

# INSIGHTS

EDITION **1** 2021

## MAXIMUM FLEXIBILITY.

The new RS 1 Robot System.

## ADDITIVE MACHINING – SUPERSONIC.

The new MPA 42 machining centre.

## STRAIGHT FROM THE SHOP FLOOR.

Three industry sector reports.



# Preface

Dear business partners and customers,  
dear members of staff,

April is already here and the Corona pandemic still dictates our daily life, both at home as well as in many business activities. We are still unable to make personal contact with you, our customers and other interested parties, at trade fairs and exhibitions. Our communication options remain restricted to virtual solutions. We gained much experience in this area during 2020, and we shall continue to develop these channels during 2021. Our traditional Open House that we already had to cancel in 2020 will still not be possible in its usual form this year. We are currently working on a hybrid concept and will be able to offer a combination of digital and personal visits to our company in June.

Hermle AG was able to conclude 2020 with a respectable result of €54 million profit from a turnover of €296 million and an order book worth €242 million. This means that our financial situation remains robust in 2021 and we are well set up to deal with future challenges.

As far as our products are concerned, we were able to present new solutions such as the RS 05 robot system and the HS flex heavy handling system. In this issue we shall be introducing our new and highly flexible RS 1 robot system. A new milestone in Hermle AG's automation offensive. The RS 1 robot system is based on our long-term experience in economically viable automation of our products. With its high degree of flexibility and compactness together with a range of technological features, it sets new standards in Hermle's steady journey towards machining centre automation. The Product Special on our website demonstrates its comprehensive potential, clearly and fully digitally.

Plan your smart production with us – and our high-efficiency machines, a large number of economically viable and flexible automation solutions and the corresponding digital components. We shall be glad to arrange a person-to-person meeting, either in our factory or on your premises. We look forward to seeing you.

Kind regards,



Franz-Xaver Bernhard  
Director of Sales, Research and Development

# RS 1

## Maximum flexibility.

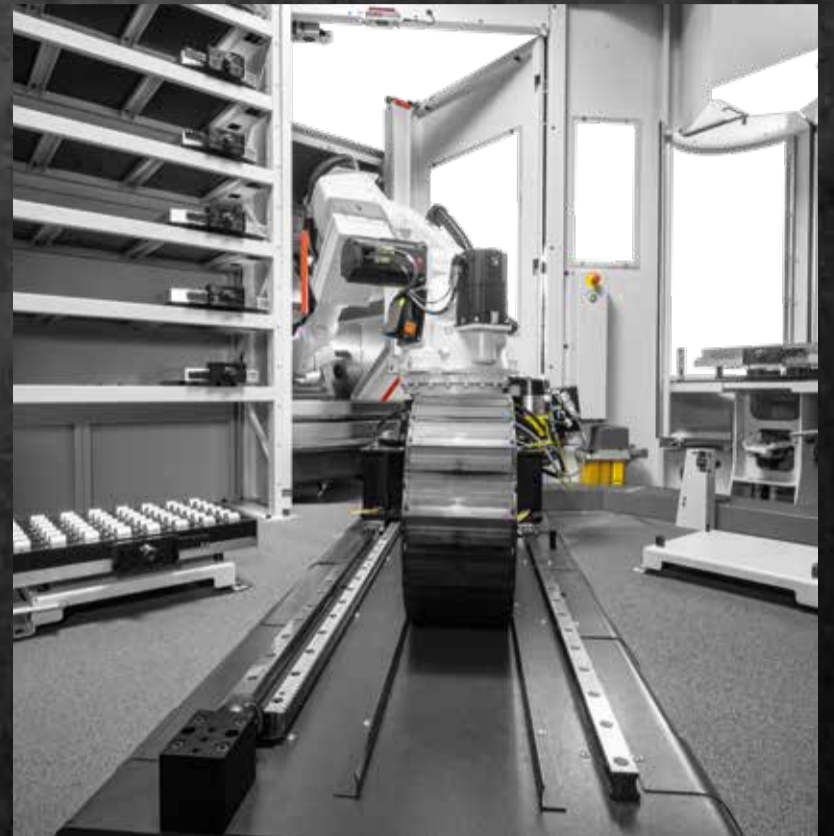
The RS 1 robot system is a fully versatile combination cell for pallet and workpiece automation. This Hermle innovation delivers a convincing mix of flexibility and productivity: The rack storage concept provides for remarkably long autonomous runtimes, gripper and adapter changing is automatic, and the fully functional setup station allows for parallel loading of pallets and workpiece carrier during operation. This makes the RS 1 the right automation solution for many scenarios. But that's not all.

