

Perfect mastery  
of surfaces



# HIGH-DYNAMIC PRECISION MILLING

Pioneering technology solutions

OPS  INGERSOLL  
Fly with the eagle!

Precision in all areas

# Trust in our expert knowledge

We are a customer-focused company with a clear passion; supporting and driving tool and mould construction with the latest technologies. You can rely on our many years of experience and benefit from our proven expert principles. This combines the unique *EAGLE* technologies with automation solutions, process experts and application know-how. Our work is characterised by special precision in all areas - around 170 employees guarantee the highest process competence and product quality.

**Our common goal: We want to keep improving, become even more flexible, and even more efficient!**

Trust in intelligent and highly profitable machine concepts from OPS-INGERSOLL and join us at the forefront of innovation!



## **EAGLE Tec inside**

Our customers around the world have relied on the strong innovative capacity of the experts at OPS-INGERSOLL for two decades. The permanent and continuous research and development of unique performance components with state-of-the-art technology provides our customers with highly-profitable trend scouting and thus long-lasting investment security.

"*EAGLE Tec inside*" is a commitment and a pioneering promise for every machine that leaves our factory – for our customers and our employees. We want to inspire everyone.

DEVELOPMENT  
RESEARCH  
INNOVATION  
TREND SCOUTING

## **Our company**

Since 1996, we have been developing and building high-speed milling machines, making us one of the drivers and trendsetters in HSC-technology.

Thanks to consistent further development, our machines can now be used for a wide range of applications. With our HIGH SPEED *EAGLE* series, we offer highly dynamic machines that ensure the achievement of the highest precision and surface quality.

These machines can also be configured for universal use.

All our machines can be easily automated, ensuring optimum accessibility for the operator at all times.

Our machines are of the highest quality "made in Germany" and are characterised by their high availability.

We are a reliable partner for our customers and offer, in addition to our machines, excellent service and application support, both in Germany and internationally.



