

emco

/ MEGAMILL GIVES BYSTRONIC A STRONG PRODUCTIVITY BOOST



MEGAMILL portal
milling machine in
continuous operation
on the machine frames

Anforderungsprofil und Umsetzung

- / Hohe Produktionsstückzahl pro Monat
- / Hohe Präzision beim Ebenenfräsen
- / Flexibilität beim Einsatz an verschiedenartigen Baugruppen
- / Komplettbearbeitung in einer Aufspannung
- / Enorme Einsparung an Fertigungszeit pro Rahmen
- / Pendelbearbeitung am Tisch mit zwei Bedienpanelen
- / Mannlose Produktion

In machine tool manufacturing, one of the main preconditions for ensuring productivity and delivery readiness is a cleanly structured production process, with precisely timed production sequences and manufacturing systems that operate reliably. This can only be achieved if the customer and supplier take a common, goal-oriented approach to production chain projects.

This was the case for the project at Bystronic Laser AG in Niederönz, Switzerland, when creating a new production line for machining the frames of laser cutting machines.

Bystronic Laser AG is a world-wide technology leader in the field of sheet metal processing, specializing in laser cutting systems. Working jointly with EMCO GmbH from Hallein / Salzburg, they undertook a complete redesign of the machine frame machining process, so that it could be carried out entirely by the MEGAMILL high portal milling machine from Emco Mecof.

A new partnership

„The machine frame quantities had risen to such an extent, that our existing production capacity could no longer keep up. As a result, we were looking for a new machine with sufficient output capacity, that could meet our high quality requirements and would be flexible», explained Raphael Kopp, Head of Production at Bystronic Laser AG.

Raphael Kopp had a clear idea of what he wanted from the new machine, namely a high rate of parts produced per month, perfect accuracy for plane milling the guide surfaces of the machine frames (evenness of 0.05 mm on a guide track length of 3-4 m), and flexibility to be able to produce different types of components. Most of all, the machine table also would have



The MEGAMILL integrated into the production process at Bystronic Laser AG.

to be large enough, because the system assemblies for the laser cutting machines need a substantial amount of space. They searched on the market, and after visiting several manufacturers and evaluating machining test results, it became clear within less than four months that the new machine should be a MEGAMILL from Emco Mecof. Meanwhile, by working in close coordination, the key requirements and conditions for purchasing the machine were specified and verified, and the feasibility was demonstrated. Raphael Kopp describes how they came to make the purchase decision, „the decisive factor was certainly the shuttle operation. In other words, we can now clamp two workpieces on the machine table, one is machined, and the second is inserted, aligned and clamped in parallel. When the first part is finished, we move the milling head to the second half of the table and start the new job. The machine always keeps chipping away, so to speak. This brings us enormous savings in production time per frame.“

Just-in-time production

At Bystronic, production throughput has to meet tough requirements. The production time for a laser cutting machine, from the automated welding of the machine frame, through manufacturing, painting, assembly, quality testing, and commissioning, to readiness for shipment, is 15 working days. The production of a machine frame to the painted component alone must be completed in five working days.

With the MEGAMILL, work is carried out in three shifts, with one shift running unmanned. The machine frames, which are available in five different sizes and weigh around 5 t, are finished in 12 to 16 hours in a single clamping operation.

Complete machining is carried out in three steps:

- / Roughing: Production time approx. 5 hours; intermediate airing of part stresses to eliminate component stresses.
- / Pre-finishing: Milling all features, holes, threads, etc.
- / Finishing: High precision machining of guide surfaces (flatness of 0.05mm /4m) and reference dimensions.

Production must be process-reliable, because with this extensive production spectrum, malfunctions and errors, machine downtimes of longer than a single day can result in considerable costs, and machine frames are not kept in stock once they are finished.

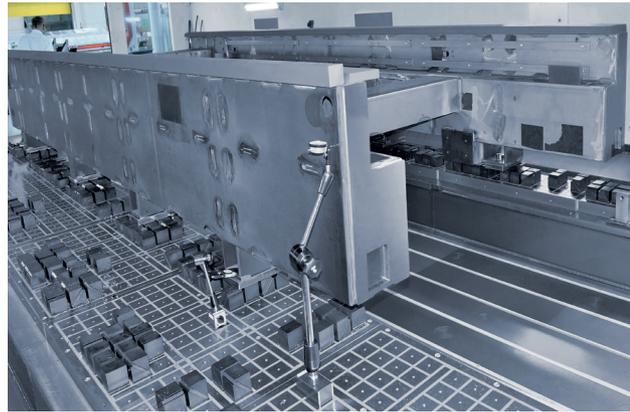
Process steps must therefore always run just-in-time.

