MANUFACTURING LINE FOR ROTOR SHAFTS FOR ELECTRIC MOTORS





TURNKEY SOLUTION FOR MACHINING AUTOMOTIVE ROTOR SHAFTS

The rising quantities of electric motors pose a challenge to production planners. In many applications, they must establish new solutions with which components such as the electric motor drive shaft can be manufactured more quickly and more efficiently – using holistic manufacturing systems. In the following, we would like to show you what a solution like this may look like.

The MIND line was created through collaboration between EMAG Systems and a leading automotive supplier. This early inclusion of EMAG Systems during the development ensured the use of excellent mechanical engineering and resulted in a lean, safe production process.

As a result, we now have an impressive process to produce rotor shafts – with twelve main and various auxiliary processes. The various machines and stations are automated and interlinked using robots, gantry systems and EMAG's own TrackMotion system.







Joining machine Joining the attachment point for the sheet package and other components.

VTC 200 4-axis turning of collar and seats for the rotor shaft.

OP 80

OP 90/100/110

Blowing, measuring, and destacking the rotor shafts in basket stacks

OP 10/20: 2x VTC 200 4-AXIS PRE-TURNING OF THE INTERNAL AND EXTERNAL CONTOURS

After the operator has fed in the raw parts on buffer belts, pre-turning starts on two VTC 200 machines from EMAG – the perfect solution for 4-axis shaft machining with reduced machining times (OP 10/20). The blow-off and measuring processes follow. Next, the measuring machine gives feedback to the turning machines, which can then make any corrections automatically.



BENEFITS:

- + Reduced machining times due to four-axis machining
- + Shorter idle times with simultaneous loading and unloading of components
- + Lower investment costs thanks to integrated automation
- Now also with standard preparation ("tunnel") for integration of the TrackMotion automation system





TECHNICAL DATA

Workpiece diameter, max.	200 mm
Chuck diameter	250 mm
Swing diameter	270 mm
Gripper diameter, max.	90 mm
Workpiece length, max.	630 mm
X-axis travel	395 mm
Z-axis travel	810 mm
Main spindle	
» Power rating at 40%/100% duty cycle	38/29 kW
» Torque, 40%/100% duty cycle	250/200 Nm
» Speed, max.	4,500 rpm

OP 30/40: INTERNAL GEARING/MIND-L 1000 HARDENING THE BEARING SEATS

Initially in OP 30, the internal gearing is produced on the only outsourced machine in the manufacturing line. EMAG Systems ensures that it is perfectly integrated. The user also only needs to contact EMAG for matters relating to service. The subsequent hardening of the bearing seats in OP 40 takes place on a MIND-L 1000 from EMAG eldec. The HPTS (High Precision Tool System) enables the machine to be set up quickly with a new inductor in just a few minutes without negative repercussions on the hardening or the overall equipment effectiveness.

BENEFITS:

- Modular, compact design allows creation of individual hardening solutions
- + Simultaneous hardening, tempering and other functions using vertical index disk concept
- + Energy sources from 10 to 1,000 kW
- Available with low, medium, high and dual-frequency generators (DFG or SDF[®])
- + Simple integration in EMAG line systems
- Extensive process data and machine condition monitoring using eQC (link)
- + Generous accessibility for set-up work
- Rigid design and precise positioning ensure reproducible and permanently stable results

TECHNICAL DATA

Workpiece length, max.	800 mm
Workpiece diameter, max.	160/200 mm
Workpiece weight, max.	10 kç
Generators	10/1,000 kW

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OP 50: 2 x VTC 200 MA 4-AXIS INTERNAL MACHINING OF THE ROTOR SHAFT IN A SINGLE CLAMPING CYCLE

The subsequent operations on two VTC 200 MA machines (OP 50, internal turning) and two VTC 200 machines (OP 60, borehole machining) from EMAG are also interesting. Both processes take place in parallel on two machines to increase output volume. The rotor shaft is then blown off again, measured, and the approved parts are marked with a DMC.