Big Points

# Diversity of business sectors

Tool and mould construction

Pressing and metal forming

Aerospace technology

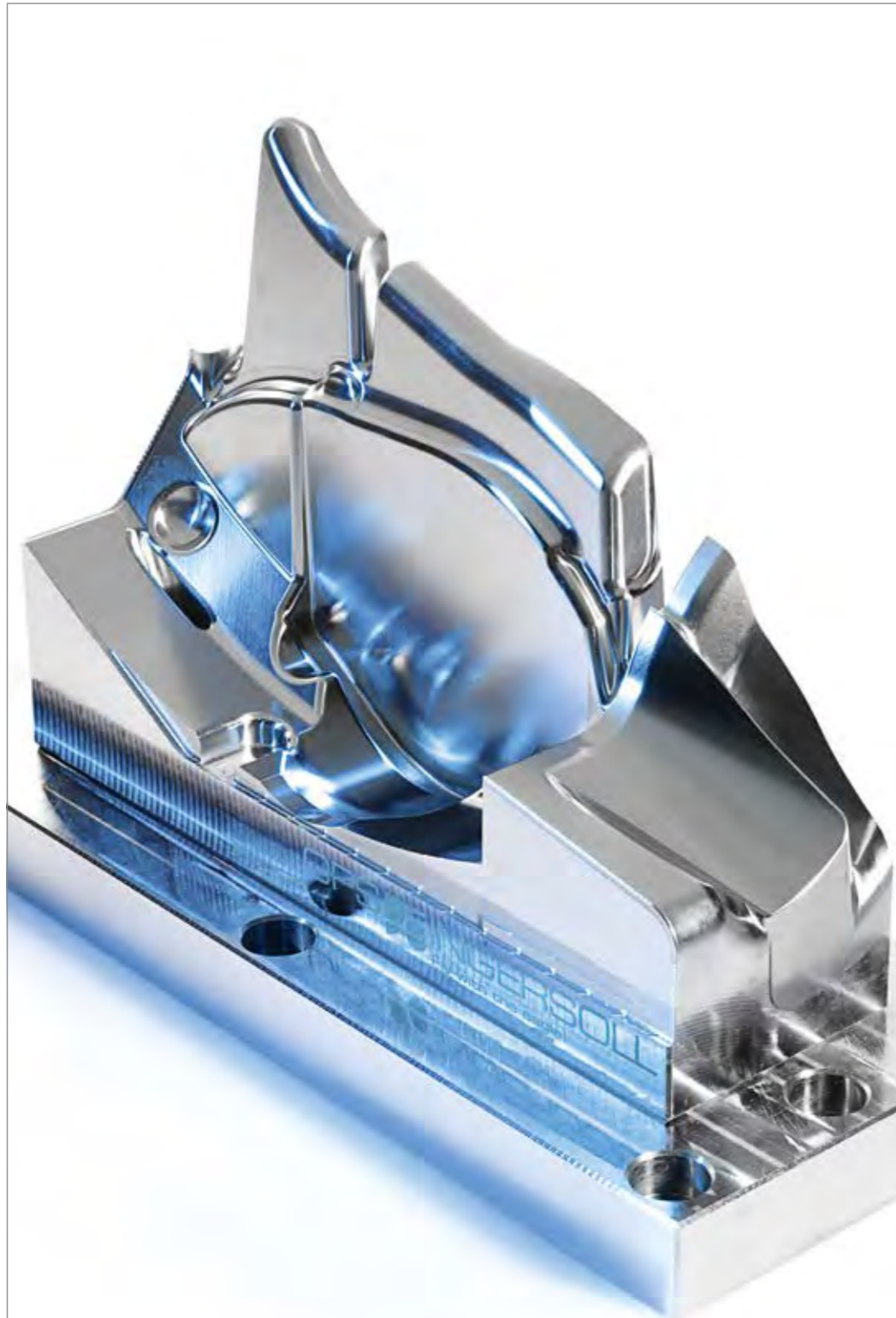
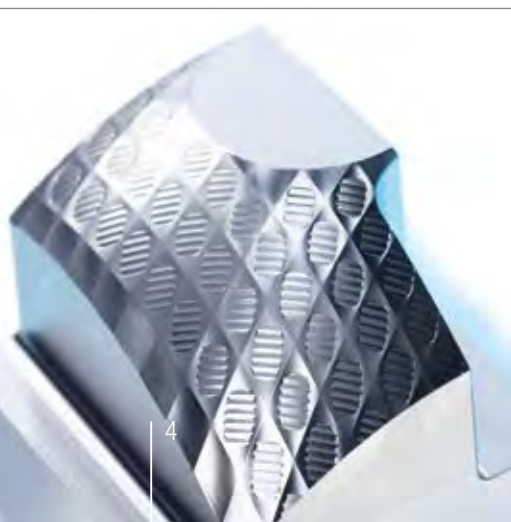
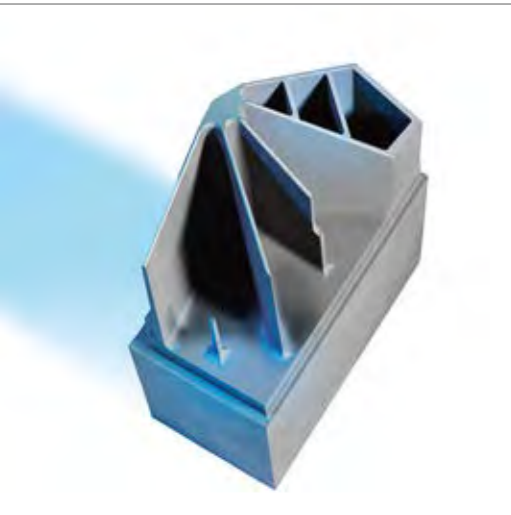
Dental and medical technology

Moulds for optical components

Micro-machining

Precision part machining

OPS-INGERSOLL offers efficient solutions to increase productivity.



