MITSUBISHI ELECTRIC

The Art of Economy

Issue 01/23

Ingersoll Werkzeuge

Optimising processes with wire EDM.

Tool manufacturer Ingersoll benefits from high-precision profile machining on the MP1200 Connect wire EDM. *P.6*

The magazine for smart users.

Profile

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Published by
Mitsubishi Electric Europe B.V.
Niederlassung Deutschland
Mechatronics Machinery
Mitsubishi-Electric-Platz 1
40882 Ratingen · Germany

Tel +49 (0)2102 486-6120
Fax +49 (0)2102 486-7090
edm.sales@meg.mee.com
www.mitsubishielectric-edm.de

Editorial board
Hans-Jürgen Pelzers,
Stephan Barg,
alphadialog public relations

Design and layout
City Update GmbH · Germany

My technological leap …

Progress yields benefits. We all know an LED is much more energy-efficient than an incandescent lamp. Innovation in the dressing of grinding wheels opens up new opportunities. Riegger Diamantwerkzeuge, for example, a company with 55 years of tradition, offers an impressive 230,000 possible combinations for grinding wheels – achieved with EDM-Dress (p. 50).

1,000,000 tools a year are produced at Fraisa in Hungary using the same technology. In microscopic images you can really see the difference (p. 18).

Even big names in the industry like Ingersoll Tools optimise their processes with EDM-Dress (p. 6).

When a new technology is so mature and has proven itself hundreds of times in the field, who is it who introduces it in the business? Who gets the credit and recognition for improving processes in the company and helping to boost profits? Perhaps you are the champion of innovation who proposes EDM dressing, introduces artificial intelligence in EDM or simply brings in a new EDM system that saves up to 69% energy. One thing is clear: progress is good not only for the company, but also for your own standing in the business.

Simply play your part in shaping the future.

Hans-Jürgen Pelzers

Hans-Jürgen Pelzers
Sales Department Manager

> Whether you act as brake or motor in the New Year is up to you.
>
> *Henry Ford*

Safety from space.

Mitsubishi Electric builds new satellites as protection from weather disasters.

Mitsubishi Electric has been contracted by the Japan Meteorological Agency (JMA) to build Japan's latest geostationary weather satellite, the Himawari-10, which will be the first Japanese satellite to use a hyperspectral infrared sensor that measures infrared rays to gain three-dimensional information on water vapour and atmospheric temperature in order to improve the forecasting of storm surges and the paths of cyclones.

The advanced image processing system also provides information on cloud distribution as well as on land, ocean and cloud temperatures based on regular radiation measurements of the Earth's surface.

A leading manufacturer in the Japanese space sector for decades, Mitsubishi Electric serves as the prime contractor for nearly fifty per cent of Japan's national satellite programmes managed by the Japan Aerospace Exploration Agency (JAXA).

Mitsubishi Electric develops AI-supported analysis tool for more efficient production lines

The innovative data science tool MELSOFT MaiLab (Mitsubishi Electric AI Laboratory) helps companies to digitise their production operations and thus boost their productivity. The new solution is an intuitive, user-centred platform that uses artificial intelligence (AI) to automatically optimise processes – be it waste avoidance by reducing scrap rates, less downtime due to preventive maintenance or reducing energy consumption through process optimisation.

MELSOFT MaiLab serves as a dedicated virtual AI data scientist that helps companies to master these challenges and enables them to implement forward-looking manufacturing strategies. The processes within the AI analysis tool use Mitsubishi Electric's proven Maisart AI (Mitsubishi Electric's AI creates the State-of-the Art in technology).

Enjoy your read of this issue!

Ingersoll Werkzeuge GmbH

Optimising processes with wire EDM.

Tool manufacturer Ingersoll benefits from high-precision profile machining on the EDM-Dress 1200P.

Typical of special tools are the special geometries and contour profiles of their cutting edges. To machine the carbide edges, specially profiled grinding wheels can be used, or the cutting edges can be directly eroded with wire. An MP1200 Connect from Mitsubishi Electric at tool manufacturer Ingersoll in Haiger is proving to be particularly useful for both profile machining operations.

MP1200 Connect for high-precision profiling.

The specialist

Ingersoll Werkzeuge GmbH is the specialist in highly smooth-cutting milling tools in standard and special designs. Together with its highly successful solutions for heavy-duty cutting and the project-oriented development of special tool solutions, Ingersoll Werkzeuge delivers a comprehensive raft of technology that is used by a wide range of industries, such as:

- Automotive industry
- Aerospace
- Rail machining
- Shipbuilding
- Wind power

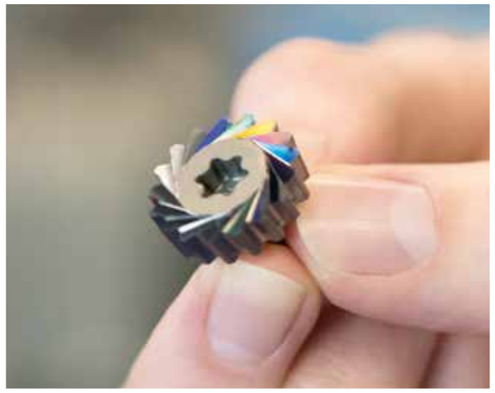
Production of indexable inserts on the versatile equipment in the production shop.

Ingersoll Werkzeuge GmbH in Haiger is known above all for designing and manufacturing special tools for certain industries and selected machining operations. This applies, for example, to hobs up to 800 mm long with a diameter of around 300 m for skiving hot-rolled plate and sheet. This also includes milling tools for machining large gears for wind turbines, among other things. The inner gears have diameters of up to 2000 mm and teeth up to 150 mm wide.

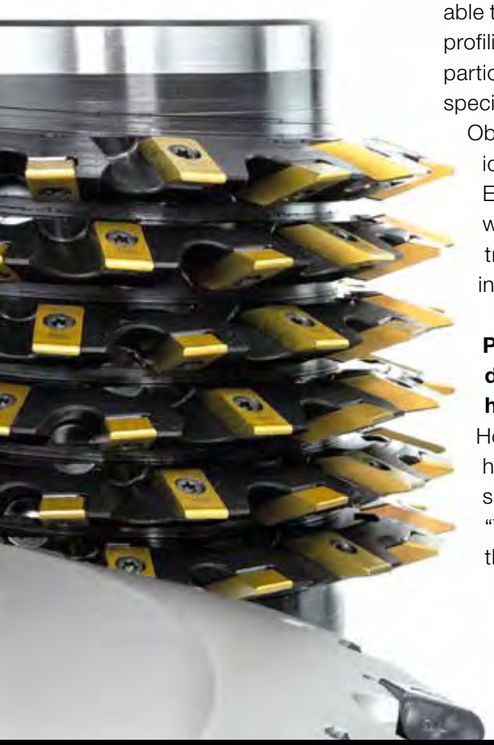
Nico Müller, who heads tool production at Ingersoll in Haiger, explains: “To produce such gears cost-effectively, manufacturers now use the hobbing process, also termed ‘power skiving’, which has been around for about 100 years. Modern control engineering makes it possible to coordinate several axes in such a way that a milling tool with numerous profiled cutting edges penetrates the annular workpiece to create the precise tooth shape.” Ingersoll in Haiger develops and machines the tools required for this, which are executed with high-precision profiled cutting edges. For smaller gears, these are mostly monobloc solid carbide tools. For larger gears, on the other hand, it is preferable to use tools that have a steel core with inserted profiled and usually coated indexable carbide inserts. “For the geometries of the gear cutting tools that are difficult to grind, I had already intended to optimise the production processes

Hob wheel loaded with indexable inserts

By using carbide inserts, large cutting volumes can be achieved at high cutting speeds.



Small-format hob made of solid carbide

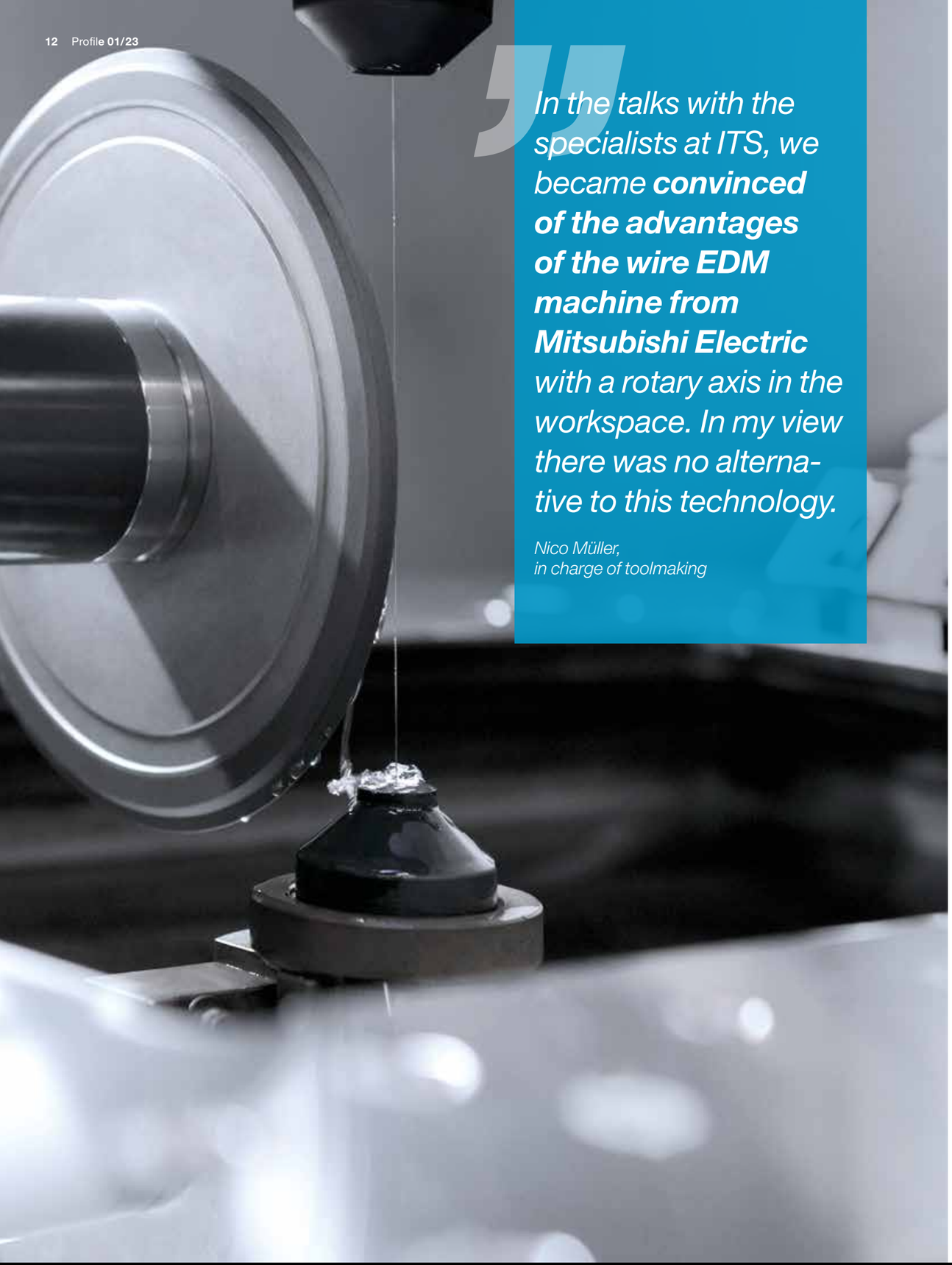


about two years ago. In this connection, it turned out that we were able to significantly improve the profiling of the grinding wheels in particular. Working together with special machine manufacturer ITS in Oberndorf in the Black Forest, we identified the advantages of wire EDM for the profiling of grinding wheels. So we initially subcontracted ITS to profile the grinding wheels for our gear hobs."

Preference for flexible and dependable processes in-house

However, Müller was not always happy with the profiling by the subcontractor in Oberndorf. "There were often delays, and throughput was long, taking 6 to 15 working days. And this was a hindrance in view of the growing number of gear milling tools in the pipeline. I therefore decided to significantly enhance the flexibility and process reliability of production in Haiger."

Müller soon persuaded those in charge at the tool manufacturer that this could only be achieved by investing in their own wire-cut EDM machine. "In the talks with the specialists at ITS, we became convinced of the advantages of the wire EDM machine from Mitsubishi Electric with a rotary axis in the workspace. In my view there was no alternative to this technology. So I have no hesitation in calling the EDM-Dress 1200P with its rotary



In the talks with the specialists at ITS, we became ***convinced of the advantages of the wire EDM machine from Mitsubishi Electric*** *with a rotary axis in the workspace. In my view there was no alternative to this technology.*

Nico Müller,
in charge of toolmaking

Profiled grinding wheel with DataMatrix code

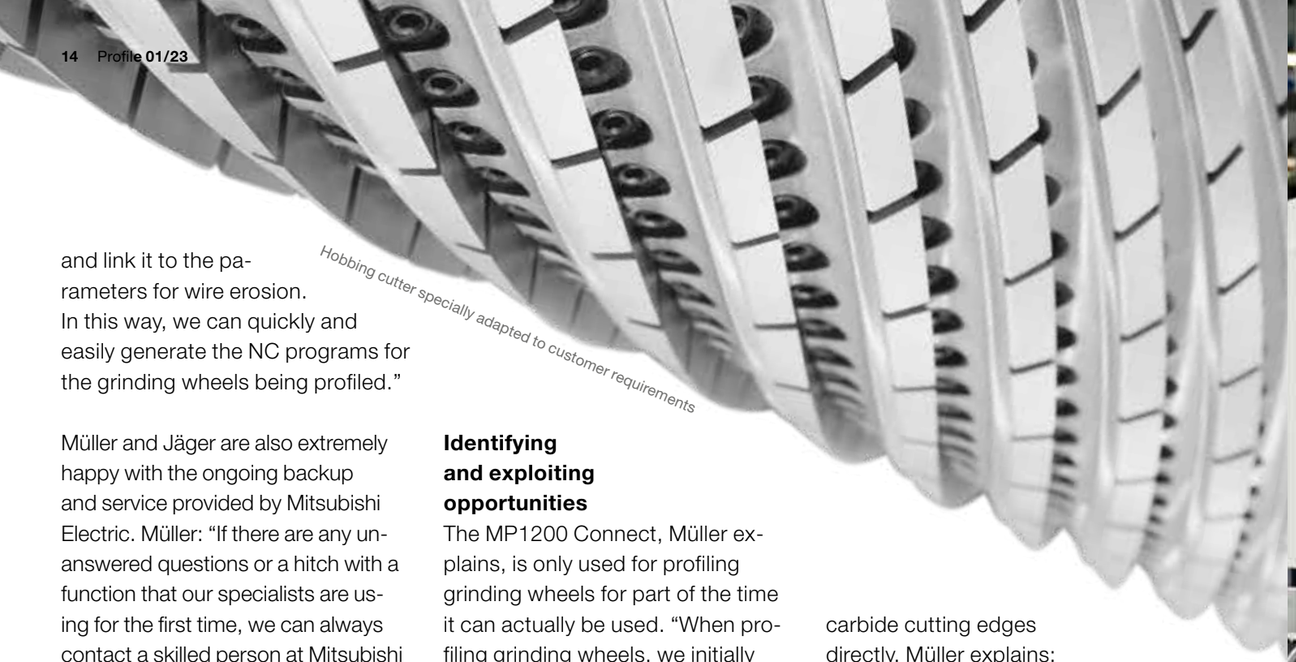
Clamping the grinding wheel in the ITS spindle in the MP1200 Connect's spacious workspace

spindle now installed at our company my baby."

Familiarisation with the technology at short notice

Among the numerous milling and grinding machines in the production shop at Ingersoll, the MP1200 Connect wire erosion machine looks a little exotic. But after only a few weeks, it became a natural addition to the production range for the machine programmers and operators. Jens Jäger, who as a programmer and operator of the tool grinding machines has familiarised himself with wire EDM, says: "We were at a training course at Mitsubishi Electric in Ratingen for two days. This training on the basic features of the technology and on programming and operating the machines was absolutely sufficient. We were able to work productively on our MP1200 Connect from the very first day, teaching ourselves all the other details as we went along. The modern CNC control system is a huge help, showing us the required input fields on the touch screen and setting the appropriate parameter limits. In just a few steps, you can define the required contour on the integrated CAD

The MP1200 Connect with ITS spindle supplements the range of machining options.



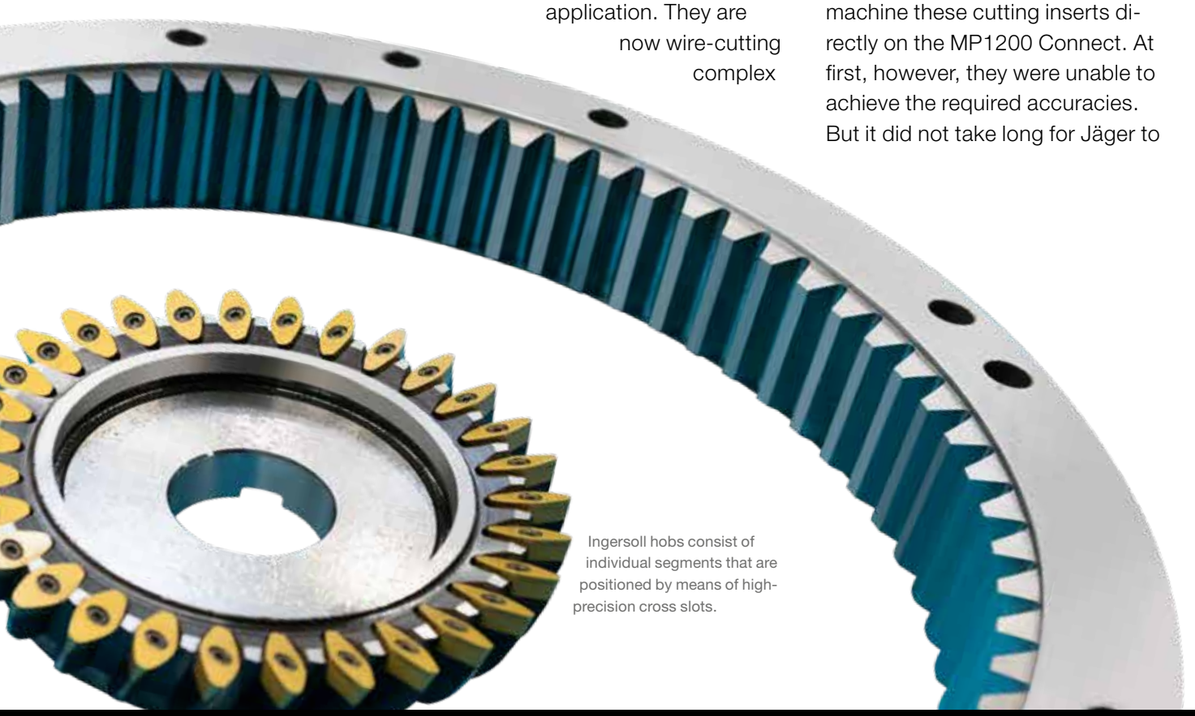
Hobbing cutter specially adapted to customer requirements

and link it to the parameters for wire erosion. In this way, we can quickly and easily generate the NC programs for the grinding wheels being profiled."