MEGAMILL – the machine that offers potential to its customers

The MEGAMILL is a high portal milling centre with an overhead gantry, ideal for machining large workpieces for applications



The key players in the project were Uwe Urban, Sales Manager Large Machines Germany, and Raphael Kopp, Head of Manufacturing at Bystronic Laser AG. „Now that we have the MEGAMILL, the productivity of our production has made a quantum leap,“ concludes Raphael Kopp.



Machine frame of a laser cutting machine. The machine frame of a laser cutting machine is clamped on the table with magnetic clamping.

such as machine tool and mould manufacturing, general mechanical engineering and aerospace. The system modules of the machine can be configured to meet the customer's specific requirements.

Here at Bystronic, it is in a configuration with a table length (X-axis) of 15,000 mm and a transverse axis (Gantry- Y-axis) of 5,000 mm. The Z-slide (RAM) has a travel of 1,750 mm. Bystronic chose a universal milling head from the very wide range of milling heads offered by Emco Mecof. This is also because the 2-axis head with a torque of up to 1,000 Nm and 8,000 rpm perfectly meets the production requirements for roughing and finishing and, thanks to its compact shape, can easily reach the frame contours which are complex to access. Dynamic positioning generates time savings in a 16-hour machining cycle.

„The speed of the rapid traverse of the axes and the dynamic performance of the milling head produce measurable savings in machining time, especially when we have to drill more than 50 holes in the component“ points out Raphael Kopp.

As well as this, the rack and pinion drives in the X and Y axes, each equipped with two motors running in a master-slave configuration, add dynamics to the process. And of course, pendulum machining on the table is a major advantage. The work areas are designed to prevent safety risks, ensuring that falling chips and access by the machinist are kept securely apart. Setup is performed in one side of the machine while the milling head is working on the other side. In this application, the MEGAMILL is equipped with two control panels, so that the machinist can intervene on either side of the table.

The box-in-box design of the moveable crossbeam is another of the machine's plus points. Box-in-box guidance means that the vertical axis of the RAM is clamped to the upper and lower sides of the crossbeam with its quadruple linear guides. This

rigid, FEM-calculated assembly guarantees compliance with the stringent workpiece quality specifications which are required for the finishing of the guideways on the machine frames. The machine is completely enclosed and equipped with an exhaust system.

Commissioning encounters some hurdles

The planning of the project, which started in 2017, the configuration of the machine and its construction at the Emco Mecof plant in Belforte Monferrato all went smoothly.

Then in autumn 2018, came the moment to deliver it to the customer's site in Niederörs. Loaded on 13 trucks, the machine was on its way to be installed and commissioned. It was then that problems started, because although Bystronic planned to have a new production hall, it was not yet completed and the machine had to be put somewhere.

Because of the access difficulties, part of the roof of the hall was removed and the crossbeam weighing approx. 30 t was placed on the longitudinal beams through the roof opening. It was a job that required extreme precision.

Part of the machine and the tool magazine with the tool changer had to be left out in the open. Solutions were found by collaborating. To enable commissioning to even become possible, a separate enclosure was built around the parts of the machine which were standing outside. Compounding the problems, just at the same time, production quantities needed to be to be increased, so the ramp-up took place practically under emergency conditions.

These kinds of imponderable situations have a way of all coming all at once!

Efficient 2-axis universal milling head

The machining heads are built in-house at Emco Mecof, an important factor for determining machining accuracy. Emco Mecof also places great importance on the accuracy of the traverse movement of the axes, to obtain backlash close to zero for example.

Achieving the maximum possible accuracy is one of the main objectives of the Emco Mecof machines.

