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Perfect combination for structural parts – faster, better, lower cutting forces

The optimum machine tool + the optimum tool = the perfect combination. And that makes cost-effective processes and impressive machining results possible. One good example of this is the cooperation between the machine manufacturer, F. Zimmermann GmbH, and MAPAL. For demonstrations and machine acceptance tests, Zimmermann equips its new horizontal machining centre with milling cutters from MAPAL.

F. Zimmermann GmbH relies on high volume milling cutters from MAPAL in combination with their machining centre FZH, which therefore raises performance to a whole new level.

F. Zimmermann GmbH developed its first horizontal machining centre specially for the machining of structural parts for the aerospace industry. The aluminium structural parts, such as wing parts and frame ribs, are generally milled from solid material – with up to 95 percent material removal. Fault-free machining with respect to dimensional accuracy and surface finish is crucial here. And the component structure that becomes more and more delicate with increasing material removal represents an additional challenge. In order to make the milling process as efficient as possible even in these areas, the new FZH machining centre offers maximum rigidity. For the core technology of the new 5 or 6-axis horizontal machining centre is a robust, water-cooled travelling column. Whereas conventional machine concepts suffer from lever-related deviations with increasing slide, the guide carriage distance of the new Zimmermann machine increases with increasing plunging depth into the material. That actually increases the rigidity. In order to achieve maximum efficiency, Zimmermann employs its own patented M3ABC 3-axis milling head in the machining centre. Particularly in the pocket corners of a workpiece, this milling head has to perform only very small swivel movements – allowing the feed rate to be kept more or less constant and hence the machining time to be significantly shortened.

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The beginning: The milling tools used are not suitable for the machine's performance level

At an open house in June 2017, Zimmermann demonstrated its new machining centre with tools from competitors. These tools failed to meet the expectations, however, and were unable to exploit the performance of the machine. "Why not test the performance of the MAPAL tools?" thought the project managers at Zimmermann, as MAPAL was presenting its milling cutters for high-volume machining at the event. No sooner said than done. A short time later, representatives of the two companies carried out extensive milling trials with different tools together.

The interaction: machine, milling head and MAPAL SPM milling cutter raise performance to a new level

"Our goal was to choose the optimum tools from our portfolio for the machining operations on the Zimmermann machine," explains Dietmar Maichel, Project Manager 3D-Milling at MAPAL. The tool manufacturer's portfolio contains different milling cutters for the different tasks during the high-volume machining of aluminium structural parts. The tools are perfectly designed for use on such high-performance machines as the Zimmermann machine. The SPM milling cutters are available in a solid carbide design and with PCD and ISO inserts. A total of four tools are used today at Zimmermann for the different demands of the roughing and finishing operations.

"The perfect combination – the machine, the 3-axis milling head and the tools from MAPAL – give the user a real performance boost," said a delighted Steffen Nüssle, Sales Director Export and Head of Applications Engineering at Zimmermann, immediately after the first tests. "With the SPM-Rough ISO shoulder milling cutter, we achieved the best results that we have ever achieved with a tool with indexable inserts." The ISO tools with polished indexable inserts are the latest addition to the MAPAL SPM product range. The SPM-Rough with wave profile also surpassed the

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expectations for material removal with excellent smooth running. "The complete machining of a 190x190x40 mm pocket is now effectively possible in less than a minute," explains Nüssle.

The experts at F. Zimmermann GmbH are convinced by the MAPAL tools. "The use of the SPM milling cutters has given us a quantum leap forward in the aluminium machining. And it shows us what the perfect combination of tool and machine means in terms of performance," says Nüssle. In the meantime, the tools are therefore first choice when it comes to machine acceptance tests or demonstrations for customers from the aerospace industry at Zimmermann.

The future: Zimmermann and MAPAL manufacture test components from composite materials

The Zimmermann machines are suitable not only for the machining of metals. "Many of our customers manufacture parts of composite materials," says Steffen Nüssle. Zimmermann therefore also wants to mill trial parts of these materials using MAPAL tools. "We are optimistic that with the MAPAL milling cutters for composite machining, we will also find a new secret weapon to exploit the performance of our machines even better." The corresponding plans are already in hand.

Key data of the tools used at Zimmermann:

Roughing – solution for diameter ranges above 25 mm

SPM-Rough ISO shoulder milling cutter with indexable inserts

Diameter 40 mm

Feed rate 21 m/min

Material removal rate 6.9 l/min

10 percent lower cutting forces with the best surface finish compared with the milling cutters from competitors previously used.

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Roughing – solution for diameter ranges up to 25 mm

SPM-Rough solid carbide milling cutter with wave profile

Diameter 25 mm

Feed rate 13 m/min

Material removal rate 7.3 l/min

Cutting depth ap 37.5 mm, cutting width ae 15 mm

High material removal rates with the highest machining values.

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Multi-stepped semi-finishing of thin-walled structures

OptiMill-SPM solid carbide milling cutter

Diameter 16 mm

Feed rate 12 m/min

Projection length 66 mm

Extremely sturdy thanks to conical form

Time savings of over 40 percent are possible in combination with the 3-axis milling head.

Finishing of deep pockets and delicate structures in a single pass

SPM-Finish solid carbide milling cutter

Diameter 12 mm

Feed rate 3 m/min

Best surface finish

Cutting depth ap 40 mm

Special finishing geometry

No vibrations

Perfect results even with large machining depths and practically complete wrapping of the milling cutter.

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About F. Zimmermann GmbH

F. Zimmermann GmbH from Neuhausen auf den Fildern is a world leading high-tech supplier of milling machines and solutions used in the automotive and aerospace industries and for special applications. The company founded by Friedrich Zimmermann in 1933 has 200 employees and branches in Germany, China and the USA.

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Captions:



The horizontal machining centre, the 3-axis milling head and the ISO shoulder milling cutter SPM-Rough achieve best results when used together.

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From left: Steffen Nüsse, Sales Manager for Export and Head of Application Technology, Bernd Scheurenbrand, Application Engineer, both from Zimmermann, Norbert Meier, Sales, and Dietmar Maichel, Project Manager for 3D Milling, both from MAPAL.



Analysis of the machining directly in the horizontal machining centre.

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For finishing deep pockets and filigree structures in one go, Zimmermann relies on the solid carbide milling cutter SPM-Finish.



Four tools for roughing, semi-finishing and finishing are in use at Zimmermann.

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From left to right: Dietmar Maichel, Project Manager of 3D Milling at MAPAL, and Steffen Nüssle, Sales Manager for Export and Head of Applications Technology at Zimmermann, in front of the new FZH horizontal machining centre.

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