EMAG Salach Maschinenfabrik GmbH, Germany

The Fast Way to the Perfect Shaft

CNC-controlled vertical synchronized-support grinding machines can give motor shafts, gear shafts and even crankshafts the final finish up to 70 percent faster than horizontal grinding machines.

More than seven years ago, EMAG Salach Maschinenfabrik GmbH had the idea to machine shafts vertically. With the synchronized-support grinding machines, a technology for the highly productive manufacture of shafts was developed. Since then, Dr.-Ing. Guido Hegener, the company’s CEO, has seen the development of this technology as a “living process.” The mechanical engineering company chose Siemens’ Sinumerik 840D sl for the control side from the very beginning.

In 2009, the revolutionary synchronized-support grinding machine VTC 315 DS was launched onto the market. Guido Hegener explains the technical principle: “We clamp the shaft to be machined vertically, grind it simultaneously from two sides with high-quality CBN grinding discs, and support it at the same time with a steady rest.” The resulting key advantages soon become evident; it is primarily the normal forces acting in the feed direction that limit the grinding performance, especially on slim and other unstable shafts. To eliminate the tangential forces, the developers at Salach also equipped their machines with an NC-controlled steady rest, which is fitted with high-quality glide materials. The grinding discs both co-rotate and counter-rotate to ensure that no torques act during the grinding process.
**The final finish to the shaft up to 70 percent faster**

According to EMAG, the sum of these technical functions leads to grinding time reductions of up to 70 percent in comparison with conventional horizontal grinding with corundum discs. Even if CBN tools are used, machining can be 50 percent faster. Tests have also revealed that roundness of 2 µm and radial runout accuracy of <10 µm can be achieved reliably with the synchronized-support grinding machines. Setup of the VTC 315 DS with the vertical structure is also easier, Guido Hegener explains: “The machine operators are not obstructed by any interfering steady rests or clamping systems, and the shafts to be machined can be loaded unobstructed up to a length of 650 mm. And, of course, functions such as the spark-up sensors in the dressing and the automatically balancing system are standard features.”

Since mid-2010, EMAG has also enabled the synchronized-support grinding of crankshafts with its VTC 315 DS. In addition to the stable vertical machine structure, a newly developed eccentric chuck, which adjusts the stroke and pitch automatically, is an important technical basis. Unlike previously known eccentric grinding methods, the chuck no longer has to be set mechanically to a new stroke or pitch but simply has to be reprogrammed. In addition to the main and fitting bearings, flanges, and journals, the lifting bearings can also be made by the classic round grinding method.

**CNC highlights — openness and supporting features**

In addition to the complex mechanical design, which is necessary for synchronized-support grinding, the control system also plays an important role. The machine manufacturer EMAG relies on Sinumerik CNCs especially in the field of grinding technology. An important reason for this is that the machine tool manufacturer must always respond to individual customer requests and, for example, adapt the number of axes on the control side. “With the Sinumerik 840D sl, this is quite simple. We can create any necessary axis interpolations we like,” explains Wolfgang Rummel, head of Control Technology. The adaptation of the user interface is equally uncomplicated. Software experts from EMAG can generate it quickly and easily using Siemens project tools.

CNC expert Wolfgang Rummel also finds the “generic coupling” developed by Siemens particularly helpful. “This enables us to link various axes easily and reliably in such a way that they move in absolute synchronization.” This is immensely important, especially in synchronized-support grinding, because it is the only way to ensure that the engagement of the two grinding discs and the steady rest takes place at the same time as the final “spark out,” therefore providing a flawless surface.

To protect the expertise for this and other specific customer-developed cycles from piracy, Siemens provides a so-called cycle protection. Wolfgang Rummel explains: “You can imagine this function as a kind of black box that protects our programs against illegal attack from competitors. The expertise for the cycles stays where it belongs — namely, with us.”

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Wolfgang Rummel, Head of Control Technology at EMAG Salach