Müller and Jäger are also extremely happy with the ongoing backup and service provided by Mitsubishi Electric. Müller: "If there are any unanswered questions or a hitch with a function that our specialists are using for the first time, we can always contact a skilled person at Mitsubishi Electric in Ratingen by phone or e-mail at short notice. He expertly explains the details and reliably gives us the right instructions, explaining the optimal programming and operating steps in plain language. This way, we can be sure that our MP1200 Connect is productively used at all times and that we avoid unnecessary stoppages."

Identifying and exploiting opportunities

The MP1200 Connect, Müller explains, is only used for profiling grinding wheels for part of the time it can actually be used. "When profiling grinding wheels, we initially focused on working more flexibly. In addition, we wanted to be able to master and monitor a technology that is crucial for the quality of our tools and attached less importance to purely economic factors in terms of the MP1200 Connect's return on investment." But within a very short time, the specialists in Haiger realised that wire EDM was a technology capable of much broader application. They are now wire-cutting complex carbide cutting edges directly. Müller explains: "An order initially of prototypes and a pilot series of hobbing tools for extra-large gear teeth means that we have to produce carbide cutting inserts that are about 200 mm long, 60 mm wide and 8 mm thick with a curved cutting edge profile. A special requirement is that the cutting edge is machined to an accuracy of +/- 5 µm over its entire length". The specialists in Haiger machine these cutting inserts directly on the MP1200 Connect. At first, however, they were unable to achieve the required accuracies. But it did not take long for Jäger to



Ingersoll hobs consist of individual segments that are positioned by means of high-precision cross slots.

So I have no hesitation in calling the EDM-Dress 1200P with its rotary spindle now installed at our company my baby.

Nico Müller,
in charge of toolmaking

Ingersoll specialists appreciate the user-friendly control of the MP1200 Connect.

develop an optimised cutting process in cooperation with the service technicians at Mitsubishi Electric. “The competent service technicians recommended using a thinner wire as well as setting some special parameters during wire EDM over the profile length. This means that we can now effortlessly machine the inserts even more accurately than required in terms of dimensions and shape accuracy,” Jäger adds. In order to wire-cut small series with the optimum of consistent accuracy and process reliability, the skilled workers set up a customised clamping device in the workspace of the MP1200 Connect.

Opinion

What is your assessment of the current situation in manufacturing industry, and especially in the machining of metals in Germany?

Nico Müller: We are currently confronted with increasing constraints. The cost of energy, and particularly electricity, has risen considerably in the last two years. We expect these costs to continue to rise due to economic policy decisions. In addition, it is becoming more and more difficult to find suitable staff for production in two or even three shifts.

We have to factor in a steadily growing share of labour costs. To avert this, we, like other companies, will continue to automate production – with robots, loading and unloading equipment and in-plant handling systems, for example. In addition, we will continue to specialise in special tools and the development of complete machining processes, as we anticipate growing competition from manufacturers in Asia for standard tools.

In doing so, they thus identified another field of application for the MP1200 Connect wire-cut EDM machine. In the working hours not needed for the profiling of grinding wheels, they now use it again and again to machine components for special jigs and other production equipment. On this Müller says: “Wire EDM is an innovative and mature in-house technology from which we can benefit comprehensively. Since the machine is capable of running reliably for a long time unmanned, we can use it profitably left to its own devices, so to speak. As we now fabricate production equipment and spare parts ourselves, the MP1200 Connect also helps us to be more flexible and cost-effective in production. In addition, we optimise the efficient use of the wire-cut EDM, as it operates productively for longer periods of time.” Thus, in addition to the MP1200 Connect’s initially narrowly defined field of application, the tool makers in Haiger have now developed far-reaching capabilities for the high-precision machining of an almost unlimited range of components.

Member IMC Group
Ingersoll Cutting Tools

Ingersoll Werkzeuge GmbH

Founding year
1961

Employees
500, with 250 in production at the parent plant in Haiger

Managing Director
Armin Engelhardt

Core business
Standard carbide drilling and milling tools, such as tools for ends, roll ends, insert, turning, grooving and threading tools, as well as special tools customised to the needs of manufacturing companies in the automotive industry, track and rail vehicle construction, energy exploration, generation and distribution, alternative energy generation as well as tool and mould making, and especially gear cutters

Contact
Kalteiche-Ring 21-25
35708 Haiger
Germany

Tel: +49 2773 742 0

info@ingersoll-imc.de
www.ingersoll-imc.de

Flexible and cost-effective production.

FRAISA Hungária Kft.

High-precision grinding wheels.

Made with Mitsubishi Electric's wire-cut solution at the Fraisa plant.

Our visit to Fraisa's Sárospatak site involved seeing how its grinding wheels, controlled by Mitusbishi Electric's EDM-DRESS, are used to manufacture drilling and milling tools. We gained insight into the technology in our interview with Dávid Zsiros, head of the grinding wheel preparation department at Fraisa Hungária.

Interview with Dávid Zsiros

What should we know about Fraisa as a global company and its Hungarian subsidiary?

Dávid Zsiros: The Fraisa Group is a global company based in Switzerland, but with subsidiaries in several countries. It is present in the United States, China, France, Italy, Germany and Hungary. Fraisa Hungária Ltd. manufactures milling and drilling tools.

What material are your tools made of?

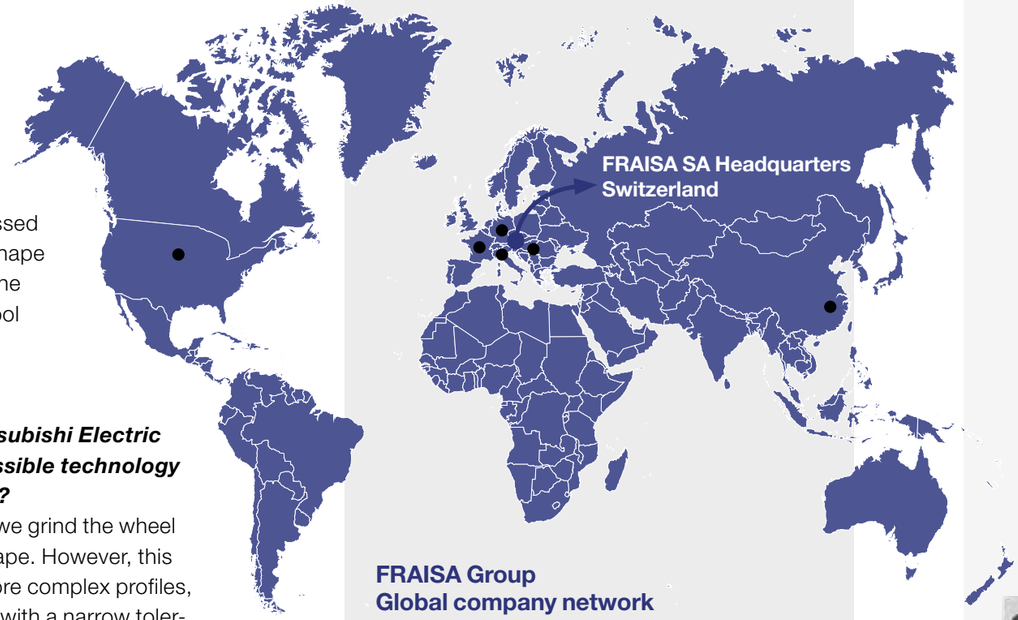
Dávid Zsiros: We produce 95% solid carbide products and the remaining 5% are made from HSS tool steel. Approximately 1,000,000 tools are produced here at the Sárospatak plant every year. Our products are stored in a central warehouse and shipped directly to our customers. Catalogue tools account for 85% of our production capacity. Since we are part of the Fraisa Group's special tool manufacturing centre, we also manufacture customised cutting tools tailored to the needs of our customers. These can be profile tools, drills, step drills, reamers, etc. and can be made of carbide or high-speed steel. I worked in this field as a production support engineer, dealing with special tools. Our products range from uncoated to PVD- and CVD-coated. We apply these coatings to the tools here on site as well.

What work is currently performed in the department where we are now?

Dávid Zsiros: This is where the preparation of the grinding wheel takes place, which is the process required for the sharpening of cutting tools. Grinding

Wire EDM solution for 1,000,000 tools.

wheels in this department are prepared in various ways. We have grinding wheel packages profiled with conventional grinding wheels and wheels dressed by wire-cutting. Here, we shape the profiles and assemble the the wheel packs used on tool grinding machines.



What were the main reasons for considering Mitsubishi Electric wire EDM-Dress as a possible technology for meeting these needs?
Dávid Zsiros: Essentially, we grind the wheel to produce the required shape. However, this has physical limitations. More complex profiles, smaller radii or dimensions with a narrow tolerance field cannot be produced using this technology. We needed another technology and so wire EDM came into focus. As the grinding wheel turns with the aid of the rotary spindle, the wire forms the required profiles according to the contour we have specified, with a simple two-dimensional motion on the machine.

Having consulted with our Swiss R&D centre, we selected Mitsubishi as our supplier. After the arrival of the Mitsubishi EDM-Dress 1200P and the learning of the wire EDM process, we started to integrate the technology into our production.

This is how we started to machine the more specialised shapes and contours that are impossible to produce with conventional dressing. To launch a separate product line, we first used grinding wheel sets with new profiles. From then on, we were able to actively participate in the development of many of our products, thanks to the meshing of research and development in Switzerland and production in Hungary.

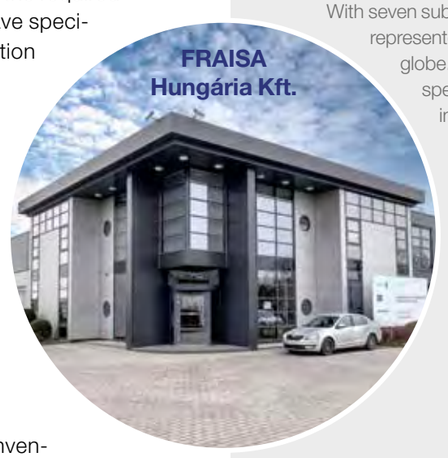
What are the characteristics of wheels with wire-cut profiles?
Dávid Zsiros: The idea is that the grinding tool

FRAISA Group
Global company network

FRAISA is a Swiss family-owned company that produces advanced metal cutting tools for the global market.

With seven subsidiaries worldwide, FRAISA is represented in all key markets around the globe. Each individual company has specific capabilities that make it individually successful.

This also applies to FRAISA's state-of-the-art plant in Sarospatak, Hungary, which produces high-performance tools.



mould is able to enclose the machining edge, so to speak. In one step, the groove, the backing and the face are made. EDM-Dress allows two – for some tools even three – grinding wheels to be combined in a single grinding wheel with a more complex profile. This makes the grinding process much more efficient.

What are the other advantages of EDM-DRESS technology provided by Mitsubishi Electric?
Dávid Zsiros: It is clean, as it is a submerged process in the so-called dielectric fluid. Thanks to the same tool for electric discharge each time, EDM-Dress produces a grinding wheel with significantly better surface structure and dimensional accuracy than conventional methods. It is not faster in terms of time; the production time of such a grinding wheel is on average 2-3 hours depending on the wire thickness, but this time is not relevant, as EDM-Dress, unlike conventional dressing, takes place unmanned. The longer dressing time pays for itself many times over within the grinding machines, where cycle times can be reduced by up to 60%. At the same time, the grinding wheels' profile life is considerably longer, so the grinding wheels can remain in use for longer despite the higher removal rate.

How does the Mitsubishi Electric wire EDM technology differ most from the other two processes you use?
Dávid Zsiros: If you look at the surface under a microscope, you can clearly see that the biggest "problem" with dry and oily control is the diamond particles that are found in the grinding wheel. These can be turned out of the bonding material or even the free gaps between individual diamond grains can be clogged by the detachment of the regulating or controlled crown, creating a surface with little protrusion of the diamond grains that are being cut - as we say, no bite. In contrast, with the

wire solution, diamond grains are exposed because the bonding material between them is removed by the wire.

An important thing to know about wire EDM is that the grinding wheel must be electrically conductive. Grinding wheels with the appropriate bond are therefore used. How are the technological parameters set?

Dávid Zsiros: The machine has a 2D CAM interface where a simple profile can be drawn. Then the material composition, wire and tolerances must be specified, and from these parameters the program is generated. After that, it is only necessary to optimise the positioning, stopping and threading points. The system has been designed to use the same program for different bond compositions, with modifications only necessary in special cases.

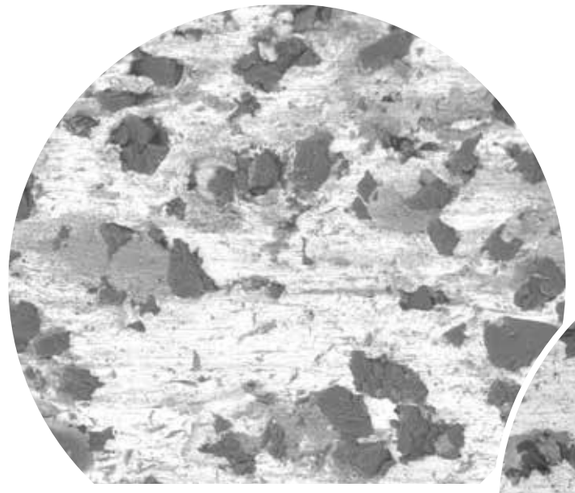
It is also very easy to program. I work from the DXF format, which comes from the head of the standard tooling department or any other department. The files are generated jointly with R&D. They use a special CAM program to create the geometry of the tool, using Numroto plus for standard tools and VirtualGrind PRO for micro tools. I optimise the DXF format I receive to make it compatible with Mitsubishi's program. I specify the start points, onset and stop points, and from there the program generates the code for the movement. We also have a master program that we got from ITS. I import the movements into it, modify the technology if necessary for special wheels, and the machining can start.

By the way, how did the Mitsubishi Electric wire EDM emerge as a possible solution?

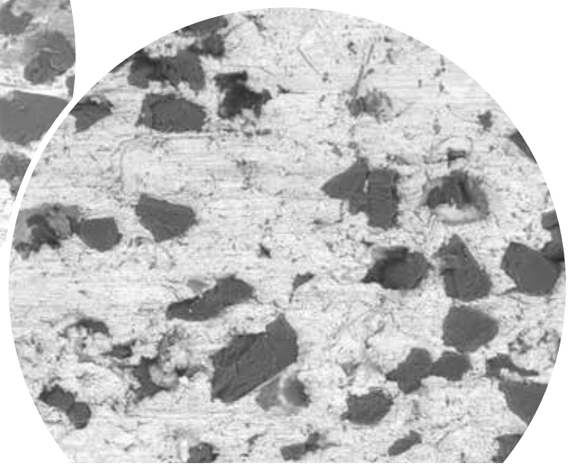
Dávid Zsiros: The M+E Szgépgép Kereskedelmi Kft., as the official reseller of Mitsubishi EDM in Hungary, offered us this machine and the ITS B axis as well as additional technology, which together can provide a solution for the quality and efficient execution of the work process we expect. The machine arrived from Mitsubishi Electric's warehouse in Germany, where M+E was involved in the commissioning and maintenance of the machine. We are satisfied, as we don't have our own staff for this and they respond quickly when necessary.

Please tell us a bit about the machine, the purchase, the installation.

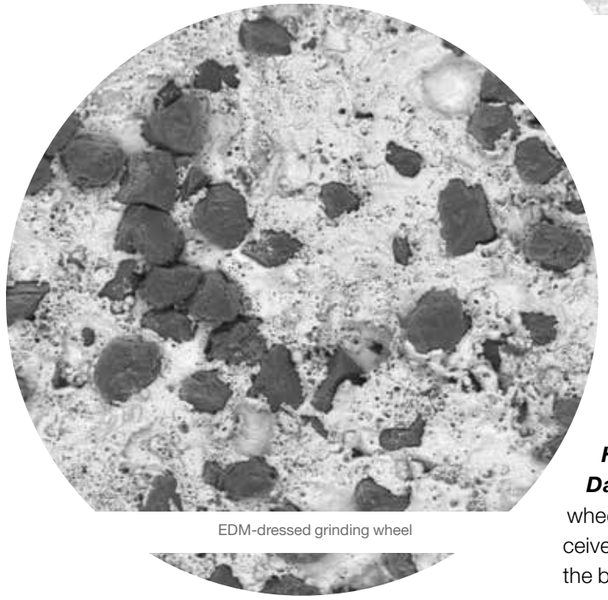
Dávid Zsiros: Mitsubishi Electric provided the basic machine with its reliable technology along with the rotary spindle from ITS-Technologies, which is fully integrated into the MP1200 and supported with technology handling. ITS-Technologies subsequently modified the connection terminal at the rotary spindle a little so that the connection leads could be perfectly laid. So, the basic technology itself is 90% perfect for certain types of bonds. For the remaining roughly 10% we can optimise the technological parameters for the specific needs, i.e. speed, machining strategy, threading, stops etc. The procurement, as I mentioned, was done through M+E, who were actively involved during the installation, commissioning and training, alongside ITS and Mitsubishi staff.



Conventionally dressed grinding wheel without cooling



Conventionally dressed grinding wheel with cooling



EDM-dressed grinding wheel

How accurate is the technology?