**Your decision: single or dual machine operation.** The RS 1 is extremely variable. You can use it with a single machine or connect two machines to maximize output. Transitioning from one to two machines is also possible retrospectively, as is the addition of a third rack module, cleaning plant, a measurement machine or a driver-less transport system (FTS).



## Variable machine selection.

The overarching RS 1 concept is compatible with a range of Hermle machining centres: C 12, C 22, C 250, C 32, C 400 or C 42. It makes absolutely no difference whether you have two machines of the same model or wish to connect two different ones – or just want to automate a single machine. And by the way: If you have two machines, the automation is managed by the SOFLEX production system; if you have just one machine you can choose between HACS and SOFLEX.



## Automatically produce more.

The NC-controlled long stroke clampers and grippers allow for fully automated workpiece changing. The innovative RS 1 robot system automatically increases your productivity through its interplay with the individual parts provisioning system via steplessly adjustable universal dies. And here is another productivity plus-point: You can – of course – operate the robot and the machine autonomously.

## Easy handling.

The RS 1 is fully integrated into the Hermle software environment and correspondingly easy to operate via the touch screen – in fact, like an individual machine. There is hardly any need for manual intervention. And if that should prove to be necessary, you can easily access the machine without hindrance.

You will soon be able to find out more about the RS 1 robot system at [hermle.de](http://hermle.de). Get ready to be excited.

# ADDITIVE MACHINING AT SUPER- SONIC SPEED

The new MPA 42 machining centre is powerful and precise but it is not for sale. In additive manufacturing, Hermle is a service provider with the knowledge of what mould builders want: short cycle times and high component quality.

What happens in the new Hermle MPA 42 at first appears paradoxical: The blanks leave the working area of the cutting machine with a mass volume that has not become smaller but significantly larger. The name "MPA" indicates how this is achieved: It stands for Metal Powder Application, a process developed and launched on the market by Hermle about seven years ago. The new generation of machines significantly increases the precision and speed of the generative manufacturing process. Generally, hot and cold forming steels with high carbon content, copper and Ampcoloy are processed. The core component is a nozzle that sprays the metal powder accurately onto the clamped metal blank. Super-heated steam and nitrogen combined with the geometry of the nozzle accelerate the powder to supersonic speed, deforming the metal particles and allowing them to bond on impacting the substrate.

## THIS IS WHERE OPTIMIZATION IS CARRIED OUT

The new MPA 42 runs in the Ottobrunn premises of Hermle Maschinenbau GmbH (HMG). Since 2009, the wholly owned subsidiary of Maschinenfabrik Berthold Hermle AG has been operating from its Bavarian outpost, developing over the years into a service provider for additive manufacturing. HMG's strong point: The specialists know exactly where it makes sense to use material combinations, how cooling ducts and functional elements can be integrated in the best way, and they know the options when it comes to making moulds for single parts. "We don't sell machines but know-how," explains HMG's Managing Director Rudolf Derntl. The Ottobrunn team advises moulding tool designers, using 3D modelling and optimizing the injection moulded parts to be manufactured with this tool at a later stage. "We are looking at reduced cycle times and improved parts qualities which would be difficult to achieve using other technologies," Derntl says. "With additive manufacturing, we deposit copper on those parts of the tool where there is no room for cooling ducts, for instance. In the injection moulding process, the copper core dissipates the heat to the closest cooling duct much faster than steel."

