Shaft Machining on VTC Series Machines

EMAG

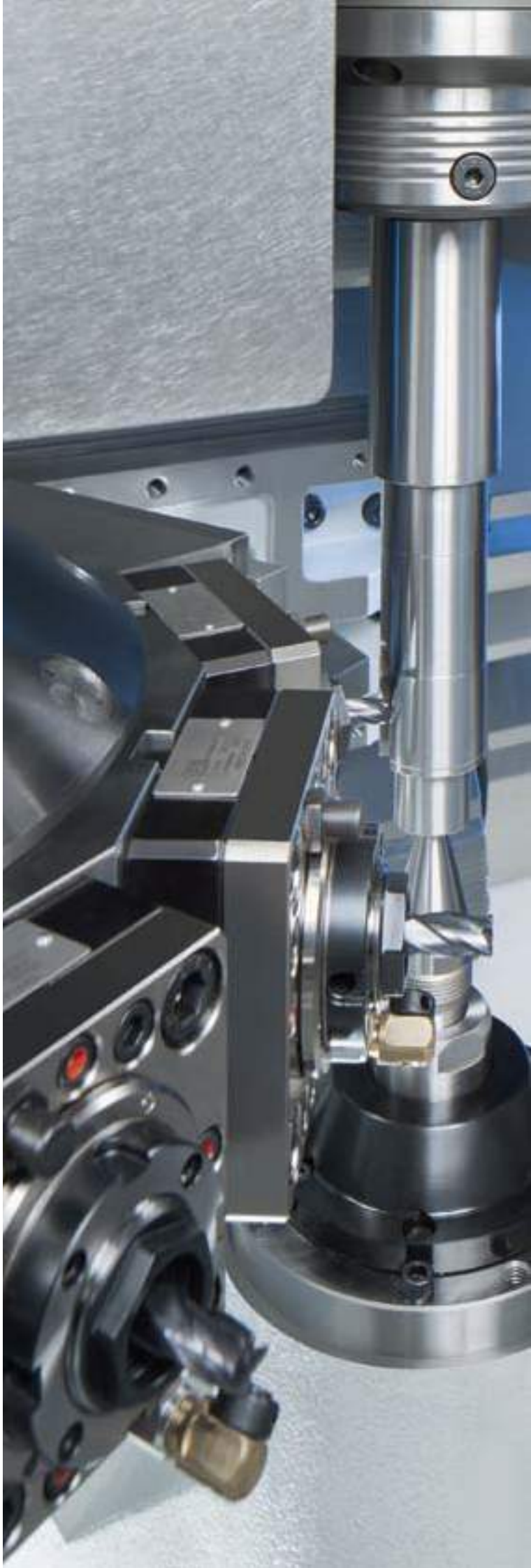
VTC 100-2 – Small, compact shaft manufacturing cell

The VTC 100-2 is specially designed for the vertical machining of shafts with a workpiece length of up to 400 mm. The machine has a machine base made of MINERALIT® polymer concrete which has 8 times better damping properties than gray cast iron. MINERALIT® polymer concrete is very stable thermally which ensures consistant production results. Its high vibration damping properties ensure long tool service lives. The VTC 100-2 has a compact design and requires a floor space of just 1,600 x 2,800 mm. All maintenance units (pneumatic, hydraulic and central lubrication systems, etc.) and the electrical cabinet are mounted on the rear of the machine for easy access.

Machining drive shafts	
Technology	Turning
Chipping tool	Front cam + Tailstock
Machine data:	
Machine	VTC 100-2
Chuck diameter	160 mm | 6.3 inch
Workpiece diameter max.	63 mm | 2.5 inch
Workpiece length max.	400 mm | 15.7 inch
Main spindle (40% duty cycle)	19,5 kW | 26 hp 144 Nm | 106 lbf ft
Max. main spindle speed	6,000 rpm
Rapid-traverse rate X / Z	30 / 30 m/min | 1,181 / 1,181 ipm
Tool carrier	Disk-type turrets, with up to 11 driven tools each

4-axis production

The VTC 100-4 vertical turning machine is designed as a 4-axis machine. The suspended main spindle is installed in the center, upper part of the machine. A tailstock is mounted below the spindle. The workpieces (shafts) are clamped between the main spindle and the tailstock and are supported by a steady rest. For the machining process, there are two turrets with twelve tool positions. A tool position is loaded by a workpiece gripper which transports the workpiece in or out of the vertical turning machine. For machining operations, there are eleven machining tools which can be equipped with either turning tools or driven tools. There are endless transport belts on both sides of the machining area. This is where the raw and finished parts are stored. In addition, there are Y-axes for both tool carriers.