Dávid Zsiros: With a properly adjusted grinding wheel, the contour accuracy is 100%. Previously, we received a request from one of our departments to design the ball shape itself for a ball mill with a very tight tolerance. In the first machining pass we managed to do it almost perfectly to a dimension of 0.499 mm, so we only had to correct it by 1000th mm to achieve the dimension of exactly 0.5 mm.

What other experience have you had with the machine?

Dávid Zsiros: Because of the extremely high precision requirements, we pay very close attention to the

EDM-DRESS grinding wheel technology has helped us to machine several of our product lines more economically [...]. And its cost-effectiveness stems precisely from what I mentioned, that with this solution up to 2-3 grinding processes can be replaced by a single grinding pass.

Dávid Zsiros, head of the grinding wheel preparation department at FRAISA Hungaria

ambient temperature, so all three of our production halls are air-conditioned and kept at a constant temperature. Changing temperatures can of course cause deviations. What I would also like to highlight is the integrated preparation of the dielectric (water) which, thanks to mechanical filtration and the recommended EKO ioniser, requires very little maintenance.

How long have you been using this machine and this technology?
Dávid Zsiros: We have been using it continuously since 2019. EDM-DRESS grinding wheel technology has helped us to machine several of our product lines more economically, such as E-Cut, Favora and the E-Cut Alu line, which is currently under development. And its cost-effectiveness stems precisely from what I mentioned, that with this solution up to 2-3 grinding processes can be replaced by a single grinding pass.

Are you planning to purchase a similar machine in the future?
Dávid Zsiros: Our parent plant has another version of EDM-Dress, a robotic cell solution called DiamondCell, which can be left for longer periods to work unmanned. But we don't need that in Hungary because we work 24/7, so we always have staff to tool the machine. However, we would definitely like to have another machine like this in the next 2 years.

FRAISA Hungária Kft.

Founding year
1999

Managing Director
György Varknal

Core business
Serving customers in the Hungarian market, production of top-quality carbide tools for customers in the FRAISA Group

Contact
Vásárhelyi Pál utca 3
3950 Sárospatak
Hungary

Tel: +36 47 511 217

info@fraisa.hu
allas@fraisa.hu

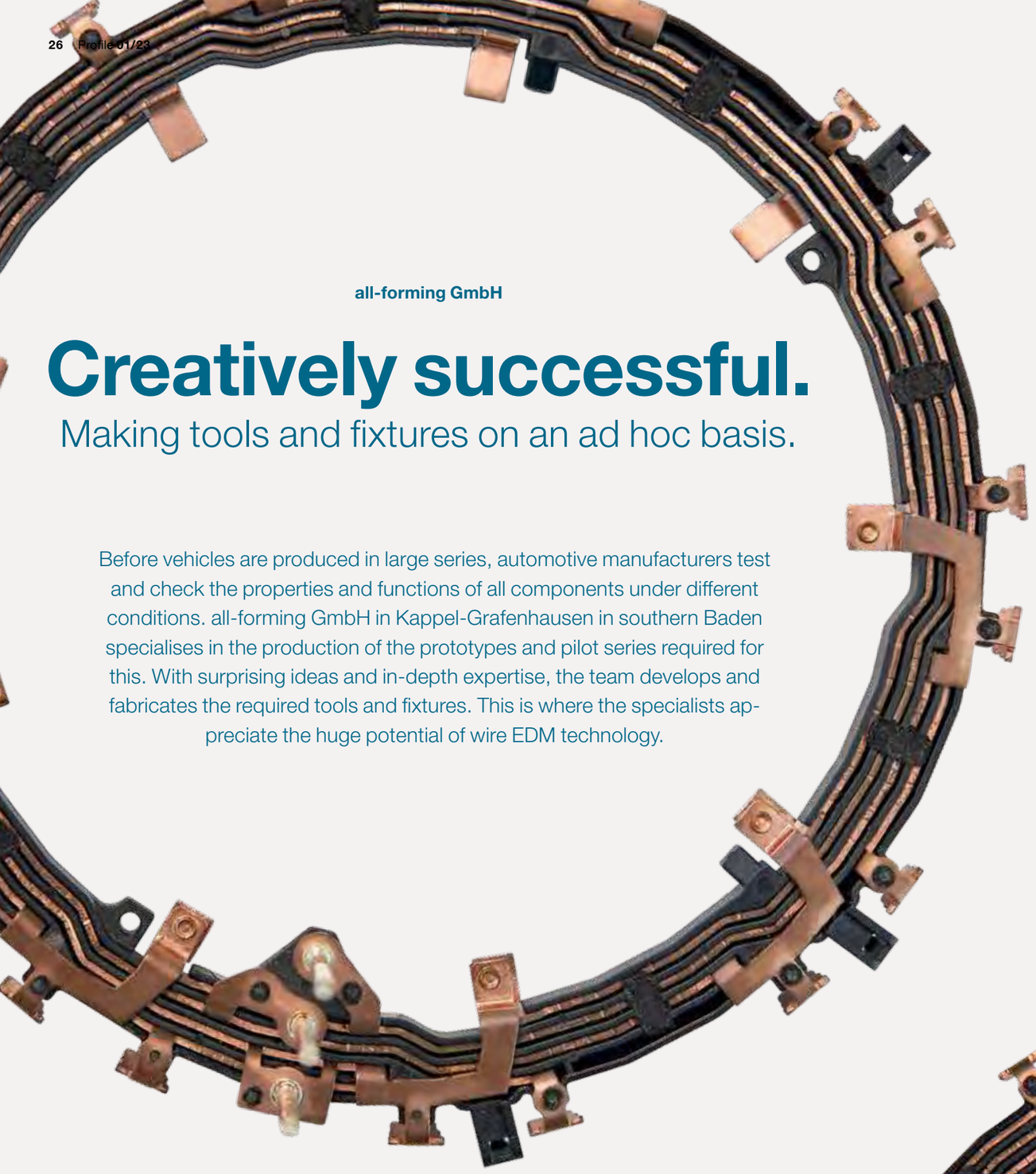
www.fraisa.com

all-forming GmbH

Creatively successful.

Making tools and fixtures on an ad hoc basis.

Before vehicles are produced in large series, automotive manufacturers test and check the properties and functions of all components under different conditions. all-forming GmbH in Kappel-Grafenhausen in southern Baden specialises in the production of the prototypes and pilot series required for this. With surprising ideas and in-depth expertise, the team develops and fabricates the required tools and fixtures. This is where the specialists appreciate the huge potential of wire EDM technology.



The production department at all-forming in Kappel-Grafenhausen appears at first glance to be a jumble of machines for a wide variety of machining processes. In addition to CNC milling machines and lathes, there are mechanical and hydraulic presses as well as (3D) laser cutting machines, electric and hydraulic press brakes and swivel bending machines. There are also a number of workstations for riveting, soldering, welding and assembly. Sebastian Singler, production manager at all-forming, explains: “We operate as a skilled service provider in the development of components and devices of the future. We produce the prototypes and pilot series required in the development process. What sets us apart is our creativity when it comes to fabrication processes along with our extreme flexibility in our work. All-important is being able to produce the required components as one-offs or in small series as quickly as possible with the aid of industrial production processes so that they can be installed and used like series components. Lead times of two to three weeks are common, and between five and six weeks for tool-related parts.”

Wide-ranging diversity

Singler and his team fabricate a vast range of components. “We turn, drill and mill functional specimens from the steel or aluminium blank. This applies, for example, to engine brackets, articulated arms and housing covers. However, we also produce a multitude of components by punching, forming and bending 0.1 mm to 5 mm thick sheet metal. Recently, for example, we had to produce a pilot series of several hundred arms for windscreen wipers from 4 mm sheet metal.” However, in most cases it is a question of stamping and forming thin sheet metal and assembling the parts into complete components. “In prototype manufacture, we are directly experiencing the current shift

Overmoulded contacts for e-mobility

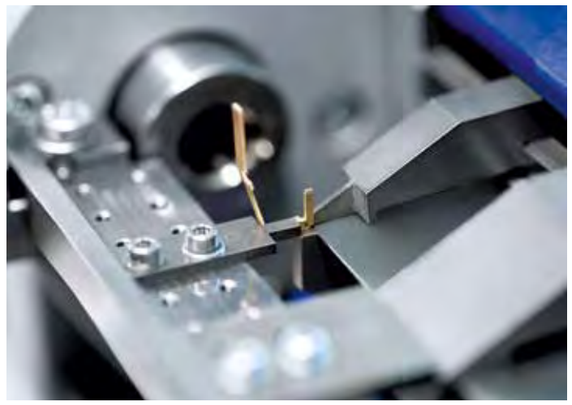
From small parts to large parts

Mastering diversity, the specialists at all-forming produce a large number of component variants in small series for testing under real-life conditions.

towards electromobility. In addition to housings, we are increasingly producing plug contacts and complete connectors for vehicle electrics and electronics," Singler explains. To this end, the specialists in Kappel-Grafenhausen have a comprehensive toolshop as well as a large number of workstations for joining and assembling the components. Contact springs measuring only a few millimetres, for example, are bent from copper on program-controlled swivel bending presses. Then, on mechanical presses, contact pins are pressed in. Singler tells us he also enlists regional partner companies to injection-mould plastic housings around the contacts he machines, so that he can supply components fully ready for installation. Recently, for example, the prototype builders at all-forming have been producing electronic housings with integrated electrical contacts for a wheel hub drive.

Rapid throughput required

Singler stresses that when it comes to the production of prototypes and pilot series, ingenious and creative toolmaking is crucial for success. The essential criterion is to produce functioning stamping and forming tools, on which a few dozen or a few hundred workpieces can be produced, with minimal time for throughput. To produce their punching and forming tools, the specialists at all-forming have been using the wire erosion process for many years.

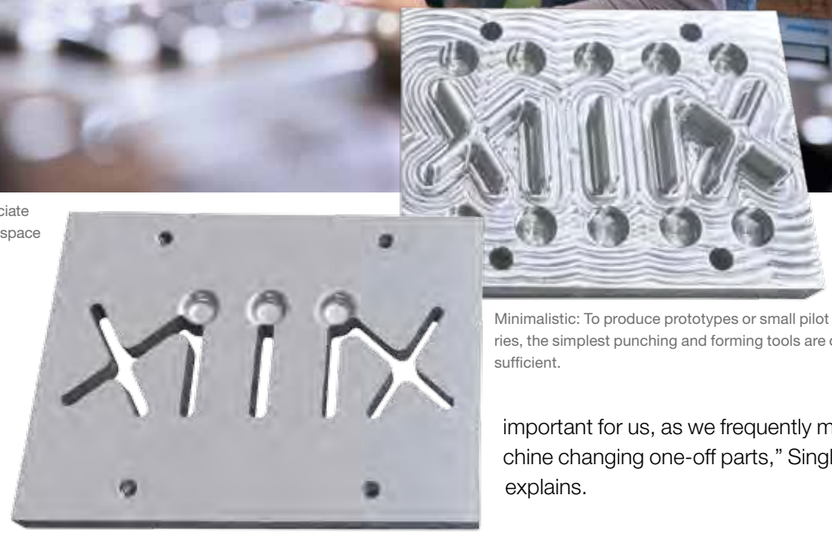


Numerically controlled swivel bending machines get the tiniest contact sheets precisely into shape.

*What's more, the **MV2400R Connect** has a **very large workspace** that is easily accessed by the machine operator. The latter proves to be particularly important for us, as we frequently machine changing one-off parts.*

Sebastian Singler,
Production manager at all-forming

The specialists at all-forming appreciate the tidy and readily accessible workspace of the MV2400R Connect.



Minimalistic: To produce prototypes or small pilot series, the simplest punching and forming tools are often sufficient.

all-forming invested in an MV2400R Connect wire-cut EDM machine in the middle of 2022 because the machine previously used had proved to be outdated in terms of programming and operation. In addition, it had been increasingly difficult to obtain skilled after-sales service.

High productivity thanks to large workspace

He and his skilled staff, says Singler, decided in favour of the wire EDM machine from Mitsubishi Electric for several reasons. "First of all, the MV2400R Connect comes with a cutting-edge and future-proof programming and operating approach. We benefit from state-of-the-art touchscreen operation. In addition, interfaces to current CAM systems are readily available. What's more, the MV2400R Connect has a very large workspace that is easily accessed by the machine operator. The latter proves to be particularly important for us, as we frequently machine changing one-off parts," Singler explains.

The components to be cut are programmed on a CAD/CAM workstation using the 3D CAD workpiece data. The data for the NC program for wire EDM are sent to the MV2400R Connect via a direct data line. There, the wire EDM specialist retrieves the current production orders and NC programs and loads the machine with sheet metal accordingly. The advantage is that several different pieces of sheet can be positioned in the large workspace. The toolmakers in Kappel-Grafenhausen have created a modular clamping device specifically for this purpose, thus allowing the trouble-free multiple clamping of sheet and blocks. In conjunction with job programming, the MV2400R Connect can cut several workpieces overnight in a single unsupervised operation. This goes a

Large and readily accessible workspace.

long way towards producing stamping and forming tools at short notice, Singler points out. As confirmed by all-forming's production specialists, the reliable automatic wire threading of the MV2400R Connect ensures that the set-up and programmed jobs are actually executed overnight. In the meantime, thanks to these advantages, the productivity of the wire-cut EDM machine from Mitsubishi Electric has proven so good that, in Singler's opinion, it could easily replace two machines of a different make.

Identifying the process benefits

Another useful feature for the toolmakers at all-forming is that the wire-cut EDM process can run unattended, giving it a decisive advantage over HSC milling. This opens up additional production capacity, the specialists confirm. Since skilled personnel are not tied to supervising the machine, they can be productive elsewhere, such as in the assembly and adjustment of the punching and forming tools. The toolmakers see another advantage of wire-cut EDM, as yet largely unnoticed, in the machining scope offered by the narrow kerf. Firstly, it is possible to machine difficult geometries with corners, narrow and deep grooves and penetrations of any kind. Secondly, machining can be programmed to enable a complete punching tool to be completed in a single cutting operation. "That may surprise some people. But for our purposes, all it takes is a 0.2 mm thin wire to cut the punch, die and blank holder out of the sheet in a single cut. The gap resulting from the wire diameter during wire eroding is acceptable and sufficient as a kerf for a punching tool for prototypes. In this way, we can produce all the shaping parts of a punching tool within a few hours in a single operation on the MV2400R Connect," Singler explains. Similarly, the toolmakers also achieve extra-fast throughput when machining welding electrodes with wire EDM. To do this, they first wire-cut the required profile out of a copper block, and then they use wire erosion to cut this into numerous slices just 0.85 mm thick. Only a few steps are then required to machine the blanks to their final shape.

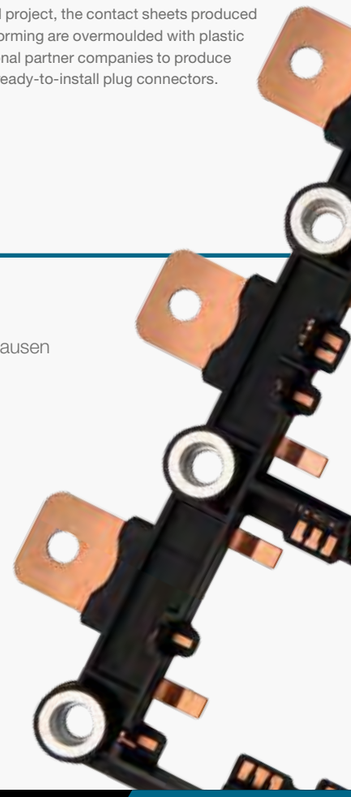
Contact pins for electric plugs are cut from the block.

Previously considered somewhat exotic, wire-cutting technology is thus becoming a preferred manufacturing process, especially in toolmaking.

The all-forming GmbH toolmaking team

Impressive operating principle

In the first weeks after commissioning, staff took a while to get used to programming and operating the MV2400R Connect wire-cut EDM machine. The principle of the touchscreen and graphically guided dialogues on the screen, says Singler, is clearly different from the programming and operating functions using numeric and special function keys that they had been accustomed to. However, the specialists in Kappel-Grafenhausen were quick to appreciate the benefits of the advanced programming and operating approach. Handling the MV2400R Connect can be learned intuitively within a few days, they now say. Moreover, numerous processes and functions on the graphic touchscreen are self-explanatory. "This simplifies and accelerates work with the Mitsubishi Electric wire-cut EDM machine quite considerably. Previously considered somewhat exotic, wire-cutting technology is thus becoming a preferred manufacturing process, especially in toolmaking."



In a shared project, the contact sheets produced at all-forming are overmoulded with plastic at regional partner companies to produce ready-to-install plug connectors.

all-forming GmbH

Founding year
In 2008 by taking over the existing Geier GmbH

Managing director
Klaus Lauppe

Employees
29

Core business
Workpieces machined in steel, aluminium, copper and plastics on the basis of drawings, samples and 3D data; sheet metal parts laser-cut, punched and formed for functional specimens, prototypes and pilot series; and components assembled by welding and riveting, manually and semi-automatically, for the automotive industry, medical equipment technology, precision mechanics, electrics and electronics

Contact
Gewerbestrasse 7
77966 Kappel-Grafenhausen
Germany

Tel: +49 7822 8610-0

info@all-forming.de
www.all-forming.de

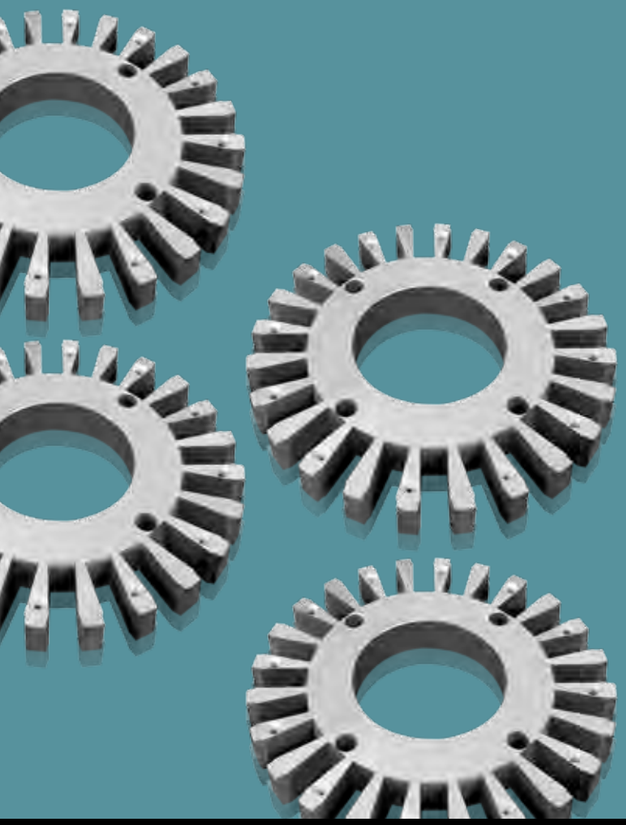
Operation can be learnt intuitively.