## MAXIMUM ROOM TO MANOEUVRE

The five axes of the machining centre make it possible to direct the powder stream to the component in practically any conceivable way. This means that cooling ducts can be built up directly on the curved surface of a blank. After application of the powder, the MPA 42 mills details such as fine fins into the new material, fills them with a water-soluble metal material and closes them up using a layer of steel. Finally, the cooling ducts are flushed clear in a water bath. The only physical limitations are determined by the C 42 U's working area. "With the new machine, we are up to date and raise our MPA technology to the next level. It is the core of our service portfolio," the Managing Director says. Mirroring all processes in-house is a priority for him, from counselling over optimisation, feasibility check and material examination up to the final quality inspection. "This makes us pro-active and protects our own know-how and that of our customers."





### **Metal powder coating**

After filling the cooling ducts with a water-soluble metal powder, the next layer of metal powder is applied.



### **Finishing**

After powder application, finishing is the next step.



### **Powder conveyor**

The powder conveyors are mounted at the rear of the unit for convenient reloading from outside.




### **Heating station**

For optimum machine utilisation, the semifinished parts are heated to process temperature in a heating station before production starts.



REPORT.

A large aircraft engine is mounted on a runway. In the foreground, a large, complex, metallic mill-turn component is shown, which is part of the engine's internal structure. The component is highly detailed and features a red-tinted section. The background shows the runway and other aircraft in the distance.

# MILL-TURN TECHNOLOGY

GETS AIRCRAFT ENGINES INTO THE AIR

Quiet and efficient aircraft engines consist of complex shaped components made of highly durable materials. Herme's mill-turn variants in its High-Performance machining centre range fulfil all the specifications for high-demand manufacturing of rotationally symmetrical components – including seamless process monitoring.

As soon as the speed and with that the uplift of an aircraft are sufficient to overcome gravity, the pilot's command is 'Rotate'. The operation can only succeed with a suitably designed wing profile, i.e. with an airflow around it that is as it should be. Achieving this is the job of the engine thrust, which is also relevant for the efficiency and noise emission levels of the aircraft. Modern engines have to deliver more thrust while consuming less fuel. This, in turn, requires more complex geometries, higher pressures and more critical temperatures. Every efficiency boost for the engine means higher demands on its components, i.e. on the materials and the manufacturing processes.

In 2010, Maschinenfabrik Berthold Hermle AG presented its first MT machine (mill-turn), the C 42 U MT. "That was the 'take-off' moment for our launch into the aerospace sector," recalls Martin Wener, Head of Key Account Management. He sees the secret of success in the machine concept. "We can swivel the workpiece that we are in the process of turning. This gives us a huge advantage compared with conventional lathes." For simultaneous swivelling allows us to create complex contours with just one tool, and that can also be shorter and stiffer. "So our users need fewer tools. And the fact that these are available as standard makes for significantly lower investment costs."

**ONE MACHINE, TWO PROCESSES**

Hermle currently has three High-Performance Line machines as MT versions for simultaneous rotational machining: the C 42 U, C 52 U and C 62 U. The process monitoring includes pressure and flow sensors in the inner cooling circuit. The data they generate are then maintained with the component itself. Blisks are one example of such components. A 'blade-integrated disk' is an engine component that allows

**"AS THERE IS A LOT OF WEAR INVOLVED IN MILLING DIFFICULT MATERIALS, AUTOMATIC TOOL CHANGING OFTEN IMPROVES EFFICIENCY LEVELS."** Martin Wener

for considerably less assembly work and lower weight. Instead of mounting individual blades on a disk, the profiles are milled from a single piece. The milling time can be as long as 20 hours. One of the challenges involved: The long blades must not begin to resonate during the machining process. Then there is the tool wear to bear in mind. "This is where owners benefit from our tool automation. As there is a lot of wear involved in milling difficult materials, automatic tool changing often improves efficiency levels", explains Wener. In the end, the engine manufacturers get a blisk valued at around €100,000. Apart from the surface densification, the blisk is ready for assembly.