Machining electric motor shafts	
Technology	4-axis turning
Clamping device	Collet chuck, tailstock
Machine data:	
Maschine	VTC 100-4
Chuck diameter	160 mm | 6.3 inch
Workpiece diameter max.	63 mm | 2.5 inch
Workpiece length max.	400 mm | 15.7 inch
Main spindle capacity (40% duty cycle)	34 kW / 46 hp | 144 Nm / 106 lbf ft
Max. main spindle speed	6,000 rpm
Rapid-traverse rate X / Y / Z	30 / 30 m/min | 1,181 / 1,181 ipm
Tool carrier	2 x disk-type turrets, with up to 11 driven tools each

Scroll-free turning technology for highly productive shaft manufacturing

The principle of scroll-free turning developed by EMAG provides new machining opportunities. Scroll-free turning is a very fast process and produces excellent surface quality without torsion.
Surfaces which previously had to be ground can now undergo scroll-free turning. Scroll-free turning is suitable for both shafts and chuck parts; there is also external scroll-free turning and internal scroll-free turning. For shaft parts, the scroll-free movement can be performed on the EMAG VTC platform. The cutting movement is achieved by the turret swiveling, in other words, the actual cutting movement is generated by the rotation of the component and the turning of the blade.

Machining axle pivots

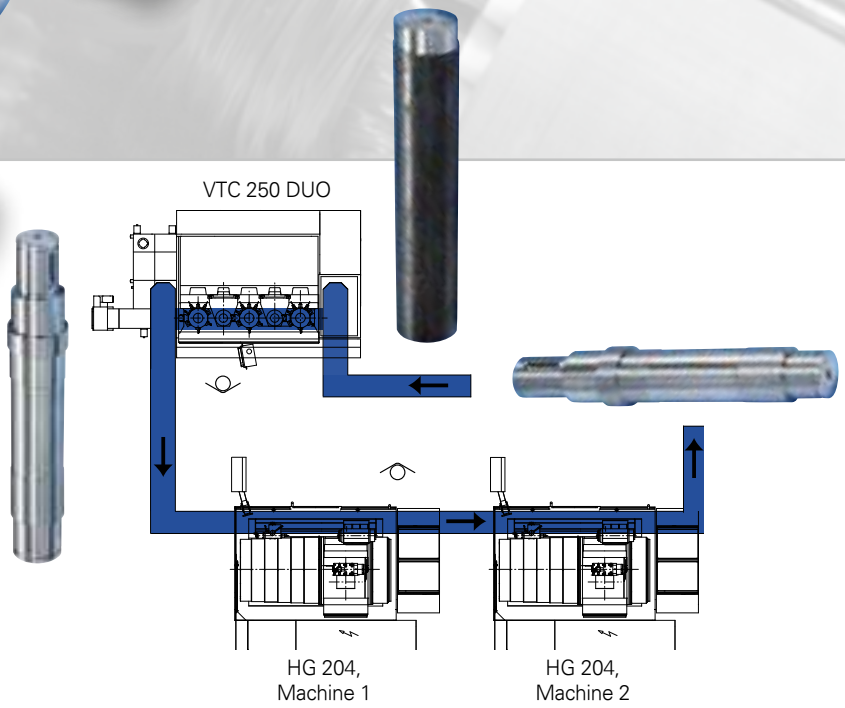
Technologies	Hard turning, scroll-free turning
Chipping tool	Machining with tailstock tip for scroll-free turning, and floating for shoulder turning
Machine data:	
Machine	VTC 250 4D
Chuck diameter	250 mm | 9.8 inch
Workpiece diameter max.	140 mm | 5.5 inch
Workpiece length max.	630 / 1,000 mm | 24.8 / 39.4 inch (special length)
Main spindle capacity (40% duty cycle)	38 kW | 51 hp
Max. main spindle speed	5,000 rpm
Rapid-traverse rate X / Y / Z	30 / 10 / 40 m/min | 1,181 / 394 / 1,574 ipm
Tool carrier	2 x disk-type turrets, with up to 11 driven tools each

VTC 250 DUO – demanding machining processes

The VTC 250 DUO is ideal for use in linked manufacturing system. For example, for machining electric motor shafts, 40 workpiece versions in lengths of 100 to 300 mm and various diameter ranges can be produced on a single system. The manufacturing system comprises a VTC 250 DUO (OP 10) for initial machining and two HG 204 grinding machines (OP 20) for the subsequent finish machining. The machines are linked by a storage section between the initial machining section and the finishing process.