JVD Engineering Ltd

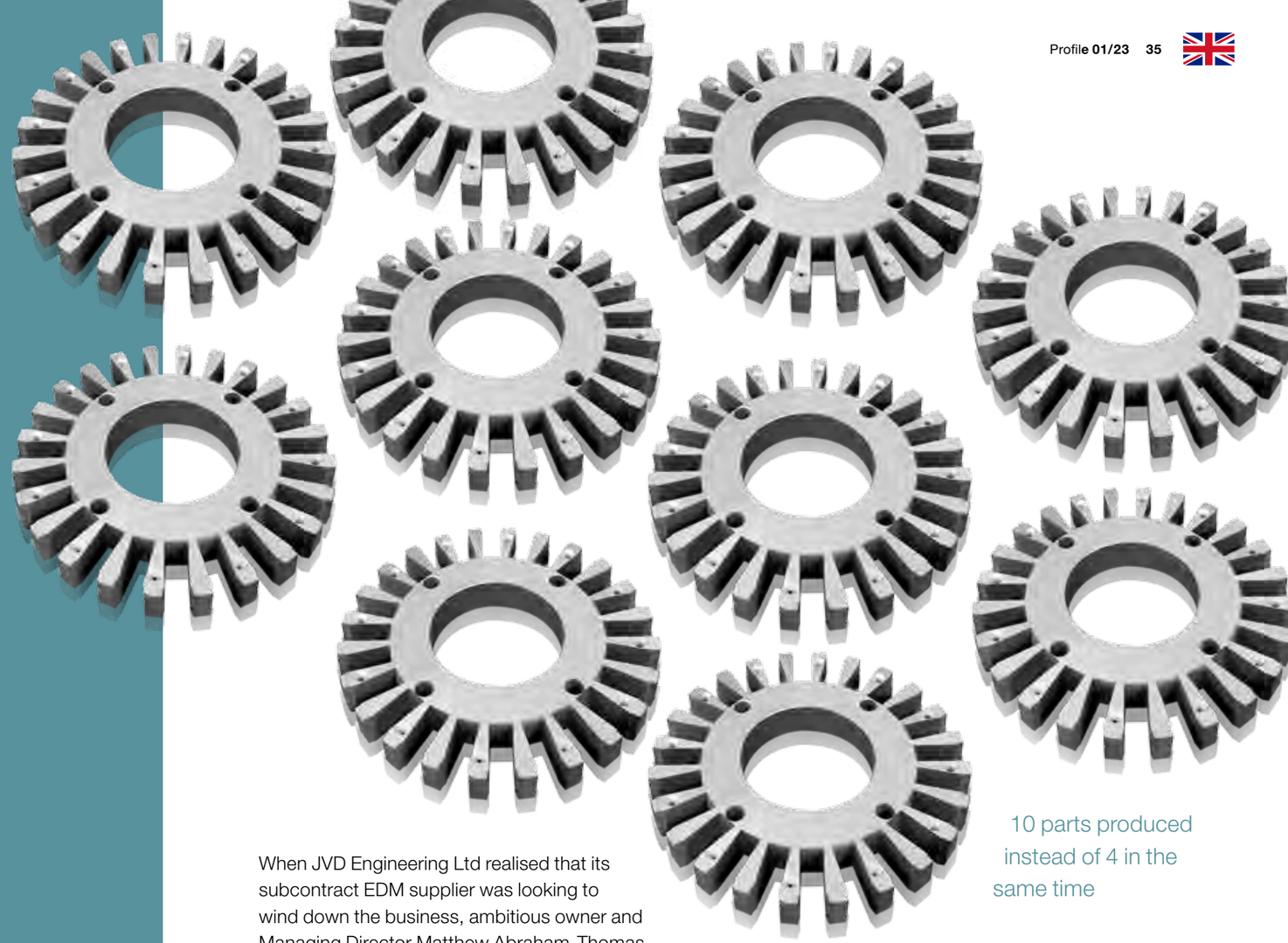
150% more output

with reduced cycle times.

With six EDM machines on site from a sole supplier, JVD Engineering was adamant it was sticking with the same brand when it wanted to buy a new EDM. However, a demo of the Mitsubishi Electric MV2400S NewGen from ETG opened the company up to all the possibilities offered by the brand. With an MV2400S NewGen replacing two EDM machines, the company explains why Mitsubishi Electric is now the brand of choice.



On a continuous investment run.



10 parts produced instead of 4 in the same time

When JVD Engineering Ltd realised that its subcontract EDM supplier was looking to wind down the business, ambitious owner and Managing Director Matthew Abraham-Thomas spotted an opportunity and bought the business, bringing it under the JVD Engineering umbrella. As a company that continually invests in new technology, JVD quickly seized the chance to improve EDM productivity with the acquisition of a Mitsubishi Electric MV2400S NewGen EDM machine from the Engineering Technology Group (ETG).

Founded in 1991, the Leeds manufacturer that occupies a 1,800 m² factory in Morley, has been on a continuous investment run, turning the company from a manual machine shop to a full CNC facility since Matthew acquired the business from the previous owner. Commenting upon the EDM situation, Matthew says: “When our EDM supplier announced they were closing their business, we stepped in to ensure continuity of EDM services for our customers. It was a simple choice – either bring the work in-house by buying the company or lose the business from our existing customers.

“The business we bought had six ageing EDM machines and only three were fit for daily use. While we incorporated three of these machines into our business, we also wanted to upgrade the technology. With all of the existing EDM machines being supplied by the same vendor, we wanted to invest in the same brand and technology.” However, this all changed when Eric Tollet from ETG introduced introduced JVD Engineering to the Mitsubishi Electric EDM machines.

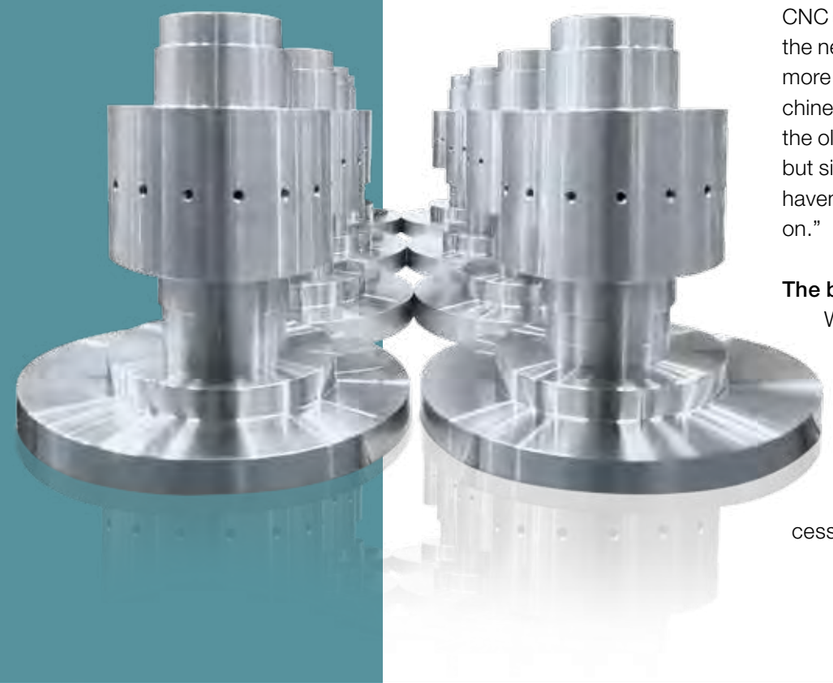
Matthew recalls: “I’ve known Eric for years and we were adamant we were buying a different brand, but

JVD History

Originally Joint Vehicle Development Engineering Ltd, JVD was founded in 1991 in a small workshop in Leeds. The company started life producing and fitting retrofit kits for air-assisted power steering used in commercial vehicles. As the firm expanded, the technologies it had developed for power steering became increasingly employed in other fields and this diversification accelerated business growth.

The company's initials were adopted as a brand name, and the company moved to a more modern environment and continued its investment in state-of-the-art equipment, thus continuing expansion.

Today, the company is one of the most modern, adaptable, comprehensive and dependable engineering companies in Leeds.



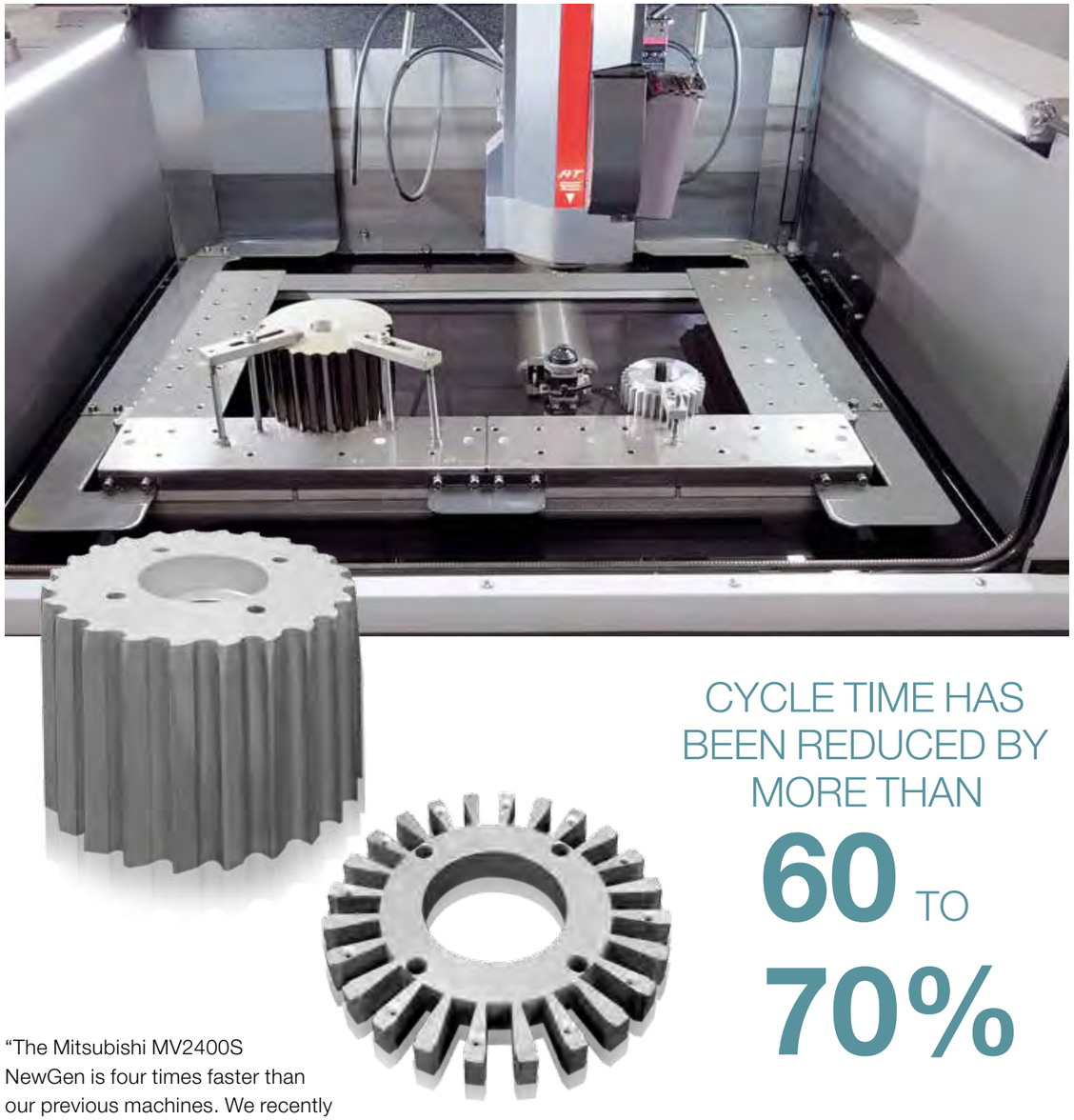
Eric persuaded us to look at Mitsubishi and have a demonstration with Scott Elsmere. Scott demonstrated the Mitsubishi with passion, pride and unfathomable expertise. This was evident when he emphasised all of the positive points of the MV2400S NewGen. Not only did he highlight the positives, but without emphasising the technical shortcomings of other brands, Scott showed us where Mitsubishi won-out over its rivals. When we eventually had demonstrations from alternative vendors, the inadequacies of other brands compared to Mitsubishi were evident and our decision was made."

The Mitsubishi Electric MV2400S NewGen EDM machine was installed in August 2022 and the benefits for the 16-employee business have been significant. As a general subcontract machining business, JVD Engineering produces components for a wide variety of industry sectors from a diverse range of materials. While EDM currently remains a small element of turnover, it is essential for producing challenging features and complex components such as keyways with very tight tolerances on tool steels and other difficult-to-process materials. It is this continuous throughput of challenging parts that previously required subcontract EDM services and eventually led to the acquisition of an EDM business.

Looking at the Mitsubishi Electric MV2400S NewGen acquisition, Matthew adds: "The Mitsubishi is a large bed machine that has a 400 mm Y axis compared to 150 mm on our existing machines. We wanted this for processing larger parts and laying multiple parts on the machine for simultaneous non-stop production. However, this larger footprint meant we had to remove two of our previous EDM machines to make space for the Mitsubishi MV2400S NewGen. As the previous machines didn't have the powerful and easy-to-use Mitsubishi CNC control or auto-wire feeding, the new machine was instantly more productive than the two machines it replaced. We kept one of the old machines to fall back on – but since the Mitsubishi arrived, we haven't even turned that machine on."

The benefits

While the previous machines may have been past their best years, the new Mitsubishi Electric MV2400S NewGen is at least four times more productive than its predecessors. As Matthew continues:



CYCLE TIME HAS BEEN REDUCED BY MORE THAN **60** TO **70%**

"The Mitsubishi MV2400S NewGen is four times faster than our previous machines. We recently completed one repeat order and the EDM running time was 38 hours, which is now less than 16 hours on the Mitsubishi. While the cycle time on this part has been reduced by more than 60 to 70%, it is the non-cutting time that is making a difference. Previously, we would have an operator paying constant attention to the machine and having to frequently re-thread the wire – losing valuable processing time and absorbing excessive man-hours. With the auto-wire feeding on the Mitsubishi, the part is set up to run, and we take a finished part off the machine with no intervention."

While the machining times are drastically reduced, it is the non-cutting times that are paying huge dividends for JVD Engineering. With technology incorporated such as Mitsubishi Electric's Corehold, E-Packs, and D-Cubes, EDM has never been so user-friendly. Intuitive operation is provided via the large screen with modern gesture control that boosts comfort, while the configurable user interface allows the main functions to be freely

Four times faster than previous machines.

arranged during daily work. With step-by-step dialogue guidance, users are piloted through the entire process, from programming to the start of machining. Visible ‘at a glance’ features include machining status, elapsed production times, state of maintenance and other data. During the preparation of pending machining tasks, support is provided by overviews of the remaining wire, state of filter cartridges, deionisation resin and other parameters. This prevents outages caused by finite consumables or worn parts and optimises machine running times. The complete machine documents inclusive of maintenance instructions are also available with the aid of photos and 3D depictions.

Discussing the innovation behind the machine, Matthew adds: “With the previous machines, we would have to enter all our cutting parameters manually. With the Mitsubishi, we load a DXF file of the part into the machine, enter the material type, thickness and area we want to cut and the control system simulates the cutting path and ideal cutting parameters – it is that easy. It is remarkably quick and easy; and once the machine conducts a simulation, it gives an accurate cycle time, so we can quote our customers accurately. Providing a precise quote very rapidly gives our business more confidence and it has also seen us win more work from both new and existing customers.

“The intuitive software gives us the running hours and expected life-cycle of all consumables, but more impressively it provides a life-cycle for machine components based on running hours for preventive maintenance purposes.

*It machines faster and smarter than any of our other machines and it uses less wire and has a lower power requirement than our other machines – **it really is an incredibly intelligent machine.***

Matthew Abraham-Thomas, Managing Director

Matthew Abraham-Thomas with his Mitsubishi Electric MV2400S NewGen

We couldn’t be happier with the machine, its technology, the expert service and support from Scott and all the team at ETG.

Matthew Abraham-Thomas, Managing Director

It machines faster and smarter than any of our other machines and it uses less wire and has a lower power requirement than our other machines – it really is an incredibly intelligent machine.

“The machine has a host of additional attributes that impress us daily. We recently had to produce a hydraulic valve guide with a 15-degree taper. The EDM work on this batch of four parts was previously subbed out at 920 EUR per part, as we couldn’t find many suitable suppliers. Now, we can do this work in-house on the Mitsubishi. The reduction in our subcontract costs is one reason why this machine is paying dividends to our business. We couldn’t be happier with the machine, its technology, the expert service and support from Scott and all the team at ETG,” concludes Matthew.

JVD Engineering Ltd.

Founding year
1991

Managing Director
Matthew Abraham-Thomas

Number of employees
16

Core business
Subcontractor for parts production

Contact
Fountain St, Morley
Leeds LS27 0AA
United Kingdom

Tel: +44 (0) 113 275 1414
Fax: +44 (0) 113 275 1313

sales@jvdengineering.co.uk
accounts@jvdengineering.co.uk

www.jvdengineering.co.uk

Sales & Service partner United Kingdom

Engineering Technology Group (ETG)
Wellesbourne Distribution Park
Unit 16
Loxley Road
Wellesbourne
Warwickshire CV35 9JY
United Kingdom

Tel: +44 (0) 1926 818 418

sales@engtechgroup.com
www.engtechgroup.com

Reduction in subcontract costs.

Japan Special

Shinkansen. Kaizen on rails.

Japan's Shinkansen is a "bullet train", an unparalleled mass transit system. This article sheds light on a masterly organisational feat that has thoroughly revolutionised Japan.