As well as the wide range of standard heads, Emco Mecof frequently develops innovative dedicated customer-specific solutions, in particular for their series of large gantry machines. In the MEGAMILL series, the machining heads with integrated rotary axis and swivel axis have infinitely variable, motor-driven adjustment and control and are available with a geared or high-speed motor spindle. Thanks to the intelligent layout of the head design, it can be positioned to perform an undercut of 15° while in a horizontal position (0°) parallel to the table surface. This is useful because it eliminates the need for compensation paths in the axes and simplifies program creation and post-process generation.

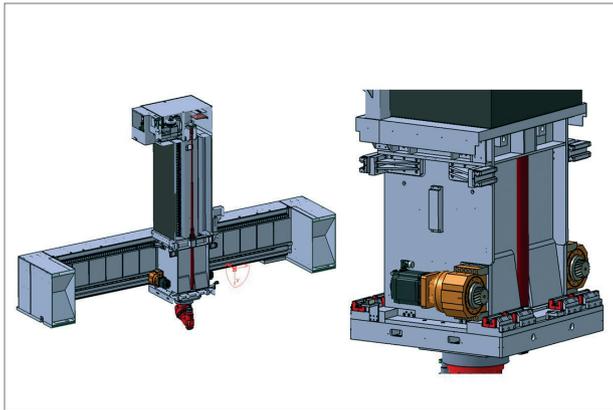
The machining heads are cooled by the central cooling system, which also feeds the spindle and torque motors.

For Bystronic, these head kinematics meant embarking on new territory. The kinematics of the previous machines allowed the work programs to be programmed on the control panel. On the MEGAMILL with its 2-axis head, this was no longer efficient. To create optimal sequence programs, a CAM tool had to be procured. Its implementation was then actively supported by Emco Mecof. Coordinate transformation, milling head retraction sequences, on all these topics, Emco Mecof was able to pass on its years of expertise to the customer.

Optimizations for unmanned machining implemented through teamwork

Adjustment and subsequent clamping of the machine frame on the machine table was previously done by hand in the conventional way. The part is laid on support surfaces which are embossed on the table. This procedure was time-consuming, which soon prompted Bystronic to think of an idea for a different method of clamping. Based on their experience with magnetic clamping technology, which is also used in the factory, this technique was then also used to clamp the machine frames on the MEGAMILL. The ends of the part are pre-levelled so that it is placed on the table at an angle. Then the magnetic clamp, adjusted by wedges in the clamping segments moves to all the support points and clamps the part. This eliminates the time-consuming manual alignment and clamping of each support point.

This method is particularly efficient and timesaving when, to eliminate internal stresses in the part, the clamp is aired for a period after pre-roughing the contour.



The vertical axis (RAM) is mounted in the movable crosshead in a box-in-box assembly, which significantly increases rigidity



Universal milling head with infinitely variable positioning, air/oil lubrication, water-cooled, power: 38 kW, Torque: 1000 Nm, max. Speed: 8000 rpm, HSK 100-A

This can now be done by the machine's control system. Manual intervention is no longer necessary. Instead, a sequence program written by Emco Mecof is stored in the control system. This can then be called directly via the M command to initiate the unclamping process.

The machinist now no longer needs go through all the clamping points, releasing the clamps and then tightening them again to 200 Nm, and do this twice for each part. This means that, in the unmanned shift, the sequence is guaranteed to be highly accurate. A practical solution has also been found for any malfunction due to drill breakage during this period. The machine ends the current machining operation, moves in shuttle mode to the next prepared part, and starts a new cycle. Reworking on the interrupted sequence is then done manually because it is critically important for Bystronic that every workpiece comes out correctly machined.

„The very good customer-supplier relationship that we had built up during the project was a real advantage when implementing our new idea of changing to magnetic clamping technology.

We cooperated with professionalism and in a spirit of partnership.“ Raphael Kopp is extremely satisfied with the current production process. Since February, Bystronic has been producing parts using the magnetic clamping. They have experienced no problems and made substantial savings in setup time.

At Bystronic Laser AG, the future is already here

The Managing Director, Mr. Fabian Furrer, is a strong advocate for Bystronic's strategies for the future and in his words, „our ambition is to be climate-neutral by 2025 and completely phase-out fossil fuels. We are achieving this by switching off

oil and gas heating systems and working with heat pumps, whose electricity requirements are supplied by PV systems. We already get electricity from hydropower.