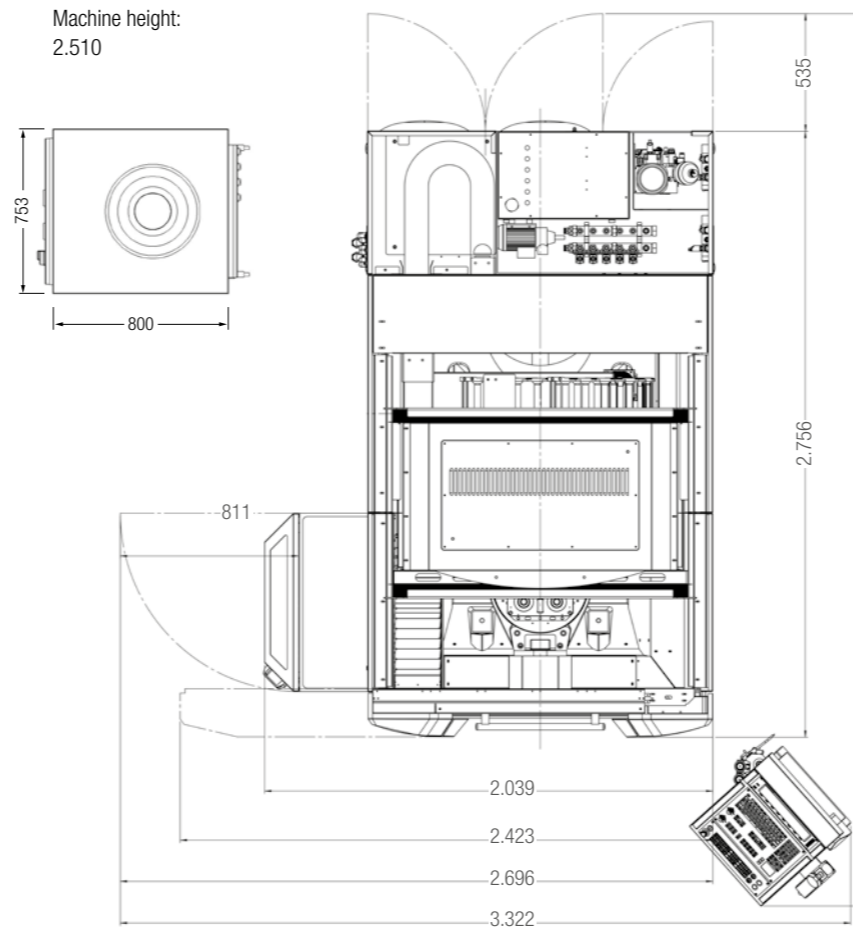


Precision, power, perfection - *EAGLE* Tec inside!

# V5 - The highly dynamic precision experience



Machine height:  
2.510



All dimensions specified in mm



## Workpiece dimensions

### 3-AXIS



X / Y / Z  
550 / 400 / 400 mm  
max. 500 kg

### 5-AXIS



Ø 400 mm / H = 380 mm  
max. 250 kg

## Setup - Technical data

Travel distances	X = 550 mm; Y = 400 mm; Z = 400 mm
Travel speed	max. 30 m / min
Acceleration	max. 15 m / s <sup>2</sup>
Table clamping surface	X = 650 mm; Y = 490 mm
Max. T-slot table load capacity	up to 500 kg
Table	T-slot table expandable over 4 <sup>th</sup> /5 <sup>th</sup> axis
T-slot	5 x 14 H12
Distance between HSK-spindle nose and table, min./max.	155 / 555 mm (205 / 605 mm*) 50 / 450 mm (100 / 500 mm*) (with UPC-clamping system and pallet)
Workpiece size 3-axis X/Y/Z	550 / 400 / 400 mm (max. 500 kg)
Workpiece size 5-axis	Ø 400 mm; H = 380 mm (max. 250 kg)
Connected load	32 kVA
High-frequency spindle selection	HSK E40: 1-42.000 rpm HSK E50: 1-36.000 rpm
Spindle power	15 kW / 17 kW
Tool changer selection	32 position (HSK E40) 24/32 position (HSK E50) Optional: MultiTool 100 / 150
Minimum lubrication	included
CNC control unit	HEIDENHAIN TNC 640 with 19" touchscreen
Dimensions	2.756 x 2.039 mm; H = 2.510 mm
Total weight	8.500 kg
Options	HSC round swivel table: Geared B-axis -120 degrees / +60 degrees Geared C-axis 20 rpm Workpiece weight: 250 kg Torque B-axis -140 degrees / +60 degrees Torque C-axis 100 rpm Workpiece weight: 200 kg
Further options	BLUM LC50-DIGILOG Laser system for tool measurement Infrared measuring probe, 3D-measuring Graphite exhaust system, Oil mist suction unit ATS Aerosol dry lubrication MHT medium distributor Wet machining, Chip conveyor, Graphite wet machining, Email messenger, Ready-for-automation, EcoTec Software options HEIDENHAIN



Multiple possibilities

# Multi-axis machining

**HIGH SPEED  
EAGLE V5**

The HIGH SPEED *EAGLE V5* offers numerous variants of multi-axis machining to produce complex contours and geometries in a single setup.