Masterly organisational feat.

krblokhin / istockphoto.com

Over
150,000,000
passengers each year

Average delay per train

6
seconds


KristinaBlokhin – stock.adobe.com

The birth of a Japanese success story

In the 20th century, many Western countries – above all the USA – started to rely heavily on private motorised transport. The rail network was trimmed, downscaled and neglected. Japan took a different approach early on, with efforts to establish an efficient and reliable method to connect its metropolitan areas. The idea of a high-speed train was toyed with back in the imperial era, with the plans finally taking shape in the post-war period.

After the war, the plans finally became more concrete, and in 1950 the first Shinkansen prototype achieved a speed record of 163 km/h and prepared the ground for a modern and interconnected Japan. The first Shinkansen line connected the capital Tokyo with the port of Osaka. As usual in Japan, the government rail project was completed on time and on budget. The Shinkansen was a resounding success and by the early 1980s had been extended to four highly advanced lines permitting speeds of up to 300 km/h.

Today, the trains on the various Shinkansen routes are coordinated by six separate operators. Depending on the line, the Shinkansen travels at up to 320 km/h in regular operation and, since its inauguration, has been operating without any major accidents.

Trouble-free thanks to the pursuit of continuous improvement

Any fears that six different operators might cause organisational chaos proved unfounded in Japan. Although over 150 million passengers travel on the Shinkansen every year, the average delay per train is six seconds (Shinkansen delays are given in seconds!). While rail passengers in European Express trains can only dream of such figures, efficiency is a given in Japan. This can be explained culturally by the way problems are dealt with in Japan.

Basically, there are two ways to respond to a problem:
1. Remedy the consequences of the problem, express surprise, regret and so forth, apportion blame and carry on as before.
2. Analyse the causes of the problem, remedy them and thus prevent the error from occurring again.

Traditionally, the second option is preferred in Japan.
“Kaizen” is the Japanese philosophy of life and work. It involves continuous improvement and the never-ending quest for perfection. The Shinkansen is a magnificent symbol of kaizen and demonstrates graphically how the philosophy is applied in everyday life. The slightest delays, interruptions or technical defects are investigated by the railway companies. On both the technical and staff levels, strict guidelines and targets apply and must always be met. Discipline and punctuality are among the most important social values in Japan and are the prerequisites for the smooth operation of the Shinkansen.

The rails are also a masterly technical feat

Japan’s Shinkansen is not just “any old” high-speed train. In fact, it is nothing less than a technical masterpiece. The bullet trains run on specially manufactured Shinkansen tracks and not on ordinary rails. The Shinkansen’s tracks come with everything that is required for a safe, punctual and comfortable journey: rails laid on reinforced concrete slabs, extra-long individual rails, sprinklers between the rails for protection from snow, ice and fire, wireless collision warning systems, curve radii of at least 2,500 metres, airtight tunnels and no level crossings.

The high-speed lines extend from the northern island of Hokkaido via Honshu and Shikoku to Kyushu in the southwest of Japan. At over 27,000 kilometres, the network is


Yongyuan Dai / istockphoto.com

Speeds of up to
320
km/h

The pursuit of never-ending perfection.

Green Car / 1st class on the Shinkansen train

one of the world's most highly developed high-speed rail systems.

Like floating on air with the Shinkansen

In many parts of the world, public transport doesn't enjoy a good reputation and is often considered slow, unpunctual, dirty and uncomfortable and reserved for the underprivileged. Not so in Japan, for not only is the Shinkansen fast, practical and punctual, it is also one of the most luxurious and exclusive means of transport in the world.

The express trains are divided into two classes, with Ordinary corresponding to 2nd class and Green Car to 1st class. The 2nd class of the Shinkansen is comparable to 1st class in Europe; ample legroom, large comfortable seats and an impressive travel experience. On some routes there is also a Grand Class, which even outshines the Green Car. Private seats that can be reclined up to 45 degrees, cuisine courtesy of Michelin-starred chefs and a wide selection of alcoholic beverages. The Shinkansen is a great way to travel!

27,000 kilometres

World's most highly developed high-speed rail system

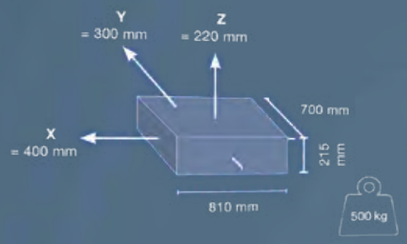
Fast, practical and punctual.

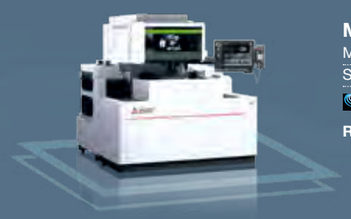
The job lot.

Wire-cutting and die-sinking EDM for all applications.

Wire-cut EDM

MP Series – High Accuracy



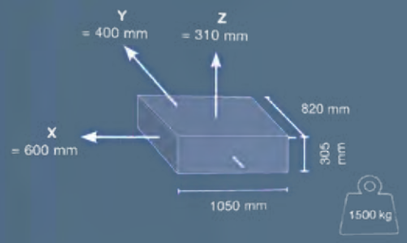


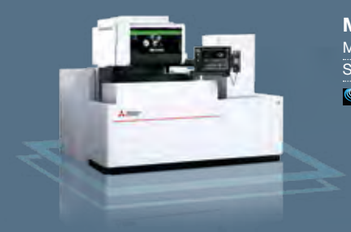
MP1200 Connect

Machine height	2015 mm
Surface finish in the standard version	Ra < 0.10 µm

Maisart

Reports on pages 6 and 70



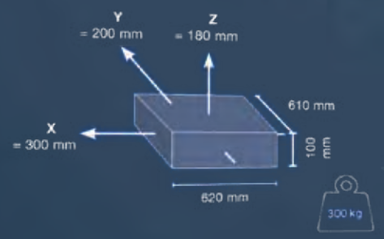


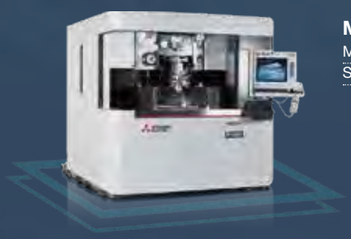
MP2400 Connect

Machine height	2150 mm
Surface finish in the standard version	Ra < 0.10 µm

Maisart

MX600 – Precision in Oil

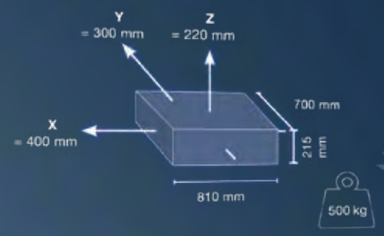


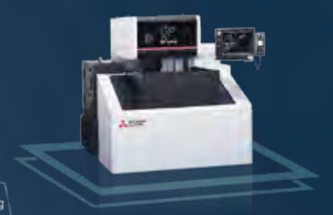


MX600 Advance Tubular

Machine height	2100 mm
Surface finish in the standard version	Ra 0.05 µm

MV-R Series – Power for Precision



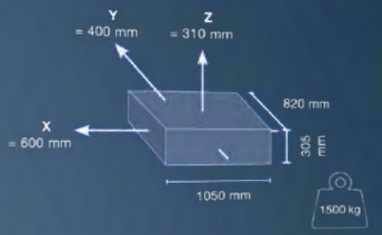


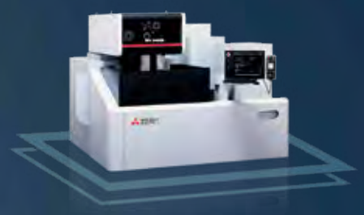
MV1200R Connect

Machine height	2015 mm
Surface finish in the standard version	Ra 0.25 µm

Maisart

Report on page 50





MV2400R Connect

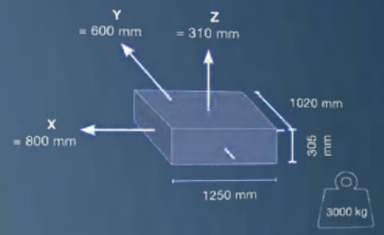
Machine height	2150 mm
Surface finish in the standard version	Ra 0.25 µm

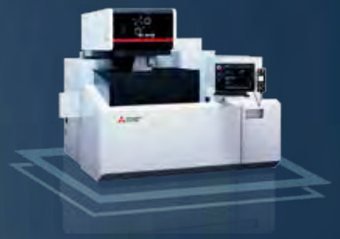
MV2400R Z+ Connect available:

Machine height	2380 mm
Travel	X: 600 mm, Y: 400 mm, Z: 425 mm
Max. workpiece dimens. (WxDxH)	1050 x 820 x 420 mm

Maisart

Berichte auf den Seiten 26 und 58



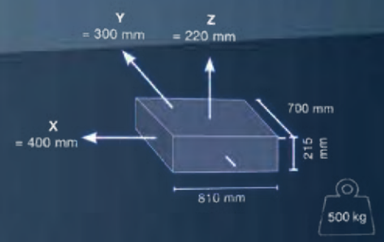


MV4800R Connect

Machine height	2415 mm
Surface finish in the standard version	Ra 0.25 µm

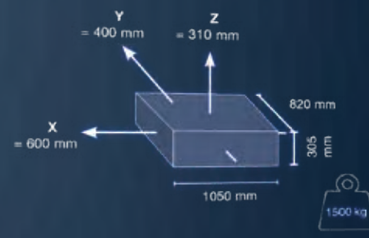
Maisart

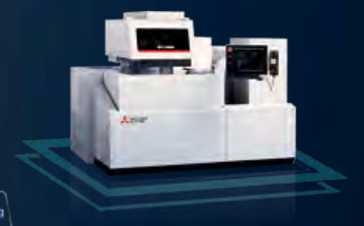
MV-S Series – Ready for Production



MV1200S New Gen

Machine height	2015 mm
Surface finish in the standard version	Ra 0.35 µm





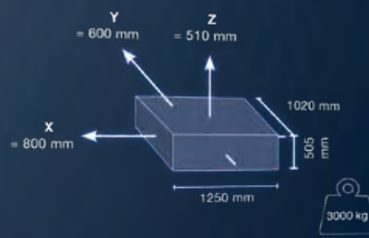
MV2400S New Gen

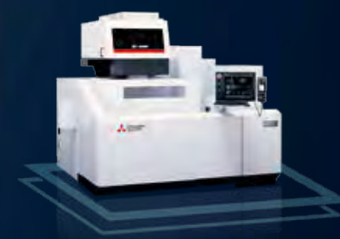
Machine height	2150 mm
Surface finish in the standard version	Ra 0.35 µm

MV2400S Z+ New Gen available:

Machine height	2380 mm
Travel	X: 600 mm, Y: 400 mm, Z: 425 mm
Max. workpiece dimens. (WxDxH)	50 x 820 x 420 mm

Report on page 34





MV4800S New Gen

Machine height	2815 mm
Surface finish in the standard version	Ra 0.35 µm

EDM-Dress – wire EDM dressing of CBN and diamond grinding wheels

DIAMONDCELL

- 100% reproducible results
- Unmanned machining
- Increased grinding productivity
- Extended grinding wheel life
- Fully automated

EDM-DRESS

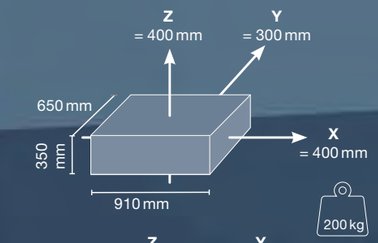
- 100% reproducible results
- Unmanned machining
- Increased grinding productivity
- Extended grinding wheel life

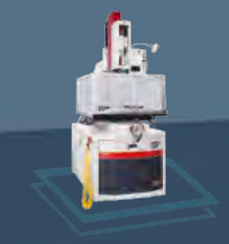
Maisart

Reports on pages 6, 18 and 50

EDM Drilling

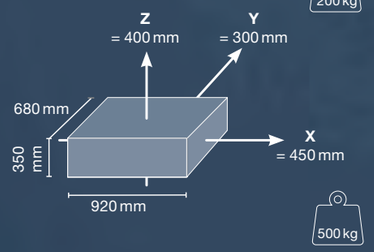
start Series – Drilling Power





start 43Zi

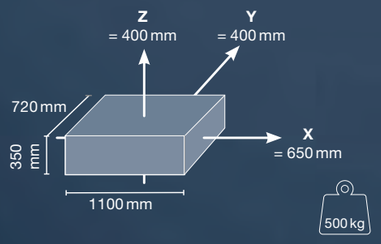
Machine height	2200 mm
Possible electrode diameter	0.3–2.5mm

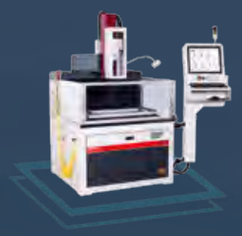


start 43Ci

Machine height	2130 mm
Possible electrode diameter	0.3–2.5mm

Report on page 58



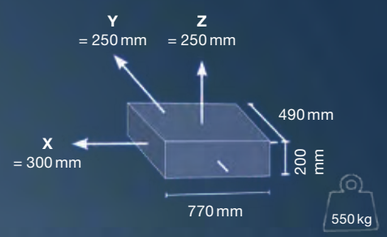


start 64Ci

Machine height	2100 mm
Possible electrode diameter	0.3–2.5mm

Die Sinking

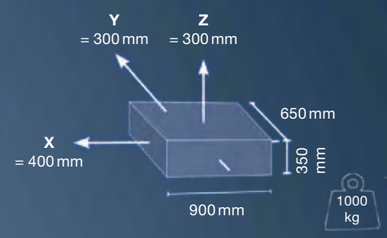
SG-R Series – Power for Precision

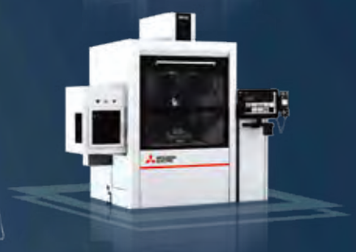


SG8R

Machine height	2140 mm
Table dimensions (W x D)	500 x 350 mm
Daylight	150–400 mm

Maisart

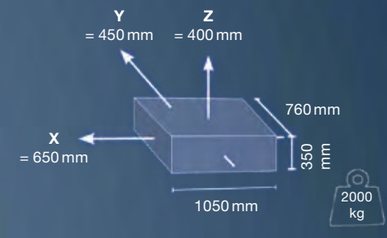


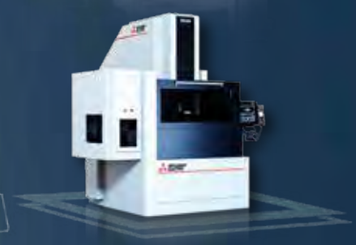


SG12R

Machine height	2420 mm
Table dimensions (W x D)	700 x 500 mm
Daylight	200–500 mm

Maisart





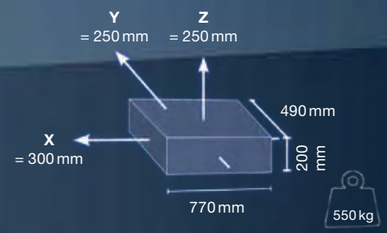
SG28R

Machine height	2745 mm

- User-friendly D-CUBES control system
- Wide range of technologies
- Heavy-duty machine construction

Maisart

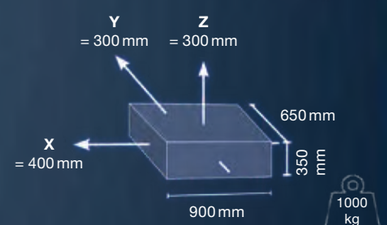
SG-S Series – Power for Precision



SG8S

Machine height	2140 mm
Table dimensions (W x D)	500 x 350 mm
Daylight	150–400 mm

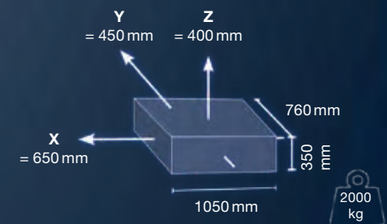
Maisart

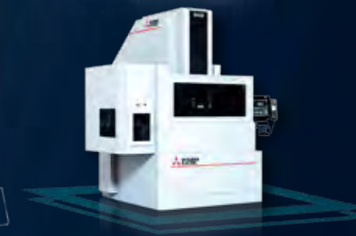


SG12S

Machine height	2420 mm
Table dimensions (W x D)	700 x 500 mm
Daylight	200–500 mm

Maisart





SG28S

Machine height	2745 mm

- User-friendly D-CUBES control system
- Wide range of technologies
- Heavy-duty machine construction

Maisart

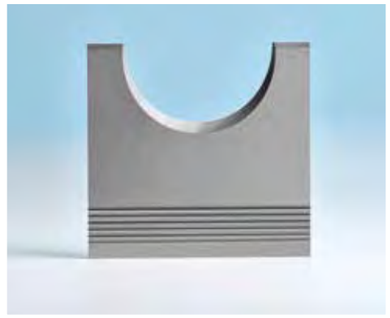
Riegger Diamantwerkzeuge GmbH

More cost-effective with a sharper profile.

Wire-cut grinding wheels are sharper, achieve higher productivity and, thanks to their long service life, are much more cost-effective.

Riegger Diamantwerkzeuge GmbH in Affalterbach develops and produces customised profiled grinding wheels whose properties are precisely tailored to the requirements of grinding firms. The specialists there have also been using an MV1200R wire EDM machine with a rotary spindle for this purpose for the last five years.

Individually profiled and precisely matched.



Precisely ground with eroded grinding wheels

Superficially, they all look the same. Whether a grinding wheel has been wire-eroded or conventionally dressed is impossible to tell with the naked eye. However, there are considerable differences, as Markus Steinhilb, application engineer at Riegger Diamantwerkzeuge in Affalterbach, explains: “You need a microscope to see the difference. But it is in the grinding process itself that the special properties of wire-eroded grinding wheels really reveal themselves.”

Riegger Diamantwerkzeuge, now in its third generation, has been specialising in developing and producing diamond and CBN grinding wheels since 1967. In doing so, the experts concentrate on grinding wheels that are precisely adapted to the respective requirements. This applies not only to the geometries but also to the abrasives and their properties. So as to be aware of and control all the factors itself, the manufacturer in Affalterbach has extensive vertical integration, extending from powder technology and pressing to conditioning and profiling. Tool grinders in particular as well as manufacturers in medical technology, tool and mould making, and the automotive industry draw on the know-how of the specialists in Affalterbach.

