Tooling a Large Machine for Turbine Shaft Machining

Scaling up and tooling a multiproduct machining center (mpmc) to machine a giant turbine shaft for a US power engineering group was a challenge for Weingärtner Maschinenbau (Kirchham, Austria). The timeframe and sheer size of the workpieces required Weingärtner to scale up one of its advanced technology mpmc 1200 machining centers to be able to machine giant turbine shafts used in gas/steam turbine plants.

“Until now, the workpiece weight between chuck and tailstock was limited to a maximum of 30 t,” said Werner Pommer, Weingärtner engineering and sales. “We had already thought about how we could scale up our mpmc 1200 machining center to accommodate larger turning diameters and heavier workpieces. In this respect, we were ahead of our competitors,” said Pommer.

This innovative approach paid off. Weingärtner received the order to deliver the machine for processing the turbine shaft destined for use in a gas turbine power plant. From the time Weingärtner received the order, it had only 20 months to deliver the machine, a situation made all the more challenging by the fact that there was only one high-tensile steel blank, worth $200,000, available to make the prototype.

Weingärtner regarded selecting the right tooling supplier as critical to optimizing the machine’s potential. From the original six potential suppliers invited to carry out simple milling tests, in the second phase, two were invited to produce special tools that were tested in-house on the mpmc 1200. Both models represent an identical machining concept. The results were evaluated using a matrix with the most important criteria for selection met by Ceratizit. “Cutting Solutions by Ceratizit convinced us with their productivity, process security and dimensional accuracy,” said Pommer. By December 2014, Weingärtner had selected Ceratizit as its partner for developing and delivering the tooling.

“For the milling tests we used the Silverstar from the new grade. We were very confident that we would obtain outstanding results using the CTPP235 grade for this material group,” said Peter Utenthaler, Ceratizit area sales manager for North America. “Other important tools included the extremely precise solid-carbide profile milling cutters for multiple
cutting edges for the finish milling of the dovetail grooves; the MaxiDrill 900 insert drill for deep holes with a diameter up to 70 mm; and the HX parting and grooving system for large parting and grooving widths with maximum stability.

“Each of these tools contributes to the excellent economic efficiency of the overall process,” said Alfred Hofegger, head of Ceratizit’s OEM services, who was in charge as project leader. “The milling concept ensures high productivity and thus short machining times. The solid-carbide profile milling cutters deliver excellent tool life and dimensional accuracy, and the HX parting and grooving systems also feature good chip control combined with relatively low cutting forces,” said Hofegger.

“You can say that in this machining center we apply tools which satisfy maximum demands but all together cost less than the tools used until now for similar tasks,” said Weingärtner’s Pommer.

Another important consideration with regard to the choice of the supplier was availability of cutting tools that would satisfy the customer’s requirements based on a rolling forecast. Ceratizit maintains its own logistics centers in Kempten, Germany, and through its US subsidiary in Warren, MI. “It was also considered a positive fact that we were able to organize the regrinding of the tools in the US through our California affiliate, Promax Tools,” said Ceratizit’s Uttenthaler.

According to Weingärtner, another advantage and evidence of the commitment of everybody involved was that the American Ceratizit employee responsible for the project spent two weeks in Kirchham at Weingärtner’s headquarters in order to become acquainted with the component, the tools that are used, and the machining parameters.

“What we have achieved here is the result of a great team performance,” said Uttenthaler, “emphasizing how closely both parties, Weingärtner and Ceratizit, worked together.

“The task was extremely demanding considering the tight timeframe we had been given, said Pommer. “We broke it down into individual work packages and planned and worked through each, step by step. Creativity backed up by engineering was vital.” In Pommer’s opinion, Ceratizit’s Hofegger was one of the key players in the project thanks to his excellent technical advice. Both sides are proud of the fact that the result ultimately has even exceeded expectations. The overall machining time for the large shaft including tool changes is only around 130 hours. Originally the goal was to reduce the machining costs by half. In fact, they were reduced by two thirds.

According to Dominik Weingärtner, vice president of the family-owned company, both Austrian companies with an extremely high share of exports, were able to demonstrate how working together they are strong partners for demanding customers around the world. “Culturally speaking, it makes things easier when two Austrians communicate with each other. We can really be proud of the technology that comes from our region and it’s very likely that more will be heard coming from team Weingärtner and Cutting Solutions by Ceratizit in the future.”

For more information from Weingärtner Maschinenbau, go to www.Weingartner.com; from Ceratizit USA, go to www.ceratizit.com, or phone 586-759-2280.

Weingärtner's scaled up mpmc 2000S-7000 is capable of machining workpieces with diameters up to 2 m and weighing 80 t for applications in the oil and gas, energy, pump, aerospace, and general engineering markets.

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