**4-axis machining**

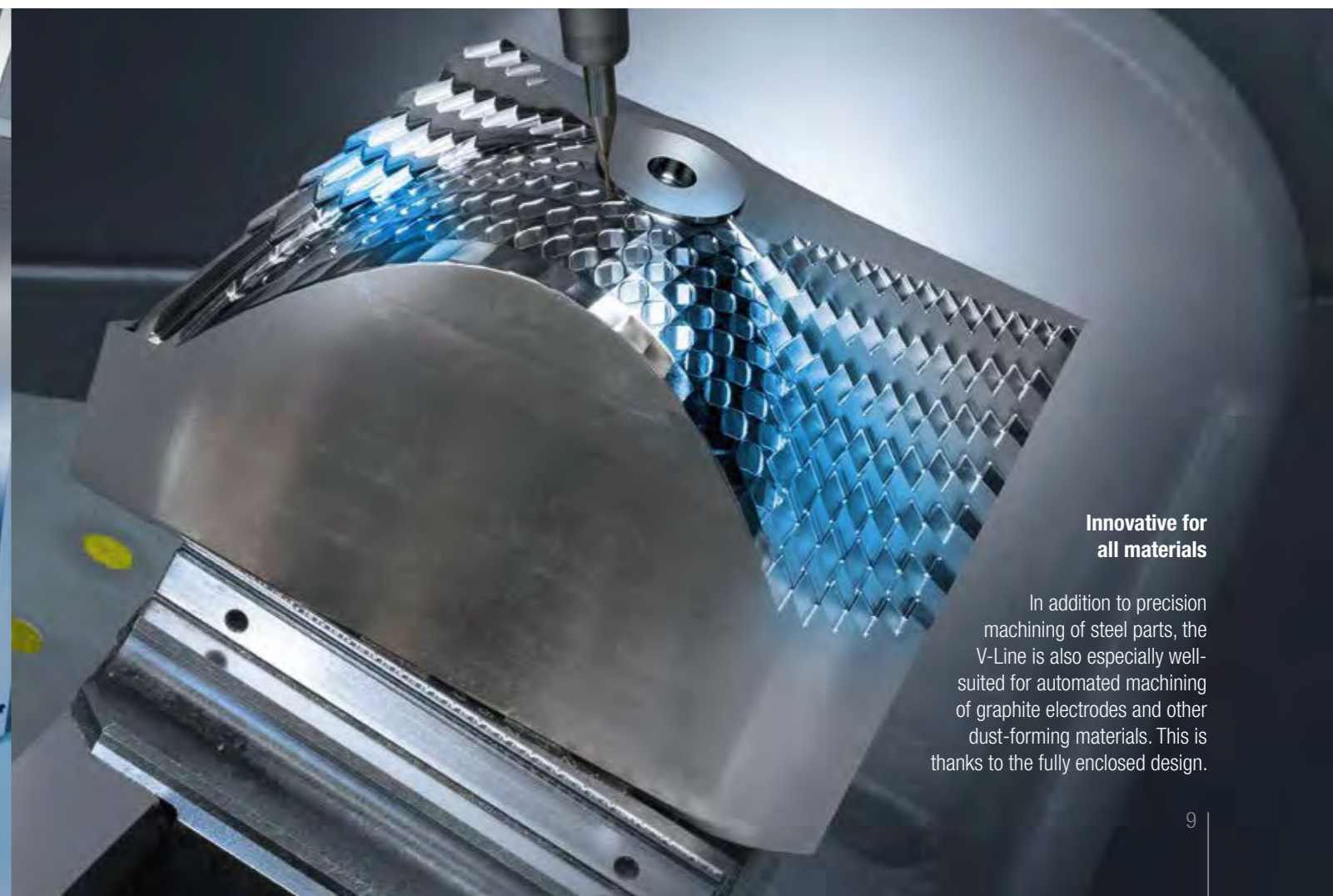
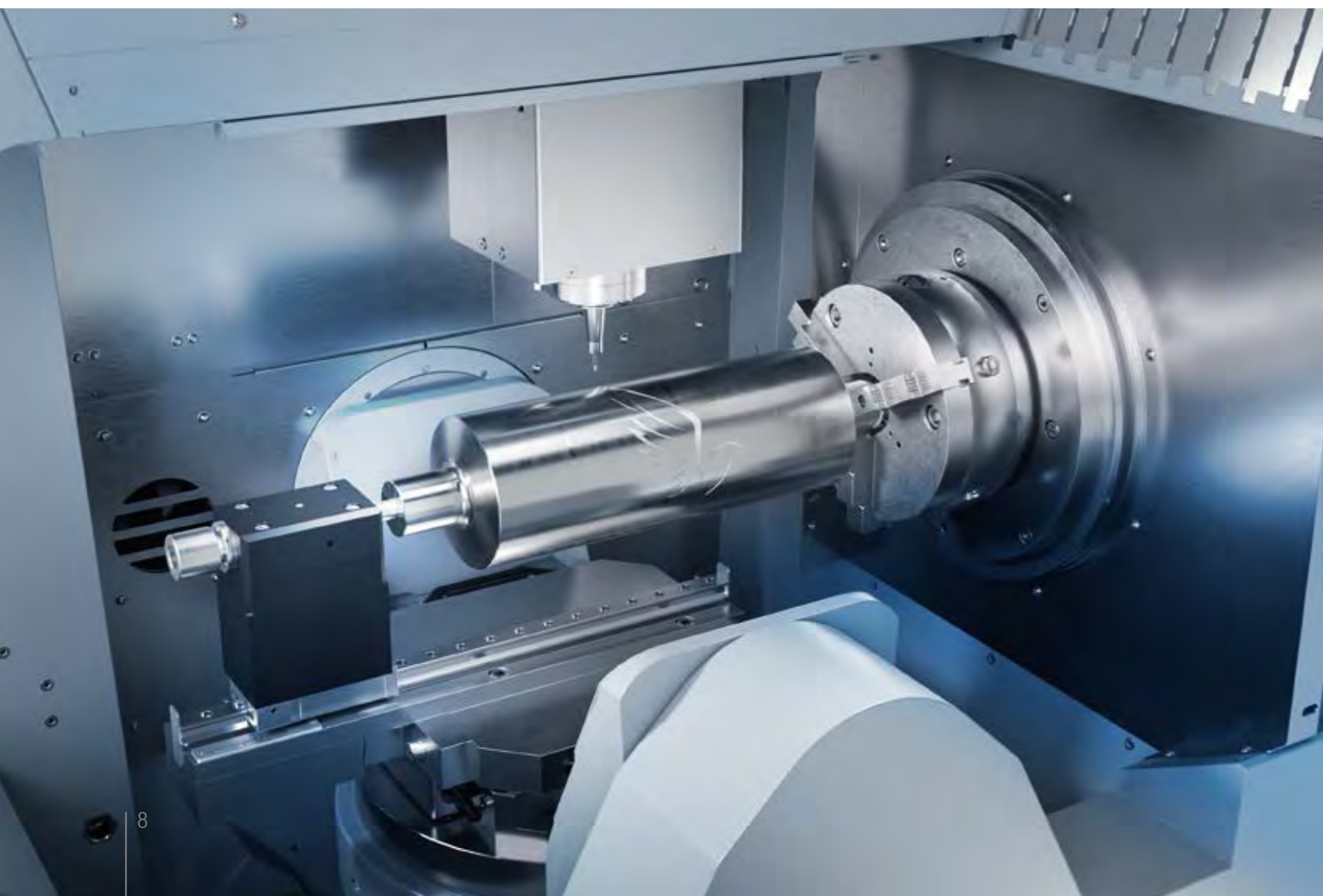