Comprehensive expertise

Thanks to the 55 years of the company’s development, the specialists have acquired detailed knowledge of abrasives. From this, they develop the grinding wheels best-suited to specific grinding operations. This enables them to match the abrasives precisely to different requirements. For example, they produce grinding wheels that process such exotic materials as nickel alloys with high productivity. They also implement optimised grinding wheels and processes for the cost-effective grinding of components to the highest surface quality in large series – in the automotive industry, for example. From the now huge range of abrasives and bonds, the developers in Affalterbach select the optimum combination in each case and use it to fabricate customised grinding wheels. This can even involve special abrasives with a grain size of only about 15 µm, which are bonded with either ceramic, metal, metal-hybrid or synthetic resins.

55 years of tradition

Riegger Diamantwerkeuge GmbH was founded by Wolfgang Riegger in Bittenfeld in 1967. The family-run company in its third generation develops and produces customised diamond and CBN grinding wheels as well as diamond dressing tools.

At Riegger, over

230,000

possible combinations are possible for a grinding wheel

Multi-loaded stacks of grinding wheels are automatically dressed and sharpened in a single process.

*Some production companies achieve **up to five times** the tool life with grinding wheels profiled and conditioned by wire erosion. Which means they can operate much more cost-effectively, of course.*

Markus Steinhilb, applications engineer at Riegger Diamantwerkzeuge

The MV1200R workspace is readily accessible from all sides for ease of set-up.

Demand for the tiniest geometries

Grinding companies have been increasingly demanding specially profiled grinding wheels for some years now, says application engineer Fritz Lenz. “These can be tool grinders or manufacturers in medical technology,” he adds. “In these industries, there is growing demand for the grinding of highly complex and often tiny geometries. This can only be achieved by plunge-cut grinding, a process calling for specifically profiled and carefully conditioned grinding wheels. With conventional diamond rollers and whetstones, it is no longer possible to dress the required grinding wheel geometries.” The topic of erosive dressing was presented at various conferences and seminars in 2016. Internal research conducted into the profiling of grinding wheels on wire EDM machines prompted Riegger’s decision in 2017 to invest in an already proven MV1200R wire EDM and to equip it with a rotary spindle. “We are convinced of the necessity to keep abreast of innovative technologies so we can stay competitive in the long run. When making this investment, we initially aimed to determine the parameters and the potential of the special wire erosion process for profiling and dressing grinding wheels ourselves,” Steinhilb reports.

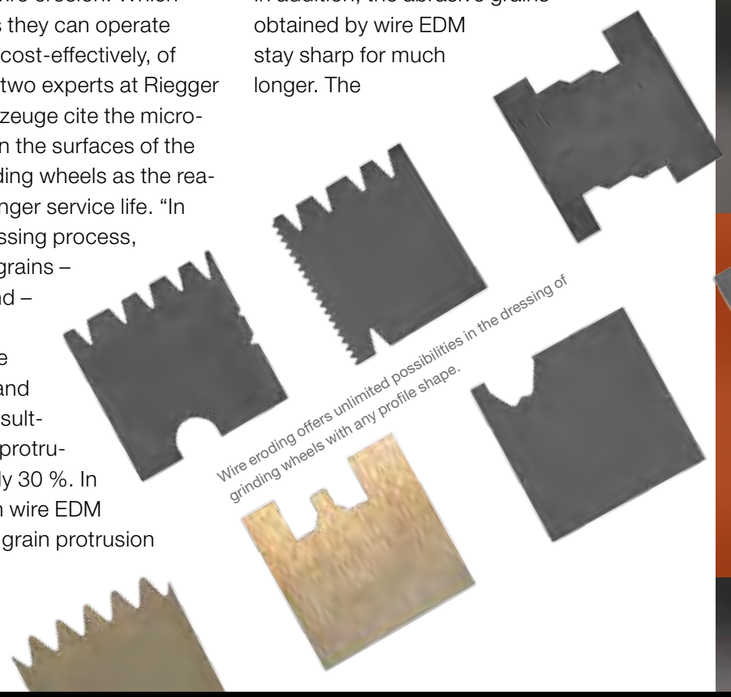
The specialists at Riegger individually profile standard grinding wheels with diamond or CBN as a solid basis.

Economic benefits

From the initial trials, the special benefits of wire EDM very soon became apparent. Lenz explains: “The fact that tiny profile geometries can be wire-eroded trouble-free and reliably has proven to be a great advantage. This is not the case with whetstones and diamond rollers. Dimensional

The programmed contour is reproduced exactly on the grinding wheel.

inaccuracies and tolerance deviations cannot be avoided in some cases, so the repeatability of a series process cannot be guaranteed. In this respect, wire EDM has unique benefits.” On top of this, grinding wheels conditioned by wire erosion have another outstanding characteristic, as they achieve a much longer service life than grinding wheels dressed in the usual way. Steinhilb confirms: “Some production companies achieve up to five times the tool life with grinding wheels profiled and conditioned by wire erosion. Which means they can operate much more cost-effectively, of course.” The two experts at Riegger Diamantwerkzeuge cite the micro-geometries on the surfaces of the dressed grinding wheels as the reason for the longer service life. “In the usual dressing process, the abrasive grains – CBN, diamond – are partially torn out of the bond matrix and smoothed, resulting in a grain protrusion of roughly 30 %. In contrast, with wire EDM we achieve a grain protrusion of well over 50 % and the grains stay sharp,” Steinhilb explains. This means that the grinding wheels have a more aggressive action, so more material can be removed within the same machining time. Depending on the process – roughing or finishing – this helps manufacturers improve their productivity. In addition, the abrasive grains obtained by wire EDM stay sharp for much longer. The “open” structures on the surface of the grinding wheels discharge grinding dust and particles highly effectively and do not become clogged. That is why wire-cut grinding wheels achieve a significantly longer service life.



Wire eroding offers unlimited possibilities in the dressing of grinding wheels with any profile shape.

Developing and optimising the technology

Thanks to the wealth of acquired practical experience, the specialists at Riegger Diamantwerkzeuge now know the optimum parameters for the wire erosion of different grinding wheels. From this they have developed a special service for customers.

“We are now largely involved in the development of grinding processes. In pilot projects, we create the grinding wheels optimally designed for a specific application and manufacturer and produce the first prototypes. Together with our customers, we continue to optimise the machining strategy and grinding wheels. If the latter prove successful in ongoing production, we provide the parameters for wire EDM and supply the required grinding wheels. Our customers invest in a wire EDM machine – ideally an MV from Mitsubishi Electric – and condition their grinding wheels themselves for ongoing production,” Steinhilb explains. Riegger Diamantwerkzeuge has thus evolved from a supplier of grinding wheels to a technology partner for grinding processes and the wire erosion of grinding wheels that is now also offering its customers EDM dressing as a service.

Riegger Diamantwerkzeuge GmbH

Founding year
1967

Managers
Michael Riegger and Constantin Riegger

Employees
60

Core business
Technical support for the optimisation of grinding processes with diamond and CBN tools, based on the development and production of customised diamond and CBN grinding wheels and diamond dressing tools

Contact
Daimlerstrasse 7-9
71563 Affalterbach
Germany

Tel. +49 (0)7144 30 60

info@riegger-diamant.de
www.riegger-diamant.de

Special benefits of wire EDM technology.

Riegger Diamantwerkzeuge

PTM Präzisionsteile GmbH Meiningen

Turning, milling – and now eroding as well.

Extending the range of processes opens up new growth opportunities for machining specialists PTM.

“How can we help our customers develop further and ultimately develop ourselves?” This question has been the prime motivation of PTM Präzisionsteile GmbH Meiningen for a long time – and ultimately resulted in the decision to add an MV2400R Connect wire-cut EDM machine and a start 43Ci EDM drilling machine to the company’s machinery.

Extension of the machine park.

“We started out purely as a machining company,” says Managing Director Thomas Wald, outlining the beginnings of PTM Präzisionsteile GmbH Meiningen. Today, the focus is still on complex and challenging turned and milled parts, which the jobshop produces to customer drawings. Founded in 1994 by former employees of the Robotron company, PTM was soon able to attract clients from the medical technology, laser and instrumentation sectors. “For these customers, it made sense to expand our range of processes,” says Wald – always keeping the question quoted at the beginning in mind. Thus, the firm’s equipment consisting of lathes and milling machines was extended to include an electroplating plant for anodising aluminium. In the following years, this was supplemented by various services such as component assembly, precision cleaning and the laser marking of components. “This way we are able to efficiently combine various fabrication processes and services, thus setting ourselves apart from the classic providers of turning and milling services. Most of all, customers appreciate the in-house surface treatment because this ensures rapid throughput and high quality,” Wald stresses.

Colour spectrum of the anodising plant

Extra services bolster core activities

Managing Director Wald always sees the extra services as a means of strengthening the core activities of turning and milling. Against this background, PTM initiated an extensive investment package in 2019 in order to increase production space by a further 600-plus square metres and expand the machine park. Wald then contacted his customers again: “I wanted to know what they were still missing in our portfolio, and what would benefit them and move us forward as a company.” It soon transpired that many customers saw EDM as an exciting addition. So Wald decided to supplement his machine park with an MV2400R Connect wire-cut EDM machine along with the start 43Ci EDM drilling system from Mitsubishi Electric.

Simple operation makes getting started easy

“I knew the Mitsubishi EDM machines from my previous employer,” explains Eric Hommel, assistant to the production manager. He was impressed by how easy commissioning was: “The machine arrived, was set up – and started running.” The support provided by the sales

PTM in figures

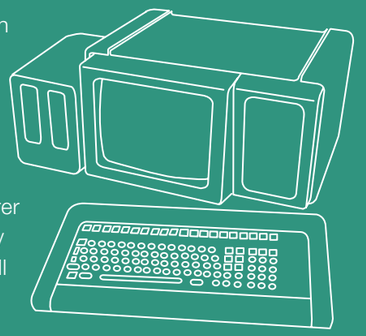
110
employees

4,500 m²
production space

200,000
turning, milling and EDM machine hours each year
in three daily shifts

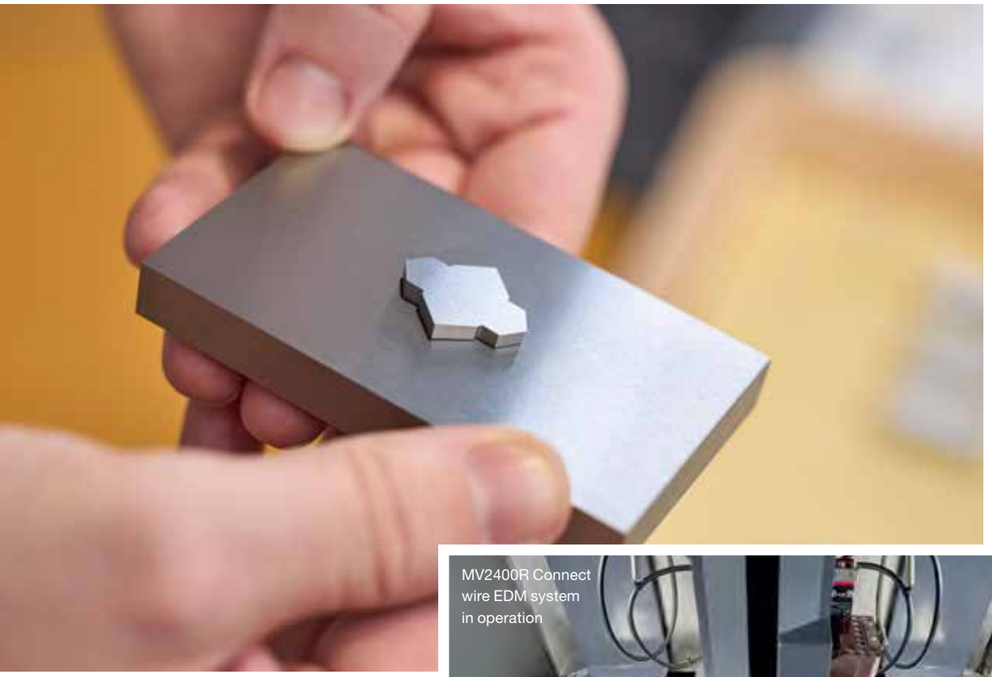
1,000,000
parts produced per year

Small computers from Meiningen

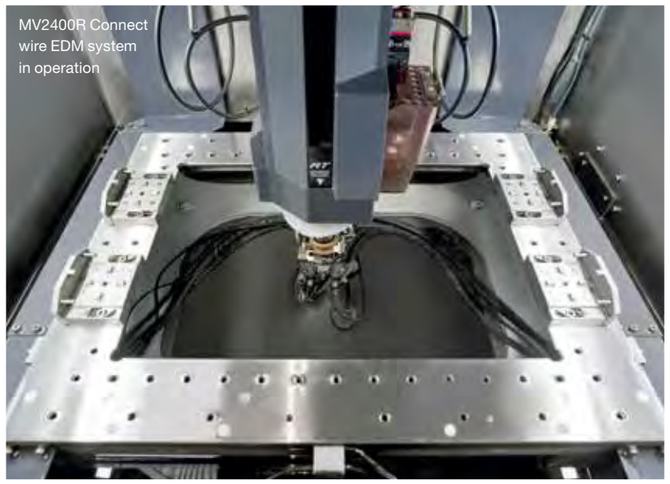


PTM’s roots lie in VEB Robotron-Elektronik. Founded in 1967, the combine was the only manufacturer in East Germany to produce small electronic computers at its Meiningen plant from 1970 onwards, and later also the first 5.25-inch hard disk storage units manufactured in East Germany to international standards. By the end of the 1980s, the factory had up to 1,400 employees.

After the collapse of the Eastern Bloc, Robotron Meiningen GmbH, which emerged from the combine, was in fact the only manufacturer of photomask substrates (mask blanks) for semiconductor production in Europe. After various takeovers, changes in the product portfolio and a necessary reduction in the workforce, Robotron went into liquidation at the end of the 1990s. However, former senior employees took over parts of the business in a number of new companies and spin-offs, one of them being PTM Präzisionsteile GmbH Meiningen.



Precisely matching contours – thanks to EDM technology



MV2400R Connect wire EDM system in operation

representative on site and by the training and technology centre during installation and later operation was also impressive. Wald trusted in Hommel's positive experience and opted to purchase the machines directly from Mitsubishi Electric.

Wire EDM has thus also been part of PTM's service portfolio since 2021. The machining specialists had no difficulty getting used to operating the system. "The bottom line is that it's the same as a milling machine – I've got X, Y and Z axes, and I've got probing cycles," says Hommel. "If you've learned to mill, you can operate the EDM machine just as well." The dialogue guidance of the MV2400R Connect in particular gives operators outstanding support, Hommel points out. "This is particularly helpful during set-up. But the maintenance menu is also neatly laid out and helps us to get the machines quickly back into operation."

Wire EDM as an important addition

Today, wire erosion has developed into an important addition to PTM's range of processes. Customers from the optomechanics and linear drive sectors in particular often have components eroded. As an example, Wald shows us a tiny component that PTM machines for the firm Physik Instrumente. How precise the radii and cut-outs in the component have to be becomes clear when you consider their use, because they are installed in piezo positioning stages. These are used with sub-nanometre resolution and extremely high guidance accuracy in metrology, interferometry and for inspection systems in semiconductor production.

Advantages over milling

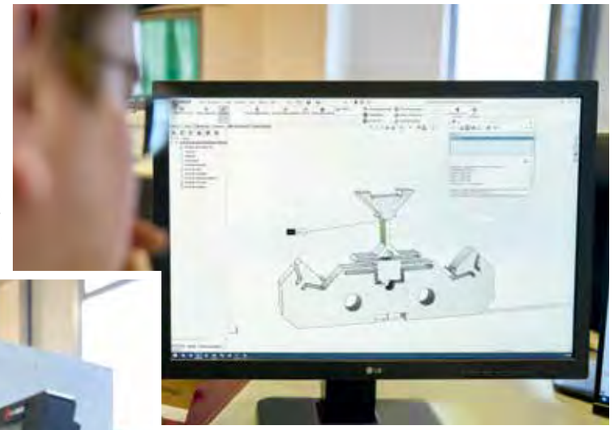
"The part for Physik Instrumente is made of titanium, but

Wire EDM as an important addition to the portfolio.

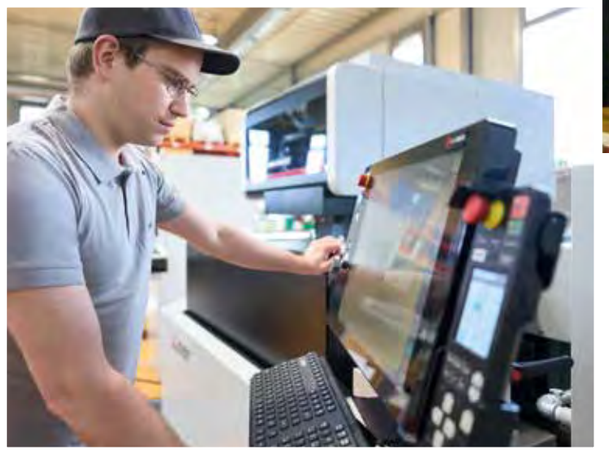
*The **MV2400R Connect always finds** the **0.3 millimetre** starting holes that we normally work with. Because it operates with such precision, we can rely on it running for long periods unmanned.*

Eric Hommel, assistant to production management at PTM Präzisionsteile

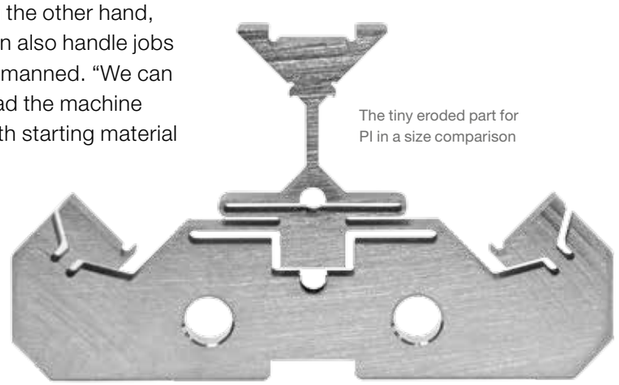
Automatic threading, an outstanding feature.