And it's not just the end result that impresses, but also the long-term precision. "An engine series will be produced over a long period of up to 20 years," explains Martin Wener. "Manufacturers expect our machines to keep pace in terms of precision and reliability right up to the last component. And that is just what they get."



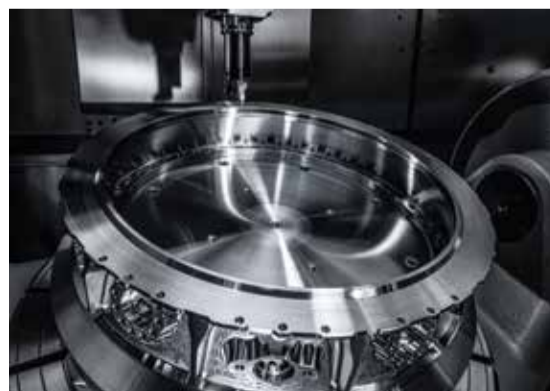
**HIGH-PERFORMANCE-LINE | C 42 U MT**

**HIGH-PERFORMANCE-LINE | C 52 U MT**

**HIGH-PERFORMANCE-LINE | C 62 U MT**



**top** For machining titanium parts such as this structural component, Hermle implements dry aerosol lubrication.



**top** A look inside the C 42 U MT dynamic: Machining the inner contour of an engine cowling involves trochoidal turning.



**top** Complex shapes accurately machined: A fuel connector after the roughing process on a C 32 U dynamic.

**left** Complex geometries and large components such as this fan module – no problem for the C 62 U MT dynamic.



# INTO ORBIT, NO RETURN

[isaraerospace.com](http://isaraerospace.com)

from left: Josef Fleischmann, COO, Tim Leidenberger, Production Technician, Christian Wenzl, Production Manager (all from Isar Aerospace GmbH), with Robert Obermeier (HPV Hermle Vertriebs GmbH)

Isar Aerospace is developing rockets that are to put satellites into orbit at low cost. Prototypes for the engine as well as sub-components are being produced on a Hermle C 42 U 5-axis machining centre. For the Munich start-up, this is the ideal allrounder for the starting phase of production.

Josef Fleischmann, COO of Isar Aerospace Technologies GmbH, explains: "We can transport several satellites into specific orbits using a single rocket." The carrier vehicle is called 'Spectrum': 27 metres long and 2 meters in diameter. Four fifths of the length are devoted to oxygen and fuel tanks, while the remaining space is for the payload and technological components. When operational, nine engines will transport the rocket together with several satellites on board to 'LEO', i.e. 'low earth orbit'. The second stage contains a tenth engine. This one can be ignited repeatedly, so it can be used for exact positioning of the satellites in LEO. When they founded Isar Aerospace Technologies GmbH in 2018, Josef Fleischmann, Daniel Metzler and Markus Brandl were inspired by the vision of launching satellites into orbit at a low cost as service providers for satellite manufacturers.

## START ENABLER

Maschinenfabrik Berthold Hermle AG has been involved right from the start. "What we needed for starting production was an all-rounder who was able to deliver high quality, high production rates and reliability," explains Christian Wenzl, Production Manager at Isar Aerospace Technologies.

**"WE COMPARED VARIOUS SUPPLIERS, ASKED OUR OWN SUPPLIERS FOR RECOMMENDATIONS AND CAME TO THE CONCLUSION THAT HERMLE PROVIDES THE BEST OVERALL PACKAGE."**

Christian Wenzl

This included service provision: "With Hermle you know that if there is a failure somewhere, the machine will not be idle for long," adds Wenzl. In selecting a model, the Munich entrepreneurs oriented themselves on the largest component that needs to be accommodated on the 5-axis machine, namely the thrust nozzle. It is manufactured additively and then finished in a subsequent step. The machining centre was ready for operation just a few weeks after the sales contract had been signed. Since then, Isar Aerospace has been manufacturing a large range of parts on the C 42 U, mainly using materials that are difficult to mill. In all cases, maintaining accuracy is paramount. The Munich rocket builders expect tolerances of  $\pm 1/100$  mm for free-form surfaces, and for high-precision cylinder fits the Hermle reliably achieves  $\pm 2.5 \mu\text{m}$  using the right tool.