When reflecting on ways to save energy consumption, he applies the same sense of ecological responsibility that each individual has for an environment worth living in.

„We have to optimize our products too, in terms of their energy efficiency. The laser cutting systems for example, so our customers can also make savings.“ In 2018 Bystronic initiated a new company activity, the SOLUTION CENTRE, where solutions are developed for digitally networking the whole production system at a customer's plant. The goal for all innovations developed here is the SMART FACTORY.

„Customers are increasingly asking for completely networked production, and we have to be able to provide that,“ affirms Fabian Furrer.

Genau die richtige Maschine

Business and production management are in agreement after four years of experience in manufacturing machine frames on the MEGAMILL:



Fabian Furrer, Managing Director at Bystronic Laser AG, „the MEGAMILL exactly meets our requirements. We are highly satisfied,“ he declares unequivocally.

„Now after four years, we can say without a doubt, the MEGAMILL is exactly the right machine for our production,“ say Fabian Furrer, in a clear statement.

He particularly emphasizes that the specified requirements for the machine have been fully met and that they will be able to use the machine to implement new ideas in future. On this subject, he already has some concrete ideas.

„We have optimized throughput times, we now achieve high productivity and currently run 30-40% unmanned.

But we intend to continue in this direction and expand unmanned production. With this machine, it should be no problem.“



Bystronic Laser AG is a world-leading technology company in the field of sheet metal processing, specializing in laser cutting systems.

- / 3500 employees, worldwide
- / Headquarters: Niederönz, Switzerland
- / 40 locations
- / Net sales 2021: CHF 939.3 million
- / Products: Laser cutting systems, press brakes, automation, software, service.
- / Laser cutting machine: Production time: 15 AT /Mach.
- / Machine frame: Production time 7 AT / frame

Bystronic Laser AG

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TECHNICAL DATA MEGAMILL

Universal milling head with continuous positioning

Power S1 / S6	38 / 57 kW
Torque S1 / S6	1000 / 1550 Nm
Spindle rotation speed	15 ÷ 6000 rpm
Options	15 ÷ 8000 rpm
Tool taper standard	"ISO 50 DIN 69871
Options	BIG PLUS
Options	HSK 100-A DIN 69893"

High-speed spindle 50 / 63 kW

Power S1 / S6	50 / 63 kW
Torque S1 / S6	100 / 125 Nm
Spindle rotation speed	12000 / 20000 rpm
Tool taper	HSK 100-A / HSK 63-A

High-speed spindle 42 / 55 kW

Power S1 / S6	42 / 55 kW
Torque S1 / S6	67 / 87.5 Nm
Spindle rotation speed	24000 rpm
Tool taper	HSK 63-A

High-speed spindle 45 / 58 kW

Power S1 / S6	45 / 58 kW
Torque S1 / S6	300 / 372 Nm
Spindle rotation speed	12000 rpm
Tool taper	HSK 100-A

High-speed spindle 70 / 86 kW

Power S1 / S6	70 / 86 kW
Torque S1 / S6	160 / 220 Nm
Spindle rotation speed	15000 rpm
Tool taper	HSK 100-A

Linear axes

Longitudinal axis travel	7500 und mehr (in Schritten von 2500 mm)
Cross axis travel	4000 – 5000 – 6000 – 7000 mm
Vertical axis travel	1500 – 2000 – 2500 mm
Feedrate	30 m/min

Vertical slide RAM

Section	550 x 640 mm
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CNC-control

Heidenhain	TNC 640 HSCI
Siemens	840D sl

Motor spindle

Standard	40 kW / 1200 Nm
Option	50 kW / 1500 Nm (S1), 61 kW / 1800 Nm (S6)

Workpiece/ tool cooling system

Low pressure	28 l/min, 6 bar
High pressure (through the spindle)	20 l/min, 20 / 40 / 60 bar

Standard options

Full 5-axis universal milling head	6000 rpm
Milling head with offset spindle	3000 rpm
Universal milling head with torque-motor and high-speed spindle	12000 / 20000 / 24000 rpm
Full 5-axis fork-type milling head with torque motor and high-speed spindle	12000 / 15000 / 20000 / 24000 rpm
Automatic tool magazine	48 / 64 / 96 / 128 pockets
Automatic head magazine	2 / 3 pockets

beyond standard /

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