CAD drawing of the part eroded for the customer Physik Instrumente (PI)



most of the components we erode are of aluminium or stainless steel," says Hommel. Currently, PTM is also conducting trials with copper components, which have so far been machined on milling machines. "But during milling, a lot of force and thus heat is applied to the components, which deform accordingly and therefore need subsequent heat treatment. This is a problem I don't have with EDM." Another point in favour of EDM is the possibility of (partial) automation that comes with it. "Of course, machining with a milling machine is faster. But an operator always has to be at the machine." The MV2400R Connect, on the other hand, can also handle jobs unmanned. "We can load the machine with starting material on the Friday and then it machines the desired parts unsupervised by the following Monday morning," Hommel explains.



The tiny eroded part for PI in a size comparison

Threading not an issue

He's impressed most of all by the automatic threader. "The MV2400R Connect always finds the 0.3 millimetre starting holes that we normally work with. Because it operates with such precision, we can rely on it running for long periods unmanned." In addition, PTM makes extensive use of the job planner in order to manage several machining programs for different parts and to process them according to the selected priority. "So if I want to manufacture different parts, I don't have to write one big program, but can simply enter the programs for the individual parts into the job planner – that's much more effective." The zero-point clamping system that PTM uses also

Managing Director Thomas Wald is delighted with the efficiency of his MV2400R Connect.

yields additional efficiency. “As a result, the changeover from the EDM drilling machine to the MV2400R Connect takes just an estimated 30 seconds,” Hommel adds.

EDM drilling machine saves components

PTM uses the start43C EDM drilling machine for almost every part selected for erosion. But not only there, says Hommel with a smile: “If a tap breaks off or gets stuck on our milling machines, we extract it with the EDM drilling machine and thus save having to discard the finished part. Even with shrink-fit chucks where we can’t get the tool out, we can use the start 43Ci to erode the tool out and thus save the fixture. This has already saved us many thousands of euros.”

A bonus for business economics

But that is only one small reason why Wald is also enthusiastic about the EDM machine from a business perspective: “It’s cheaper than a milling machine or lathe, I don’t have to invest in a variety of tools, I don’t have the hassle of tool breakage and if I can machine a part on the EDM system instead of a milling machine, I save on such additional operations as heat treatment.” The MV2400R Connect has also proven to be economical

with energy, as power consumption is lower than with milling machines, says Wald.

“This is in line with the other economic benefits that come with the machine,” Wald continues. “From an entrepreneurial point of view, I can imagine EDM eventually becoming as important to us as milling, turning and anodising.” He already has an idea of what this could look like.

The measuring room moved into the hall extension completed in May 2023. “That gives free space for EDM,” says Wald. Three to four machines could be located there. However, this is a plan “spread over several years”, Wald adds. “But if our existing and new customers discover EDM for themselves – especially in combination with our turning and milling services – we will certainly generate good growth.”

PTM Präzisionsteile GmbH Meiningen

Founding year
1994

Managing Director
Thomas Wald

Employees
110

Core business
Contract and subcontract production of high-quality milled/turned and eroded parts as well as surface treatment in small and medium-sized batches

Contact
An der Winde 18/20
98617 Meiningen
Germany

Tel: +49 (0)3693 4458-0
Fax: +49 (0)3693 4458-10

ptm@ptm-meiningen.de
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Highly complex miniatures
from the 3D printer.

3D printing has become a proven technology in many sectors. With the micro laser sintering process, additive manufacturing is now conquering entirely new fields of application. Complex products with optimised geometries ranging from a few millimetres to a few centimetres are created on 3D MicroPrint machines. To cut these high-precision workpieces from the platform and rework them, the Chemnitz-based company resorts to EDM equipment from Mitsubishi Electric.

New applications for the micro 3D printer.

3D MicroPrint GmbH came into being in 2013 as a result of cooperation between EOS GmbH and 3D-Micromac AG. “Starting in 2006, we developed our micro laser sintering technology to series maturity and then launched the first 3D printer on the market in 2013,” Managing Director Knut Hentschel explains. “Our team was convinced of the massive potential of this technology from the very outset – and developments over the last ten years have fully vindicated us.”

Additive manufacturing and micro-machining

Micro laser sintering is the first technology to combine the advantages of additive manufacturing with those of micro-machining. In metal printing, macro-additive processes operate with layer thicknesses of up to 150 micrometres and grain sizes of up to 80 micrometres. This means that these processes can print complex workpieces within tolerances of a few tenths of a millimetre.

“If narrow tolerances and high precision are required, conventional printing processes are pushed to their limits. This is where MicroPrint technology comes into its own,” says Hentschel. Micro laser sintering allows high-precision workpieces to be printed with tolerances in the range of a hundredth of a millimetre and with high surface quality.

Powder bed process

“Our printers are micro laser sintering machines on the principle of the powder bed process,” Hentschel explains. With this additive manufacturing method, the powder is melted with a laser spot of less than 30 micrometres. Three-dimensional micro-objects are built up with layer thicknesses of under ten micrometres. For this, the company uses powders with grain sizes of around five micrometres. For very fine structures, the Chemnitz company also processes grain sizes of less than one micrometre. “The finer the powder, the more precisely the contours can be formed,” says Hentschel. “Smaller grain sizes and thinner layers also mean longer run times, but this also means the process is incredibly precise when it comes to forming contours and geometries.” This is what distinguishes 3D MicroPrint’s machines from standard printers. And with this technology, the company has succeeded in opening up new opportunities for medical technology, electronics, watch making and jewellery production.

If narrow tolerances and high precision are required, conventional printing processes are pushed to their limits. This is where MicroPrint technology comes into its own.

Knut Hentschel, Managing Director of 3D MicroPrint

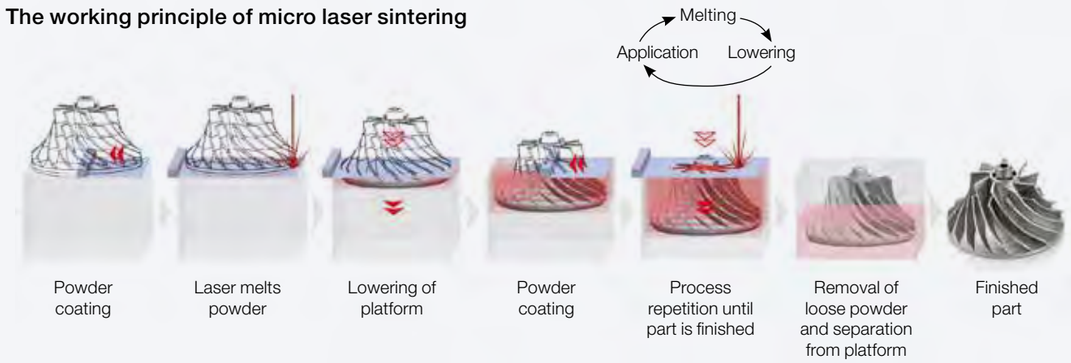
Three mainstays

3D MicroPrint concentrates on three business areas. Service business takes centre stage. The company offers its customers the complete production-to-order of series parts and one-off prototypes as well as comprehensive series production. This includes design and material development as well as the preparation of feasibility studies and functional models.

The development and distribution of its own laboratory and production equipment is another focus of 3D MicroPrint. If customers in medical technology or computer systems, for example, want to protect their own development work, the company supports them in technology and process

Powder grain sizes from
1 to **5 micrometres**

The working principle of micro laser sintering



3D MicroPrint's quality has been demonstrated in the aerospace industry.

development.
This enables customers to produce their components on their own micro laser sintering systems.

Pure gold

It is possible to print gold. And the specialists at MicroPrint don't need an alchemist to do it. All they need is a 3D printer stocked with gold powder. Jewellery designers have discovered this technology for their work, as it allows them to create out-of-the-ordinary pieces of jewellery whose shapes and geometries are difficult to achieve using classical methods. In addition to gold, the order list of the jewellery segment also includes a number of other materials such as tungsten. Using this versatile metal, the Chemnitz-based company produces, among other things, pendulums for automatic wristwatches.

Micro-components for aerospace

But it is not only designers who appreciate the merits of MicroPrint technology, for engineers in the aerospace industry are now 3D-printing micro-nozzles. Micro-nozzles are the preferred solution for measuring the tiniest fluid flows. "Among other things, we develop and build the tiny measuring nozzles used in the aerospace industry," Hentschel explains. Besides this, the company also manufactures microwave couplers and high-frequency antennas as well as micro-engines for steering small satellites. Measuring only two to three centimetres, these thrusters are highly efficient and able to keep small satellites on course.

Extraordinary pieces of jewellery can be produced using 3D printing.

From copper to stainless steel

Just as varied as the fields of application are the materials used for printing. "For the manufacture of our series products, we process two medical stainless steels and, for implants, different classes of titanium," says Hentschel. For the high-temperature range, 3D MicroPrint has materials such as Inconel in its portfolio. To obtain the desired properties, the choice of printing material is crucial, so the company is heavily involved in materials development. "In our laboratory, we can develop customised alloys tailored to customers' needs," Hentschel continues. "We can define all the technical parameters of a formulation and do all the necessary test runs."

New square platforms increase capacity by around 20 per cent.

Releasing printed workpieces from the platform

The company's first generation of machines still operated with round, 60 millimetre platforms. With the latest generation of machines, 3D MicroPrint was able to expand the print area and hence capacity by a good 20 per cent by using square platforms. "And this is where Mitsubishi comes in," says Hentschel. "In order to release the printed workpieces from the platform, precise, thin cuts are required."

In the early years, the company got an external service provider to cut the workpieces from the platform. "Our service provider did this with a Mitsubishi machine," says Hentschel. "The quality and the price-performance ratio were right. Outsourcing has a number of advantages, but it reaches its limits when the order exceeds a certain volume."

Jörg Nöbel always has his eye on the machine.

*In addition to the separation cuts, we can also use **the MP** to rework **very delicate workpieces to perfection.***

Knut Hentschel, Managing Director of 3D MicroPrint

Reworking workpieces

On the basis of their positive experience, it was obvious for the decision-makers at 3D MicroPrint in their search for the right EDM technology to put their trust in a Mitsubishi Electric machine. "We have been using our MP1200 Connect since 2018," says a satisfied Hentschel. "In addition to the separation cuts, we can also use the MP to rework very delicate workpieces to perfection." One example of this is the grippers of minimally invasive instruments. The company prints these instruments in a single piece and the teeth are then subsequently separated by wire-cutting. "This way we adapt the jaw structure to the customer's individual requirements," says Hentschel. "With this mixed machining of printed mechanism and eroded jaw shape, we utilise our machines to the maximum."

Medical grippers for endoscopic procedures

3D MicroPrint GmbH

Founding year
The firm came into being in 2013 as a result of cooperation between EOS GmbH and 3D-Micromac AG.

Managers
Dipl.-Ing. Joachim Göbner
Dipl.-Bw. Knut Hentschel

Core business
Production of micro metal parts by micro laser sintering and sale of the associated machines

Contact
Technologie-Campus 1
09126 Chemnitz
Germany

Tel: +49 (0)371 5347 837
Fax: +49 (0)371 5347 836

www. 3dmicroprint.com
info@3dmicroprint.com

Human-robot match-making.

Clear the stage for speed dating with fascinating robots and androids, our delightful friends and intelligent helpers in everyday life!

In Japan, day after day, service and assistance robots make up the task force that meets human needs and overcomes bottlenecks. Their purpose is to give ageing society professional and personal assistance. ERICA helps at the reception desk, while Lovot combats loneliness. Increasingly human-looking robots are also welcome elsewhere.

The bakery employees have a lie-in while their collaborative robot or “cobot” workmates prepare baking trays for the oven and stock the appetising displays in the shop. A cobot, a baked goods presenter that keeps an eye on things with artificial intelligence, and a network-compatible oven that automatically loads and unloads, collectively ensure in the early hours that freshly baked products reach the breakfast table on time. Together they comprise the “Bakisto” team system consisting of a Japanese robot, the Bavarian-Swabian based BakeOff i and the Württemberg-Swabian Dibas blue2 with TrayMotion. Their human colleagues arrive later. And therefore with all the more enthusiasm. This is no longer an isolated case, for trade and commerce are making use of cobots because they are adaptable, do not require protective fences and are easy to program.

From a Japanese point of view, robots have a soul – like everything in nature. Why should anything around us be lifeless, or even dead, if it is even capable of moving us? That sounds appealing, especially if robots are expected to or have to replace humans. Robots-as-a-service take on important roles not only in manga comics when demographic change and the lack of skilled labour encourage the shedding of uncomfortable routines. “Would you like a coffee?” – The words of Pepper, the robot companion Pepper from Softbank, or rather from Aldebaran and the United Robotics Group, sound tempting as you walk through the IFA Berlin trade fair. The bug-eyed communications professional charmingly entices weary trade fair visitors to a smart technology stand. As is so often the case, the people he addresses cannot resist the friendly mechanical being, especially as he eagerly supplies information and gives directions. Pepper, this archetype of a humanoid service robot consisting of arms, a head, a touch screen and a mobile undercarriage, is also popular as a companion in retirement homes. The social robot reacts to emotions and gives attention. And he provides interactive entertainment with games and fitness instructions.

Yet there’s room for improvement. Pepper can’t pour out coffee. Nor play chess or empty the dishwasher, skills that the next generation of assistance robots will gradually acquire

Pepper, the humanoid robot, behaves impeccably in company as well as in the shop, listening, talking and even dancing.

Service robotics

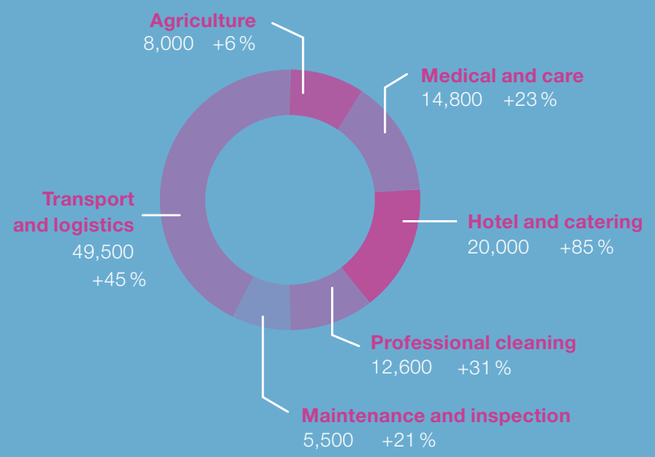
Service robot sales rose by **37 %** worldwide in 2021

19,121,000

robots were sold in 2021.
Of these, 19,000,000 were robots for domestic use and 121,000 were professional service robots.

Top 6 applications

for professional service robots
(units sold in 2021)



Top 3 producing nations

Most suppliers of service robots are domiciled in the USA.

USA	China	Germany
223	103	91
Of these, 29 start-ups	Of these, 9 start-ups	Of these, 12 start-ups

Source: “World Robotics 2022 – Service Robots”, produced by VDMA Services GmbH, Lyoner Str. 18, 60528 Frankfurt, Germany

for everyday life. Necessary for this are such technological advances as advanced language models, artificial intelligence (AI), sensitive sensor technology, gripper arms with multi-functional hands, and all-round camera systems. Best of all so-called “multimodally interleaved systems”, for which autonomous, reflexive behaviour as well as transfer services are commonplace in digital and changing environments.

This robot takes your dishes, but not tips

Robots also make work and life easier outside of factories. As waiters in restaurants, for example, mobile service and transport robots provide assistance to humans. Servi is a courteous serving tray on wheels, the outcome of cooperation between the Softbank Robotics Group and Bear Robotics. The indoor robot serves customers, patrols and collects dishes. Outside the door in the Meguro district, the mini-mobile from ZMP, a Tokyo pioneer in robot design, is already in operation and, as a delivery robot, is making its contribution to the digital city.

A pleasant smile, a friendly question as to whether the guest has had a good trip or a pleasant day, and even in the appropriate language: this kind of personal service is to be provided by android robots in so-called Henn-na Hotels in Japan. Receptionists, for example, who are modelled on humans, with silicone skin and a flutter of the eyelashes to simulate vitality. The Japanese “Henn na” means “forward-facing” or “changing” in English. One such highly automated overnight resort in Nagasaki has even made it into the Guinness Book of Records. At CES,

Pollen Robotics presented their French robot Reachy, a creepily friendly open-source type with AI in its head and wheels on its legs that is capable of handing out keys at a hotel reception, for example. With their grasping hands, such sensitive companions are coming into closer contact with people in everyday life and are becoming useful in many areas.

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“You certainly have warm hands!” Anyone who strokes the purring BellaBot high-tech serving cat not only gets their order, but also a compliment.

In the 1980s, Honda built the humanoid robot Asimo, a favourite of the Japanese and the country’s visitors, that even shook hands with former German Chancellor Angela Merkel. Since then, Asimo hasn’t just got older, but has continued to evolve. Meanwhile, the veteran robot can even play football, although it is radio-controlled. Differences even blur when choosing between partners from the machine room and the world’s sporting elite. Fans call tennis star Rafael Nadal a machine. The Korean training robot iVolve Pro whizzes across the court with similar precision. Equipped with artificial intelligence and computer vision, the ball machine from Curinginnos replaces a human opponent. The winner of the CES 2023 hits balls in rapid succession here, there and everywhere.

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Send your double to school

The work-life balance is becoming increasingly important. So are pragmatism, efficiency and smart solutions for problematical situations. Sleeping longer instead of setting off early and travelling long distances to an appointment is now possible. With telepresence robots, such as those from Double Robotics, anyone can virtually attend real meetings by switching to their stand-in via PC or smartphone. The seats of sick or immunocompromised pupils, students and lecturers are occupied by doubles with display heads equipped with loudspeakers, microphones and cameras. For logistics and warehouse work, the intelligent double travels through warehouses and offices instead of its human counterpart and checks the situation. In hospitals and old people’s homes, too, telerobots pop in to take the strain off human staff or enable otherwise prohibited on-site visits by connecting friends and relatives live on their displays.