## AUTOMATION ON THE AGENDA

Isar Aerospace develops the rocket components on the virtual drawing board and then sends them directly to production via the order management system – no paper involved. "At the moment we have to discuss each part and program the machining," says the Production Manager. At a later stage many processes will become highly automated. The first step towards that has already been taken: A production cell with two smaller Hermle machining centres, automated by means of a charging and discharging robot, has already been ordered and will be ready for operation in the second quarter of 2021. "Hermle's automation solutions rank with the best, with the highest level of quality. We know that the plant can run round the clock and it produces 99.9% usable parts," adds Fleischmann.



left Many components are still prototypes that Tim Leidenberger optimizes 'on the fly'. right Isar Aerospace makes high demands on the Hermle machining centre: It has to deliver high quality, be highly productive and keep going reliably.





# IN FUTURE: EVEN MORE COMPLEX

toolcraft.de

Ready for the next machining step: a workpiece for the semiconductor industry in the C 52 U.

Anyone who dares to combine additive manufacturing with precise machining clearly loves complexity. Judging by the quality of its products, toolcraft exactly fits this description. Hermle's thought-through machine design plays an important role here.



toolcraft lives for forward-looking technologies, which explains why this medium-sized and family-owned company began investment in additive manufacturing at an early stage – and why it has been successful. Jonas Billmeyer, head of the Machining Division at toolcraft AG, points out two decisive advantages: the integration of functions and processing of high-strength materials. “Of course it would be possible to mill something like that from a single block. But the amount of material used and especially the tool wear would be extremely high.” However, a certain amount of machining is still necessary: 20% to 25% of the machining capacity is devoted to post-processing additively manufactured parts – and that proportion is on the increase. In addition, Billmeyer and his colleagues turn, mill and grind items for the semiconductor and aerospace industries. The remaining capacities are used in connection with other sectors such as motor racing.

## LARGE-SCALE PRECISION

“Generally, we use machining centres from another manufacturer for machining components longer than a metre,” explains the Division Head. “This time, though, while extending our manufacturing capacity for the semiconductor industry we also took a look at Maschinenfabrik Berthold Hermle AG.” The technical advantages of the C 52 U make the difference. “The machining table is fully traversable. The tool can reach every location in a single operation without the need to rotate the table. This is how we achieve the specified high degree of surface smoothness.”

With the PW 3000 pallet changer, machining mechanic Jasmin Zippel can set up the machine in parallel with the main operation. She is already familiar with the operating concept from the smaller Hermle plant – toolcraft currently has 29 machining centres from Gosheim in operation. What is new to her, though, is the HACS software for the pallet changer. She organizes the pallets using drag and drop, incidentally confirming Hermle's claim that the software is fully intuitive. The C 52 U mills parts for the semiconductor sector. It makes grooves for cooling



left from left: Benjamin Schuh, HPV Hermle Vertriebs GmbH, machining mechanic Jasmin Zippel and Jonas Billmeyer, head of the Machining Division at toolcraft. right toolcraft always keeps its plant for full treatment of individual workpieces or assemblies up to date.

ducts, places bore holes and smooths the surface. This takes roughly one week. “Errors are extremely expensive here,” emphasizes Billmeyer, and that explains his appreciation of the reliability of the machines and his colleagues.