VT SERIES:

Turning machines for demanding shaft production

The vertical, 4-axis pick-up turning machine from the VT Series allows machining of shafts measuring up to 630 mm in length and up to 200 mm in diameter. This system particularly comes into its own for high volumes because its automation solution delivers very short chip-to-chip times and low component costs. Workpiece grippers transport the raw parts into the machine and remove them again after they have been machined. The loading and unloading processes take place in parallel.

The machine can be configured as a center drive machine (OP 50) or with a main spindle and tailstock (OP 60), between which the component is clamped so that it can be machined from two sides. Two tool turrets, each with eleven tool positions, can hold turning tools or driven tool and are available for this purpose.

OP 60: 2 x VTC 200 DRILLING OPERATIONS, FOR EXAMPLE, FOR COOLANT DISCHARGE



BENEFITS:

- + Reduced machining times due to four-axis machining
- Shorter idle times with simultaneous loading and unloading of components
- + Two tool turrets, each with 11 tool positions
- + Excellent chip flow due to vertical machining
- + Also available as a center drive machine

TECHNICAL DATA

Workpiece diameter, max.	200 mm
Chuck diameter	250 mm
Swing diameter	270 mm
Gripper diameter, max.	90 mm
Workpiece length, max.	630 mm
X-axis travel	395 mm
Z-axis travel	810 mm
Main spindle	
» Power rating at 40%/100% duty cycle	38/29 kW
» Torque, 40%/100% duty cycle	250/200 Nm
» Speed, max.	4.500 rpm

OP 70: JOINING MACHINE JOINING THE ATTACHMENT POINT FOR THE SHEET PACKAGE AND OTHER COMPONENTS



A sleeve and a cover are pressed onto the rotor shaft in OP 70. These are used later as the attachment point for the sheet package and other components.



OP 80: VTC 200 4-AXIS TURNING OF COLLAR AND SEATS FOR THE ROTOR SHAFT



The final turning (OP 80), once again on a VTC 200, perfects the collar and seats for the rotor shaft. Blowing, measuring and destacking the rotor shafts are the final operations on the line.



SCROLL-FREE TURNING TECHNOLOGY HIGH SPEED MACHINING FOR ELECTROMOBILITY

EMAG uses innovative scroll-free turning technology for the final machining of sheet metal packages.

Scroll-free turning rotor shaft sheet metal packages delivers a whole series of benefits compared to the classic turning process. Firstly, scroll-free turning enables significantly higher feed rates per revolution, reducing cycle times. The use of the entire blade not only reduces machining time, but it also increases the service life of the tools as well as significantly improves surface finish quality. VT Series machine turrets have been completely revised so that its mechanical design and control of the indexing axis to satisfy the requirements of scroll-free turning. Programming for the process has also been significantly simplified, which makes it possible to control the machine and the process safely.



SCROLL-FREE TURNING: FAST, PRECISE, RELIABLE.

The principle of scroll-free turning differs from conventional turning due to the fact that the blade engagement point slides along the blade. The angle of the blade and the superimposing movements of the tool and workpiece cause the blade engagement point to move continuously. In contrast to the single-point stress of ISO turning work, this spreads the wear over the entire length of the blade. Nevertheless, completely different stresses occur than with conventional turning. Not only is the appropriate expertise required to master this technology, a reliable, stable

machine concept is also vital. If this is provided, as in the case of the VT Series from EMAG, the user will benefit from a finishing process around 5 to 6 times faster than conventional turning. Special surface properties can be delivered by this turning process, such as zero scrolls or a defined tp material ratio, which are normally only possible by grinding. It may also be replaced by a single scroll-free turning cut for soft machining, depending on the oversize or raw part properties of the roughing and finishing process.



BENEFITS:

- + 5 6 times faster finishing process
- + Scroll-free surfaces possible
- + Integrated automation
- + Reduced cycle times thanks to higher feed rates
- Lower tool costs due to longer service lives

EMAG ONLINE

You can read more about scroll-free turning here:





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