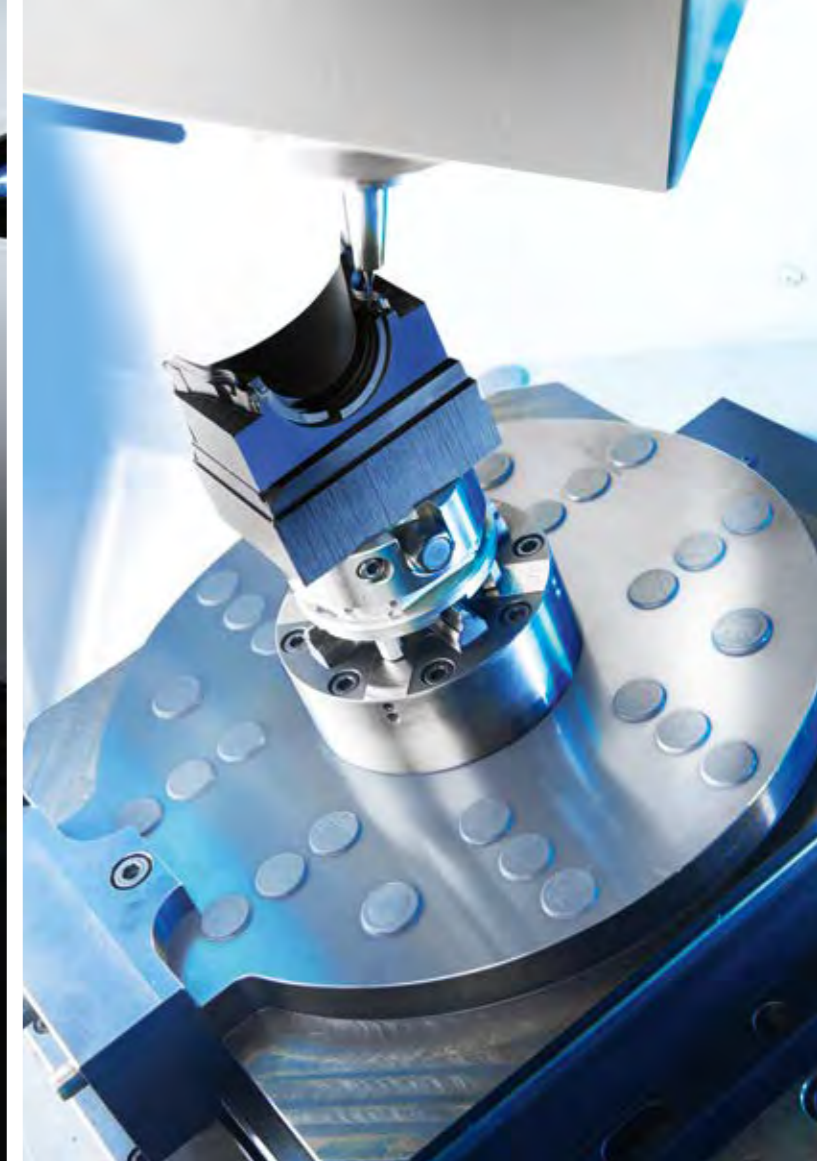
**5-axis machining**