## THE MILL-TURN CONCEPT SAVES TIME

The world of the C 42 U MT is significantly smaller. 70% of the workpieces machined here end up in aircraft engines. The machine concept enables toolcraft to improve its own operation. “We manufactured this component previously, but we had to split up the workflow and we were not at all satisfied,” relates Billmeyer. Far too much reworking, too far

removed from perfection. “The C 42 U MT allows us to mill and turn whenever it makes sense to do so.” The result: Significant time savings and better quality.

The Division Head expects toolcraft to keep looking for challenges in terms of basic precision and machining capability. And that is what motivates him.

**“THE C 42 U MT ALLOWS US TO MILL AND TURN WHENEVER IT MAKES SENSE TO DO SO.”**

Jonas Billmeyer

Asked what the future has in store for his area of responsibility, he replies: “We want to achieve new levels of precision and complexity as well as taking on parts that are more and more difficult to machine. And our partner Hermle is a permanent fixture in this strategy.”



# THE PERFECTIONISTS

feinbearbeitung.com

from left: Patrick Schulz, authorized signatory, Alfred Schulz and Michael Schulz, managing directors of Schulz GmbH + Co. KG.

For Schulz, appearance is the decisive factor. The goal of maximum precision characterizes every working step – from milling to ultra-fine laser machining. The highly specialized family business can find 3- and 5-axis machining centres meeting these requirements in Hermle's High-Performance Line.

"Perfection is almost always a must," says Michael Schulz, Managing Director at Schulz GmbH + Co. KG, a family-owned company with 45 employees in Welzheim in Baden-Wuerttemberg. By this he refers not only to the components Schulz manufactures predominantly for the semiconductor industry, special machine construction and the measurement technology sector. Equally important to him is a tidy work environment – he is convinced that this is transferred to the way his employees work. And the environment must be even more than tidy: "We manufacture in some cases with +/- 1 µ accuracy."

## RIGHT FROM THE BEGINNING

Alfred Schulz, the senior manager and owner of the family-owned business developed his love for perfection as early as during his time as an employee. "I assembled handling robots and we had to rework many parts," he remembers. At that time he decided: "If I ever have an own manufacturing workshop, this will not happen to me." A project that he put into practice in 2002 after he founded Heckel & Co. GmbH together with two of

his colleagues. They invested directly in a machining centre of Maschinenfabrik Berthold Hermle AG. The C 800 V of that date is still in operation – together with eight further machining centres from Gosheim now.

In 2012, the company owner took a decisive step for today's success when he paid off his co-founders. A turnaround which ensured a significant upswing, driven by the high standards with which Schulz manufactures its products. In 2013, the C 40 U and C 32 U marked the company's entry into simultaneous 5-axis machining for the rapid manufacturing of complex parts.

## AUTOMATION TIMES TWO

In 2018, production again reached the capacity limit and Schulz decided to invest in a C 42 U with handling system HS flex. "At first we really had respect for the automation," Michael Schulz admits. But the fear of producing rejects and the feeling of uncertainty while the system was running unmanned proved to be completely unfounded.

## "AT FIRST WE WERE REALLY CAUTIOUS ABOUT AUTOMATION."

Michael Schulz

"The automated system accomplishes as much as three of our stand-alone machines while relieving our employees of monotonous, repetitive tasks," Schulz says. As a result, the automated machining centre reached over 5,000 spindle hours within a year and was quickly running at 100 percent utilisation. Convinced of the stability and benefits, the management team ordered a second C 42 U with flexible automation solution. "We now have a bit of leeway which we can use for maintenance work, for example," Schulz says. He also has Hermle do the maintenance work: "This

makes perfect sense. After all, the Hermle engineers know the machines best and know what needs to be done."

Alfred and Michael Schulz are fully convinced of the stability and accuracy of all their Hermle machines. "We machine some of the components for weeks. Even after four weeks we need not make corrections. We are working in the tolerance range of five µ," Michael Schulz explains.



top The individual workpieces are on the C 42 U between one and three hours. During this time the employees can take care of the other machine on which predominantly individual components and prototypes are machined.



top Setup in parallel with key production times is just one of the many advantages of the handling system HS flex.



top Individual parts and prototypes are produced on the stand-alone machines.

