Efficient production of very large workpieces such as power plant turbine housings, for example, is only possible if all the work steps can be performed in a single clamping — from the heavy-duty machining of blanks that weigh hundreds of tons to the precise finishing of joints and surfaces. This requires large five-axis machine tools capable of turn-milling as well as mill-turning operations. To meet the increasing demands of the power industry in terms of efficiency and precision, Dörries Scharmann Technologie GmbH, a member of the Starrag Group, developed a new large-scale machine series for the global market.

Flexible large-scale machines for a wide range of applications

The new five-axis machines offer portal passage heights of up to 10 m and, when required, can be equipped with a wide range of milling heads, a variety of different tool magazines and additional rotary tables. In order to improve dynamics and precision, the tool’s vertical motions are executed by a vertically mobile crossbar (w-axis) and a RAM that functions as the z-axis. However, the real engineering challenge lies in ensuring the narrow production tolerances required when building turbines with repeat accuracy across the entire workspace. For maximum precision, dynamics and durability, all the axes in the new series of machines are mounted hydrostatically, and even the RAM is braced hydrostatically on all sides. In combination with the compensation functions of the CNC, rack and pinion drives, which are braced free from play in the servomotor, ensure the necessary precision when the gantry is being moved.

Seamless automation minimizes project risks

The first machine in the new series, a Droop+Rein G-L, was delivered to a customer in St. Petersburg at the beginning of the year. This gantry machine has a range of 21 m on the x-axis and 9 m on the y-axis and a portal passage width of 8.5 m, and, like all the machines in the series, is a completely new development. To minimize possible project risks Dörries Scharmann and Droop+Rein decided to use the seamless control and drive technology from Siemens. As a result, inconveniences and uncertainties that normally arise when integrating components from different manufacturers could be avoided. In addition, the consistent and uniform development environment for the electrical equipment allowed for many simplifications that all parties involved could take advantage of early-on during project planning. Further time-saving simplifications are derived from synergies between system-integrated safety technology, which can draw on drive-based safety functions, and the power supply.

Dörries Scharmann Technologie GmbH, Germany

Gigantic dimensions

Using integrated CNC and drive technology, Dörries Scharmann developed a series of large-scale machines for the production of turbine housings and brought them to market in a short period of time.
Intelligent power supply, high energy efficiency

The mixed operation of booksize modules and high-performance chassis modules of Sinamics S120 drive components, which is now possible, proved especially advantageous. With the Active Line Module (ALM), they can now support larger drive capacities, and the newly-integrated reactive power compensation in the ALM accounts for lower energy costs for the machine operators. Combining the drive components with new drive motors results in a high degree of efficiency ranging between 88% and 94%. The use of a synchronized spindle in the Droop+Rein machine also provides for energy savings, reduced heat loss and cooling capacity because its permanent magnets do not require an exciting current. In addition, coil control and electronic triggers reduce internal power loss, thereby reducing waste heat from the control cabinet by more than 90% in comparison to classic bimetal technology and coil control. This also means that the machine’s connected load can be limited to 230 kVA.

Thanks to the Siemens intelligent drive interface Drive-Cliq, which — among other things — supports electronic type plates, less time is needed for cabling and commissioning. “Via Drive-Cliq, distributed drive controllers can be connected directly to the CNC moving on the gantry. This was not possible until now, and it made modularizing such a large machine significantly easier. Rotary tables and horizontal fulcrum shafts, including the CNC-controlled steady rest and tailstock, can be easily incorporated into the automation system as needed,” explains Dietmar Wallenstein, head of the e-construction and commissioning divisions for Droop+Rein products.

Short development period despite the complexity

All-in-all, the development period for the new series, lasting until the delivery of the first 21-m gantry portal machine, was only 22 months — a relatively short time for a project of this magnitude and complexity. Wallenstein concludes: “The new series of machines paves the way to an attractive growth market. Using state-of-the-art control and drive technology for a system as integrated and consistently as possible has given support to our development strategies and made it possible for us to enter the power plant component market early-on.”

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Left: With a total workspace of 21 m x 10 m x 8 m, the Droop+Rein five-axis portal milling machine offers the same precision as small machines and provides very high spindle power

Right: Sinamics S120 drives with the Active Line Module allow a reduced connected load