**Shaft machining**

Simultaneous machining with five axes – also fully automated with the best accessibility – increases cost-effectiveness without limiting flexibility.

We offer special solutions for special machining tasks, e.g. shaft machining.

Widely used in the market, the HIGH SPEED *EAGLE V5* promises maximum precision with high dynamics and is perfectly matched to your applications with task-optimised options.



**Innovative for  
all materials**

In addition to precision machining of steel parts, the V-Line is also especially well-suited for automated machining of graphite electrodes and other dust-forming materials. This is thanks to the fully enclosed design.



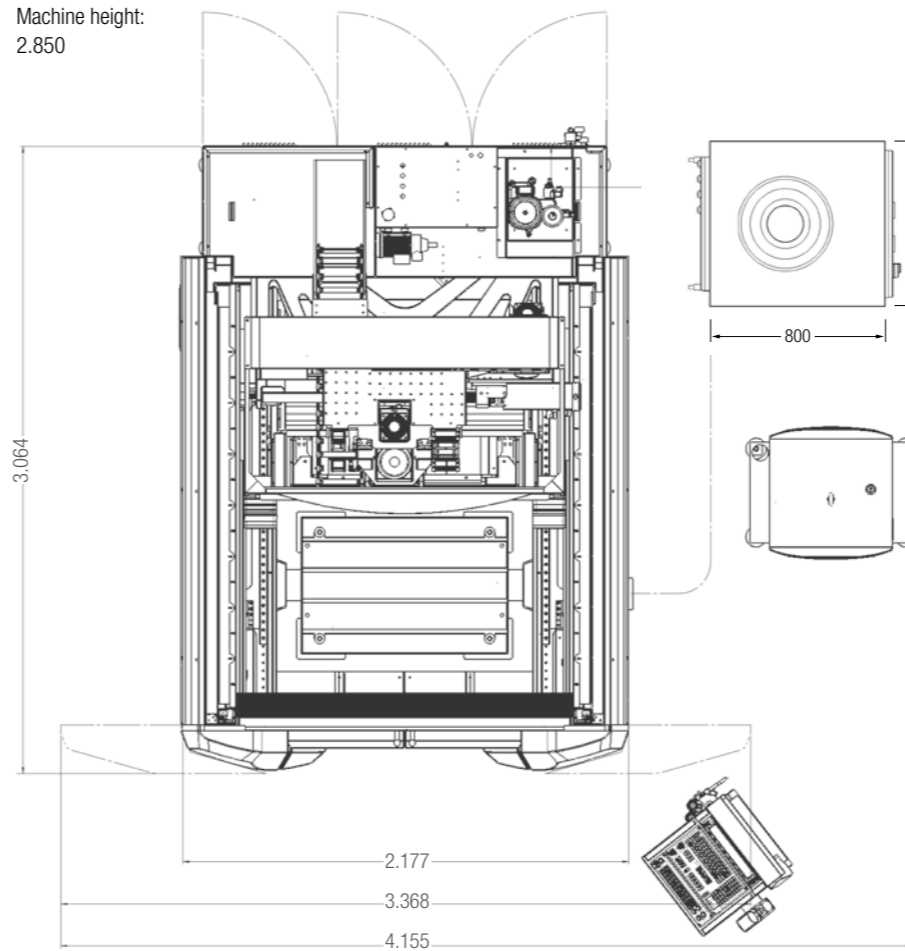
Precision, power, perfection - *EAGLE* Tec inside!