# AUTOMATION IN ITS MOST COMPACT FORM.

## THE RS 05-2 ROBOT SYSTEM.

The RS 05-2 provides high performance with a small footprint: You need only 2 m<sup>2</sup> to make a noticeable difference in productivity. And the robot system can be docked onto various machining centres: laterally onto the C 12 and C 22, frontally onto the C 250, the C 400 and the C 32. It goes without saying that both variants allow for unrestricted ergonomic access. But Hermle's automation solutions have more to offer.



### Intuitive operation.

The RS 05-2 can be set up with universal matrices and individually programmed via the intuitive HACS software. This means that the RS 05-2 can be configured ideally for every requirement – and no in-depth robot programming knowledge is required for easy operation.



### Exact-fit productivity.

Despite its compact dimensions, the 6-axis robot enjoys complete freedom of movement, and it is also possible to set it up in parallel with the automated production process. At the same time, the aligning station ensures that workpieces are gripped exactly and positioned with an exact fit.



### Various storage options.

Three variants to meet any challenge: The drawer storage unit with 4, 5 or 6 drawer elements provides plenty of room in a small space; the pallet storage unit with its up to 67 small pallets allows for setting up during operation, and the single storage unit with two universal matrices is a good basic solution for many areas of application.

ENERGY EFFICIENCY.

# Quality protects the environment.



## HERMLE'S ENERGY EFFICIENCY MEASURES.

An energy-efficient machining process is a win-win setup – for the manufacturer and for the customer. So Hermle has already been focussing on integrated conservation of resources and energy efficiency for decades. However, Hermle doesn't just make sure that its machines are produced efficiently, but also that they are energy efficient during operation. Or to express it in figures: The efficient Hermle machining centres can save you up to 80% energy. Which in turn allows for an up to 30% government subsidy for new machines. We save energy. You save costs.

### Energy-efficient operation.

- ⊕ **Low-energy manufacturing:** Our efficient manufacturing translates into cost savings for you – with topology-optimized construction and with mineral casting technology in our on-site, state-of-the-art foundry.
- ⊕ **No material tourism:** Locally sourced components and materials for a lower environmental impact.
- ⊕ **Reduction of transport energy consumption:** Benefit from our high levels of in-house production at our two locations
- ⊕ **High efficiency levels:** We use high-quality ball screws, guideways and roller bearings for minimal energy losses
- ⊕ **Less material usage:** We use virtual tools for machine optimization and development

### Energy efficiency during manufacturing.

- ⊕ **Energy recuperation as a standard:** Hermle has been doing pioneering work in this area for over 20 years
- ⊕ **Efficient technology:** In addition to high-quality servo axes, the application-dependent drive technology saves you a great deal of energy – thanks to the internal coolant supply system with frequency-regulated high-pressure pumps and pick-up tool changers without additional axes
- ⊕ **As cold as is needed:** Benefit from demand-driven cooling technology in dimensioning and usage
- ⊕ **The de-energize system:** In standby mode, our machining centres consume up to 80% less energy – made possible by automatic shutdown, automatic sealing air switch-off and convenient post-shift shutting down
- ⊕ **Quality pays for itself:** Long-lived machines generate lower costs

### Energy efficiency within the process.

- ⊕ **Being faster can save energy:** Our adaptive feed control (AFC) shortens machining times, so you can save up to 20% energy
- ⊕ **Very short warming-up phase:** Directly measured NC axes, thermosymmetrical machine construction and the optional compensation of thermal expansion ensure that our machining centres quickly reach their operating temperature
- ⊕ **No reclamping needed:** The 5-axis concept allows for direct machining of up to five sides
- ⊕ **Save time and clamping operations:** With Hermle's MT technology you can mill and turn in one setup
- ⊕ **Digital is often faster:** We use digital production, digital operation and digital service for more energy efficiency

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info@hermle.de · www.hermle.de

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