths. The circular blank punches can temporarily store up to 1,000 circular blanks in operation, meaning that the coil change (in less than 12 minutes) can be bridged and production can continue. The system is rounded off with the automatic supply of the circular blank punch directly from the coil and 3-D transfers in the forming machines.

Direct drives for dynamics

Two water-cooled torque motors from the Simotics T-1FW3 Heavy Duty series, operated with torque-balancing control, ensure high torques and variable, reproducibly accurate ram motions on each of the forming machines. Together, these motors generate a peak torque of around 23,000 Nm, which results in a peak torque of around 600,000 Nm on the crankshaft. This means that the required working capacity of 200 kJ is reached even at low forming speeds. Simotics M-1PH8 energy storage motors store the electrical energy generated during braking in the form of kinetic energy and then supply it back to the drive system when required. This reduces the system’s energy costs.

Raster-Zeulenroda Werkzeugmaschinen GmbH, Germany
“Siemens’ support was exemplary – from the design of the drives according to the characteristic curves determined by us, to the initial commissioning of the coupled torque motors in combination with energy storage motors,” says Joachim Klaus, head of the electrical design and software team.

**PC-based motion control: high-performance and open**

For reasons of consistency and in order to safely achieve cycle times of 1 ms, the press manufacturer ported its Windows-based visualization system to the Simotion P350 motion control system for the first time. This enabled the company to maintain familiar operating procedures practically 1:1 and to pool all software on a single PC system, including a speed editor to program the ram, an envelope calculation to reduce defective parts, and the Critical Checks Proving System (C²PS). In conjunction with the servomotors, the latter facilitates very short, defined braking distances, therefore further improving tool protection. In addition, Simotion P350 provides diagnostics in a convenient manner, reducing hardware and the intermediate communication, which in turn contributes to shorter cycle times.

**Efficient engineering on an established platform**

The functionality of Raster-Zeulenroda’s first PC-based motion controller (Simotion P) is identical to that of the drive-based system (Simotion D), which has already been proven on other presses at the company. Even the programming of logic modules in Structured Text is similar to that of the original control system. This sped up the engineering process and contributed to a very short implementation time of just 14 months from the receipt of the order to press start-up.

**Flexible coupling via Profinet**

The motion controllers of the two forming machines communicate via Profinet with IRT (isochronous real time). Here, the first Simotion in the feed direction acts as the master for the second press controller. Subordinate to each, there is a drive-based Simotion D445 for the transfer system, which receives a calculated master set point and precisely follows the press movements. The control systems of the circular blank punches, tool data management, and higher-level production planning and control system are also connected via Profinet/Industrial Ethernet.

**Performance with potential**

Since early 2013, the plant has been producing various kinds of complex drawn parts in varying batch sizes of a consistently high quality and with the required stroke rates. With a potential performance of 45 strokes per minute, it offers even more potential for further improvement. With this solution, the operator has organized production much more flexibly and can respond more quickly to customers’ requests.

**INFO AND CONTACT**

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All pictures: Raster-Zeulenroda