Machining electric motor shafts

Technologies	Cutting to length, centering, turning and milling
Clamping device	3-jaw chuck and tailstock
Machine data:	
Machine	VTC 250 DUO
Chuck diameter	250 mm | 9.8 inch
Workpiece diameter max.	140 mm | 5.5 inch
Workpiece length max.	700 mm | 27.6 inch
Main spindle capacity (40% duty cycle)	38 kW | 51 hp
Max. main spindle speed	4,000 rpm
Rapid-traverse rate X / Z	30 / 40 m/min | 1,181 / 1,574 ipm
Tool carrier	3 x disk-type turrets, with up to 11 driven tools each or end machining turret



Complete machining of electric motor shafts:

VTC 250 DUO:	Centering and cutting to length
	Turning external diameters, shoulders and milling keyways
HG 204:	Machine 1
	Grinding external diameter and shoulders with an angular plunge on left side of the workpiece
HG 204:	Machine 2
	Grinding external diameter and shoulders with an angular plunge on right side of the workpiece

Shorter grinding times – higher quality

The synchronous support grinding technology developed by EMAG is a vertical shaft grinding process with two simultaneously engaging disks. Its potential for rationalization is enormous. The process reduces the grinding time while at the same time improves workpiece quality in terms of peak-to-valley height,true running, roundness and ripple, even on very thin shafts.

Machining transmission shafts	
Technology	Synchronous support grinding
Clamping device	Clamped between tips without separate cams
Machine data:	
Machine	VTC 315 DS
Chuck diameter	315 mm | 12.4 inch
Workpiece diameter	240 mm | 9.4 inch
Workpiece length max.	700 mm | 27.6 inch
Main spindle capacity (40% duty cycle)	38 kW | 51 hp
Max. main spindle speed	4,000 rpm
Rapid-traverse rate X / Z	30 / 40 m/min 1,181 / 1,574 ipm
Grinding wheel diameter	540 mm | 21.3 inch
Grinding wheel width	80 mm | 3.2 inch

VTC – camshaft production line

EMAG supplies complete manufacturing systems for machining precision metal parts. The capacity of these systems can best be seen in camshaft production.
The manufacturing system consists of two parallel, almost identical production lines, one each for intake and exhaust camshafts. The linked shaft machining process starts with two EMAG VTC 250 DUO turning centers. These

complete the end machining and turning of the shaft while the second machine completes the deep-hole drilling process, the drilling of radial oil holes and the milling of a marking area.
The full grinding operation is then completed in the two subsequent EMAG VTC 315 DS grinding centers. The first system grinds the main bearings while the second completes the non-circular grinding of the cams. The highlight of both machines is that their principle is based on the use of two grinding wheels which act on the camshaft from both sides, moving in different directions.
The forces which are generated in the feed direction are cancelled out by the fact that the grinding wheels are mounted opposite of each other.

Advantages of the VTC series…

- ✓ Automation and self-loading system included
- ✓ Complete machining by a combination of various technologies in a single machine
- ✓ Machine base made of MINERALIT® polymer concrete. 6 – 8 times better damping than gray cast iron.
- ✓ Shorter idle times thanks to simultaneous loading and unloading of components, on multi-axis machines
- ✓ Smaller footprint due to compact design
- ✓ Raw and finished parts storage areas form an integral part of the machine
- ✓ Wide-opening machining area doors with large window areas
- ✓ Modular machine concept with components that have been tested numerous times

… and your benefits

- + Increased flexibility and cost savings since external loading units are not required
- + Increased flexibility and shortening of the process chain by saving on other machines
- + Increase in precision by reduction in number of clamping operations and machines
- + Longer service lives, higher accuracies, and higher surface qualities, especially in the case of brittle and hard materials
- + Increase in your productivity
- + More productive machines can be accommodated in your production building
- + Optimized interfaces ensure smooth production processes and short tooling and retooling times
- + Easy and quick machine set-up and good visibility of the machining process
- + Implementation of your specific requirements and at the same time, high technical availability of the overall system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