# V9 - Dynamics and precision

**HIGH SPEED  
EAGLE V9**

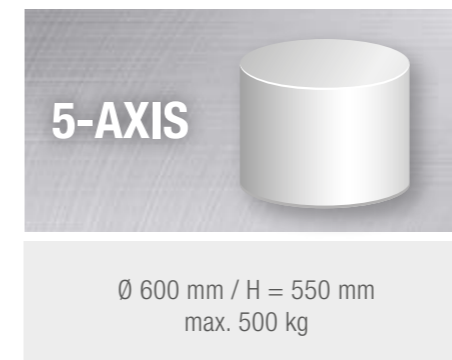


Machine height:  
2.850



All dimensions specified in mm

## Workpiece dimensions



## Setup - Technical data

Travel distances	X = 800 mm; Y = 600 mm; Z = 500 mm
Travel speed	max. 30 m / min
Acceleration	max. 15 m / s <sup>2</sup>
Table clamping surface	X = 1.000 mm; Y = 660 mm
Max. T-slot table load capacity	up to 2.000 kg
Table	T-slot table expandable over 4 <sup>th</sup> /5 <sup>th</sup> axis
T-slot	4 x 18 H12
Distance between HSK-spindle nose and table, min./max.	175 / 675 mm 70 / 570 mm (with UPC-clamping system and pallet)
Workpiece size 3-axis X/Y/Z	800 / 600 / 500 mm (max. 2.000 kg)
Workpiece size 5-axis	Ø 600 mm; H = 550 mm (max. 500 kg)
Connected load	32 kVA
High-frequency spindle selection	HSK E40: 1-42.000 rpm HSK E50: 1-36.000 rpm HSK A63: 1-18.000 / 20.000 / 24.000 rpm
Spindle power	15 kW / 17 kW / 25 kW
Tool changer selection	88 position (HSK E40) 72 position (HSK E50) 48 position (HSK A63) Optional: MultiTool 150 Optional: external tool changer as production changer 30 position internal and 181 position external
Minimum lubrication	included
CNC control unit	HEIDENHAIN TNC 640 with 19" touchscreen
Dimensions	3.064 x 2.177 mm; H = 2.850 mm
Total weight	11.500 kg
Options	HSC round swivel table: Geared B-axis +140 degrees / -60 degrees Torque B-axis +140 degrees / -60 degrees Torque C-axis 100 rpm Workpiece weight: 500 kg
Further options	BLUM LC50-DIGILOG Laser system for tool measurement Infrared measuring probe, 3D-measuring Graphite exhaust system, Oil mist suction unit ATS Aerosol dry lubrication MHT medium distributor Wet machining, Chip conveyor, Graphite wet machining, Email messenger, Ready-for-automation, EcoTec Software options HEIDENHAIN

'Dimensional' precision guarantee!