Very special remote workers are the brainchild a creative research lab in Japan. By this we mean telephony that has become robotic, and waxwork-like androids designed to blur the boundaries between humans and machines. As “telenoids” created by the robotics engineer Hiroshi Ishiguro at Osaka University, these surrogates even record human movements and facial expressions live via a computer program, transmitting the human’s words via voice software. In the case of their creator, the humanoid android dummy looks roughly like its human original. Telenoids may even wear the human’s hair. A human being much in demand cannot replicate himself with such telepresence robots, because he controls them from a distance and they only embody him. In the variant as series-produced soft, hairless beings for ordinary folk, telenoids are not attempted clones in robot form, but simply a little humanised.

In Europe, people prefer robots that don’t resemble them too much but are still intelligent.

Android receptionist at Henn-na-Hotels in Ginza

© Ned Snowman – stock.adobe.com

And then there is the the Geminoid F, to enable it to act autonomously, cognitive scientists want to teach it needs – like smiling, for example, in order to be loved. The humanoid android ERICA is already autonomous within her reference space. The young woman works at reception desks, hotels, retirement homes or even at a research lab in Japan. In the science fiction film b, she landed a leading role in Hollywood. Humanoid androids like ERICA score points with human looks, reactions, shaking their heads or thoughtful responses to key words in conversation. This is initially enough to establish a kind of personal relationship between a robot and a human being.

Strong care workers and therapeutic animals

Robots can also be therapeutically effective. “Paro”, a baby harp seal, was designed in a Japanese developer’s workshop in the previous millennium. This personal medical robot has been on sale since 2004. The cute robot seal’s road to success has also taken it to German institutions. The furry animal that can be stroked and cuddled is said to have a positive

20,000

robots were sold in the hotel and restaurant sector in 2021.

“Let me carry that!” At theme parks, digitally equipped dinosaurs lend a hand and take the strain off hotel staff.

© Ned Snowman – stock.adobe.com

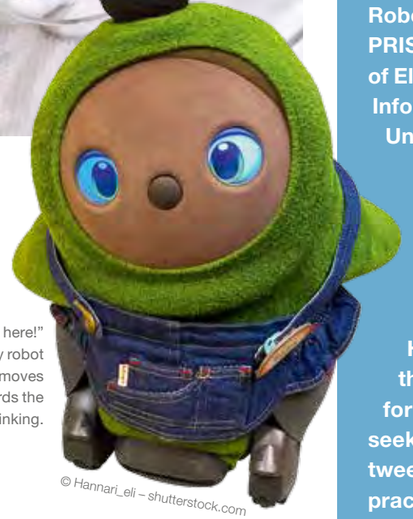
effect on dementia patients with its life-like responses. Though resembling a sloth, Lovot follows his humans around, has big saucer eyes, a heart choc-a-bloc with AI and a cuddly suit. He is another brainchild of Kaname Hayashi, Pepper's originator, who is now the head of the Japanese start-up Groove X.

© Beru – shutterstock.com

"Give me a stroke!" The harp seal cub Paro responds to touch.

with its two hands. One hand disinfects and delivers, while the second arm opens the door. Technologies such as navigation, deep learning, AI and vision help him do this.

In some places, the future has already arrived for the humanoid Aeo, a robotic assistant designed to make people happier and more productive in open, human environments. Aeolus Robotics aims to bring its intelligent robotic services from Japan to Europe and the US. This means that robots are already available for "pickup-navigate-deliver" or "monitor-decide-warn" applications. For example, in care homes for the elderly, in hotels, at airports, in restaurants and on security missions. Aeo is firstly strong enough to lift heavy loads, but also careful enough to delicately handle medicines or electronics



"Come here!" The cuddly robot Lovot moves towards the speaker, blinking.

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Interview

Making robots as intuitive as smartphones

Three questions to Professor Bruno Siciliano

Professor Dr Bruno Siciliano, born in 1959, is Professor of Robotics and Coordinator of the PRISMA Lab at the Department of Electrical Engineering and Information Technology of the University of Naples Federico II. His research fields include force feedback control and visual robot control, cooperation between humans and robots, and flight and service robotics. He was director of ICAROS, the Interdepartmental Centre for Robotic Surgery, which seeks to create synergies between clinical and surgical practice and research into new technologies for computer- and robot-assisted surgery.

Professor Siciliano, five years ago at Automatica in Munich we talked about the trend towards mobile, personal robots. In the meantime, we are now seeing the first robots that can assist in the home or in care and that ideally also respond to voice instructions. Are we nearing an age when personal robots will be as important as smartphones as human companions?
Professor Bruno Siciliano: In December 2006, Bill Gates wrote in Scientific American that we are at the "dawn of the age of robots" and that within about two decades we will have "a robot in every home". We are fast approaching this scenario. In my opinion, the big challenge is to make robots as intuitive as possible so that they can be used by anyone, like commercial plug-and-play devices such as smartphones and tablet computers. Only then will we have personal robots as companions in our daily lives, at work, at home, at school, in hospitals, in agriculture and in virtually every human environment. Come that day, robots will live alongside humans and robotics will have become a pervasive and ubiquitous technology.

Will robots ever be able to care for the elderly or children?
Professor Bruno Siciliano: This is an important, ethical question. If you look at Japanese families, they have Pepper at home, a robot from the French company Aldebaran that was bought by the Japanese company Softbank. The robot is with their children and they can use it to keep an eye on them because it has a camera. Caregivers with limited cognitive or physical abilities might maltreat the children entrusted to their care. Babysitters might smoke or prepare food that is not fresh. If you have a machine that you trust, that you can rely on and that has programs designed by humans and has been programmed well, machines could certainly handle assistance tasks.

Are robots preferable to humans or animals in certain situations?
Professor Bruno Siciliano: In its interaction with autistic children, a robotic cuddly toy has proven to be much more dependable than a live animal. The therapist should program the robot to help the autistic child make progress – in the cognitive field, for example. You may one day come to the realisation that machine assistants are more reliable than human ones.

If you program your robot to be good to your children or to elderly people, it can help. I don't believe in a world where robots will replace us. But there are dangerous, boring and fatiguing jobs in factories, in the home and in hospitals that could be done by robots. Exhausted nurses may make mistakes when dispensing medication. Robots can check the dispensing of medicines and do everything very accurately.

BRAND Werkzeug- und Maschinenbau GmbH

Toolmaking in three shifts.

Problem-solving with challenging materials.

“Since our founding in 1992, we’ve shaped quite a lot tonnes of steel to the customers’ wishes,” says Dieter Brand, Manager of Brand Werkzeug- und Maschinenbau GmbH, describing his company’s activities. For over 30 years, the family business has been turning, milling, drilling, grinding, eroding and polishing a wide range of assembly components. In its range of advanced equipment, six Mitsubishi Electric machines – four for wire-cutting and two for die-sinking – deliver the best-possible EDM results.

Several tonnes of steel brought into shape.

Last year, Brand celebrated his company's 30th anniversary. Three years after the fall of the Berlin Wall, in 1992, Brand was invited to take over a small toolmaking company in Oederan, Saxony. An offer the trained toolmaker and mechanical engineer couldn't refuse. Only six years later, the firm ran out of space. "For the business to develop in line with my ideas," Brand explains, "the town-centre location was not ideal, so we decided to relocate to Oederan's new industrial estate. We moved into our new premises in 2002."

All technologies in-house

From the very beginning, Brand has attached importance to having all the required technologies in-house and thus under its own control. The business practises all relevant machining methods. "We've stuck to this principle right through to today," the entrepreneur proudly reports. Brand only outsources heat and surface treatment. Its activities also include its design engineering. The engineers develop all tools to customer order. "Of course, we are also happy when customers come to us with complete design documents," Brand states.

One of Brand's specialities is the machining of large moulds. With its machinery designed for the production of single parts, the company can handle moulds of 10 tonnes and measuring 3.2 by 1.60 metres. "Our customers come from right across the industry and appreciate our efficiency and reliability," Brand reveals. "We have made a name for ourselves as a problem-solver for challenging materials, which include iron-nickel alloys for complex moulds. This is where there's demand for our expertise and machining capability."

Toolmaking and stamping

In successful operation since 1992, the company has established itself in particular in the areas of stamping and progressive dies, hydroforming tools and injection moulds. Today, Brand has about 40 employees in toolmaking and 30 employees in a stamping shop on its payroll. Because OSUT – Oederaner Stanz- und Umformtechnik is also part of the company group. Progressive dies are highly efficient items of production equipment whose design and fabrication require extensive knowledge. "Our stamping shop also evolved from this production area," Brand explains. "By combining toolmaking and stamping, we have also become attractive to customers who need not only tools but also finished products." Thanks to its stamping shop, the company also has access to a test press and can thus test tools of several tonnes in-house.

The specialists also fabricate complicated individual, replacement or wear parts.

Customers from highly diverse fields

Hollow metal parts with complex external geometries and high strength can be produced using hydroforming. "80 per cent of our work with this process is for customers in the

Tools weighing up to
10 tonnes
and measuring up to
3.2 x 1.6 metres

High-productivity progressive dies require special expertise.

Brand has been making a name for itself with complex stamping and progressive dies since 1992.

automotive sector, for chassis parts and for the exhaust system. The remaining 20 per cent is accounted for by the electrical industry and other production sectors.” Road and rail vehicles need brakes and clutches. Brand manufactures pressing tools that get brake shoes and clutches into the right shape. “Our mouldmaking for brakes and clutches is pretty special and something that not many can do,” Brand explains proudly. “To release the brake and clutch shoes easily from the mould, special surfaces are important, so we chrome and polish them.” Such surfaces are useful for the production of brake and clutch linings. These linings of abrasive material are produced with exposure to pressure and heat. The materials tend to stick together. However, an acceptable service life can be achieved with chromed and highly treated surfaces.

Planters and flower pots

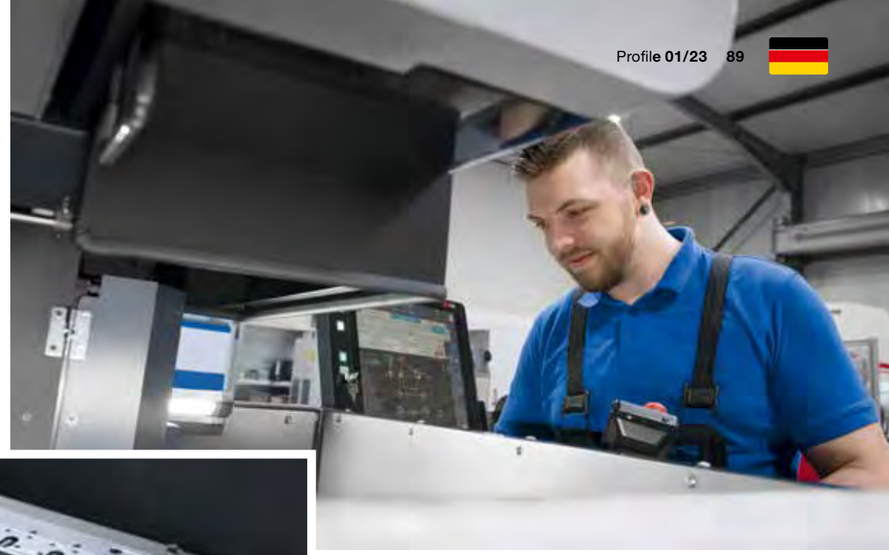
For many years, Brand has also been working for Scheurich GmbH & Co. KG in Kleinheubach/Main, a well-known maker of plastic planters and flower pots. “We’ve made a good 200 injection moulds for planters with diameters of 7 to 70 centimetres,” says a pleased Brand. “The market is very fast-moving and requires new designs every year”. The firm machines the planter moulds from start to finish. And sometimes the engineers are even allowed to tweak the design a little.

With Mitsubishi Electric for over 30 years

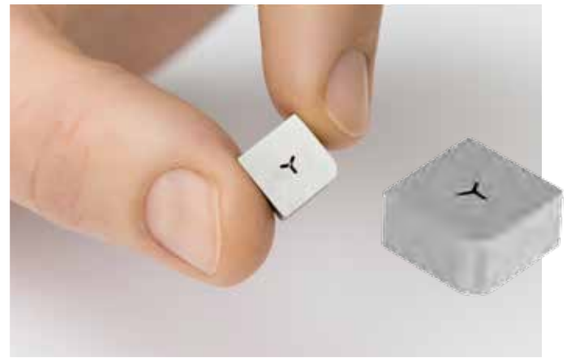
“I started out in a position of responsibility at a well-known toolmaker in the Rhineland in 1989. To increase capacity, one of my first tasks was to restructure the EDM equipment,” Brand recalls. “I looked at machines from the main manufacturers and compared their performance. We bought a Mitsubishi. It featured high productivity and fully met our requirement profile.” That was the beginning of longstanding cooperation.

Six Mitsubishi Electric machines achieve optimum erosion results at Brand.

When Brand took the step to start his own business in 1993, he was very familiar with Mitsubishi Electric’s technology and impressed by its performance. “When the time came for our own business to introduce EDM equipment, I was clear that I would stay with Mitsubishi. I knew the machines and knew that they were good, met our requirements completely and had good after-sales service.” Brand invested in two EDM machines straight away, and now there are six Mitsubishi Electric machines in Brand’s toolshop: four for wire-cutting and two for die-sinking.



Cutting punches for a 0.3 mm kerf are no problem on the Mitsubishi Electric EDM systems.



“After 30 years,” says Brand summing up his experience, “we can claim that we are still highly satisfied with our machines and the support and that we have found the right supplier in Mitsubishi.” Because machines also break down once in a while. And then it’s key that you can rely on the service to solve the problem as quickly as possible.

Around-the-clock operation calls for dependable machines

The company operates around the clock. Two shifts are staffed, while the night shift runs unmanned. “In our shift system, it is important that the machines work. So a good threading system is essential for us,” Brand explains. “We are always amazed at how quickly the

Production is geared to a tool size of 1000 x 1000 mm.

machine threads the wire, even with tiny kerf widths.” The Mitsubishi Electric system works swiftly and saves wire. The machine doesn’t take several attempts at threading. “It usually succeeds first time and the machine is up and running again after 30 seconds,” says Brand reporting from experience.

In the last few years, Brand has produced over 200 injection moulds for planters.

Brand Werkzeug- und Maschinenbau GmbH

Founding year
1992

Employees
40

Managers
Dieter Brand and Sirko Brand

Core business
Production of injection moulds, progressive dies, cutting and forming tools, hydroforming tools, friction lining press moulds, casting moulds, individual and spare parts

Contact
Ringstrasse 3
09569 Oederan
Germany

Tel: +49 (0)37292 39820
Fax: +49 (0)37292 39830

info@brand-werkzeugbau.de
www.brand-werkzeugbau.de

When the time came for our own business to introduce EDM equipment, I was clear that I would stay with Mitsubishi. I knew the machines and knew that they were good, met our requirements completely and had good after-sales service.

Dieter Brand, Manager of Brand Werkzeuge- und Maschinenbau

From brake discs to flower pots.

Horoscope

for hard-wired EDM experts.

Capricorn
22 December – 20 January

Mercury's unwavering influence will control your life over the next few weeks – unfortunately not quite as effectively as your EDM Dress. Nevertheless, you dress all your grinding wheels much more neatly than your competitors who, for their part, are struggling with the turbulence caused by Neptune's quadrants and low removal rates. This is your chance!

Aquarius
21 January – 19 February

Your taper angle is currently at full height. However, don't be distracted by confusing travel paths. Meanwhile, Saturn's moon Mimas is a source of great curves – both at work and in your private life. Make sure you get some exercise to evenly discharge your energy. In doing so, you will meet an important person who will give you new inspiration.

Pisces
20 February – 20 March

Beware of summer flu and watch your diet! Not everyone is as well taken care of as the SG-R die-sinking EDM machine with its fully automatic central lubrication. So don't risk a standstill and ensure a continuous supply of vitamin-rich fruit – entirely without grease nipples or cumbersome grease guns.

Aries
20 March – 20 April

As an Aries, you are passionate and ambitious. Jupiter intensifies these qualities still further. Just make sure you spread your fervour evenly. Otherwise you will have precisely eroded workpieces with a magnificently smooth surface finish, but your energy level will drop off once the job's done. Save some of your enthusiasm for your free time.

Taurus
21 April – 21 May

You feel like a workpiece that's been abandoned in your EDM system's water tank. It's about time you got out. Unlike EDMs, downtime is essential for humans. Go on holiday or take a weekend trip into the country. After that, you can return to your usual precision.

Gemini
22 May – 21 June

You avoid possible conflicts and stay clear of trouble. In doing so, you are almost as adept as an MV-R series machine at automatic wire threading. At the same time, you realise that this can't go on forever. The next time trouble's brewing, speak up! You might even cause a significant drop in friction.

Cancer
22 June – 22 July

Avoid unnecessary friction not only at work, but also at home. This will result in less wear and tear on the workpiece and in your family life. Actually, you are not such a grumpy person. If something does rub you up the wrong way, simply erode it properly and everything will run again smoothly, just like on your die-sinking EDM machine.

Leo
23 July – 23 August

Thanks to the current constellation in the heavens, you can't put a foot wrong. Whatever you tackle works flawlessly. Full of admiration, your workmates can't believe you don't have CNC control. Take advantage of this phase and finally do all the things piling up in your job planner for so long.

Virgo
24 August – 23 September

"Attack is the best form of defence" is your current motto when on course for a confrontation. With dielectric oil in your veins, strength in your muscles and plenty of heart, you achieve top performance where it counts. You can rely on your Mitsubishi Electric machines – their solid machine bodies are a match for any challenge.

Libra
24 September – 23 October

With Venus giving you a good boost, you're in top form and as efficient as an EDM-Dress 2400 with a V350 erosion generator. In a frenzy, you erode one grinding wheel after another and achieve unprecedented stock removal rates with them. However, save some of that productivity for your personal life as well.

Scorpio
24 October – 22 November

As an experienced EDM specialist, you're capable of operating your machine in your sleep and achieving outstanding results with every workpiece. In your private life you are plagued with worries and problems. But you don't really have any reason to. Life simply isn't as easy to control as an EDM system with smart user guidance. Just take it as it comes, and everything will be fine.

Sagittarius
23 November – 21 December

Sagittarians currently have a special talent for dealing with finances. In your hands, money becomes a renewable resource. As if by magic, money accumulates on your bank account, and your boss is delighted with your cost-consciousness. Keep it up, and your steep career curve will keep eroding at a positive angle.

It's written in the stars. And you can read it here …