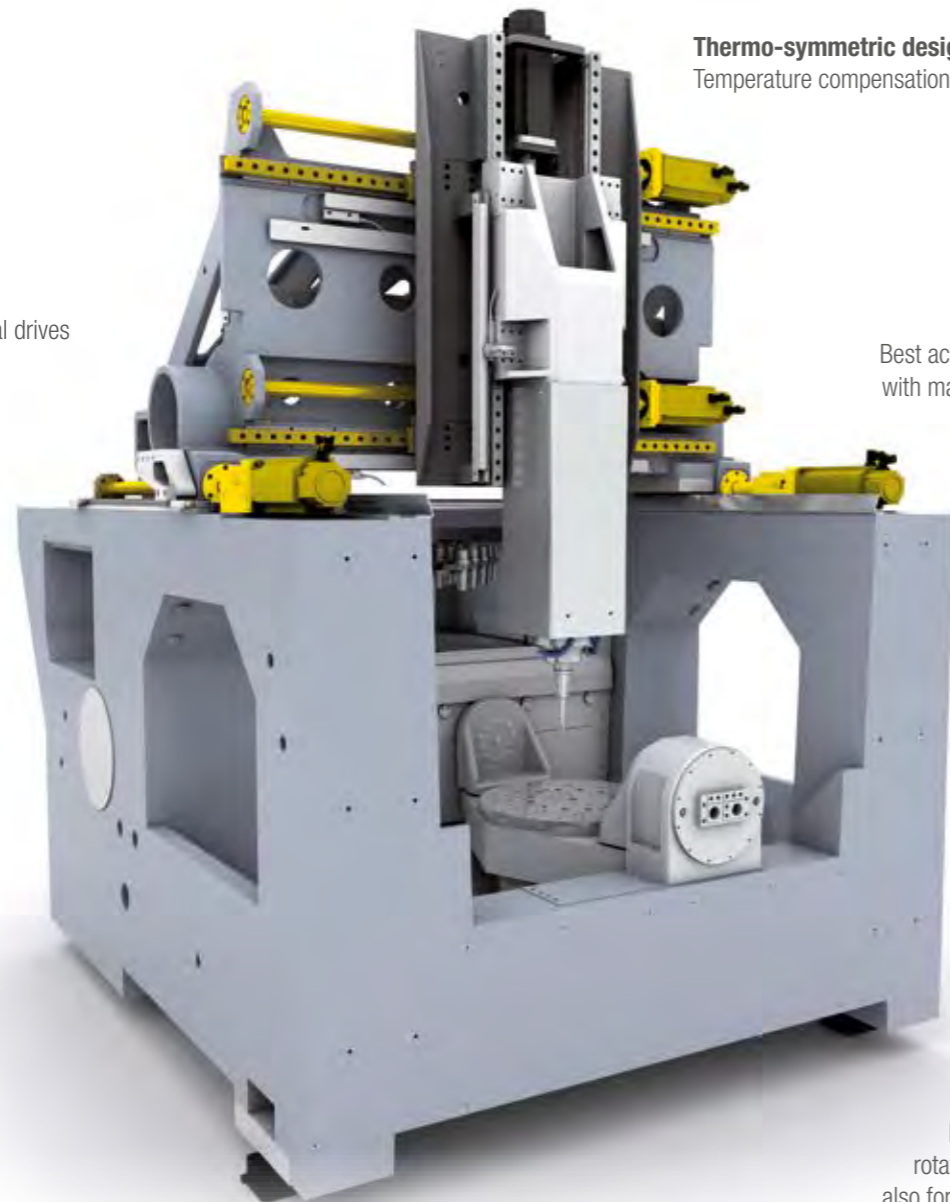
# Unique Gantry machine concept

## Excellent machine design

Highest dynamic rigidity thanks to polymer concrete bed with maximum damping



Gantry design / dual drives



Optimum proportion footprint to travel ratio

**Thermo-symmetric design**  
Temperature compensation / stability

**Automation**  
Best accessibility even with manual operation

**4<sup>th</sup>/5<sup>th</sup> axis**  
Highly dynamic rotating swivel axis also for heavy weights

**5 years warranty**  
on all mechanical drive components

Precise and versatile

# Precision milling spindles

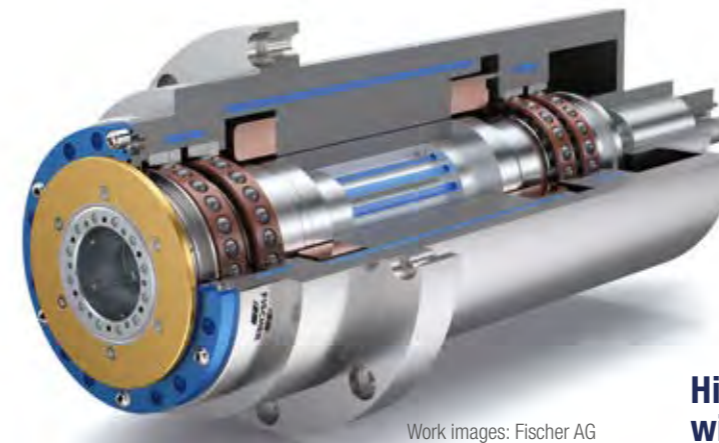
From high-speed spindles for the finest details and high-end finishing to high-torque powerspindles (up to 120 Nm) for steel and drilling operations.

All milling spindles are optionally available with internal coolant supply for all common media (air, aerosol, water).

In addition, the Precision-series machines can be equipped with shaft-cooled milling spindles for optimum thermal characteristics, maximum precision and maximum repeatability.



Work image: Step-Tec

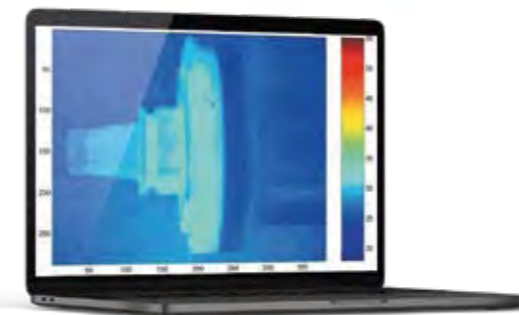


Work images: Fischer AG

## High precision CSC spindle with shaft cooling

Highest precision thanks to thermally stable process conditions due to cooled spindle shaft

- Low axial expansion
- High repeatability
- No temperature load into the tool or measuring probe
- Shortened saturation times after tool and speed changes



Cool HSK interface and tools



High number of tools for increased productivity  
Faster changeover times

# MultiTool 100 / 150

**NEW**



The magazine creates solutions for machining different materials, automated machines and complex applications with a wide range of tools.



- 100 / 150 tools\*
- For HSK 40, 50 and 63
- Tool identification
- Control-supported magazine assignment
- Double gripper for short changeover times

\* MultiTool 100 and 150 available for HIGH SPEED EAGLE V5 | MultiTool 150 available for HIGH SPEED EAGLE V9

Efficiency bearer -  
Versatile technology in smallest space

# MultiChange *plusTools*

A further development of our successful  
MultiChange series



With the MultiChange *plusTools*, workpiece pallets, electrode holders and milling tools can be handled with just one handling system. The robot-cell can operate both HSC and EDM technology, as well as both in combination.



- Modular configuration
- Customisation according to the requirements
- Double gripper for fast changeover times
- Prepared tool change
- Identification via RFID chips
- Job manager
- Tool management



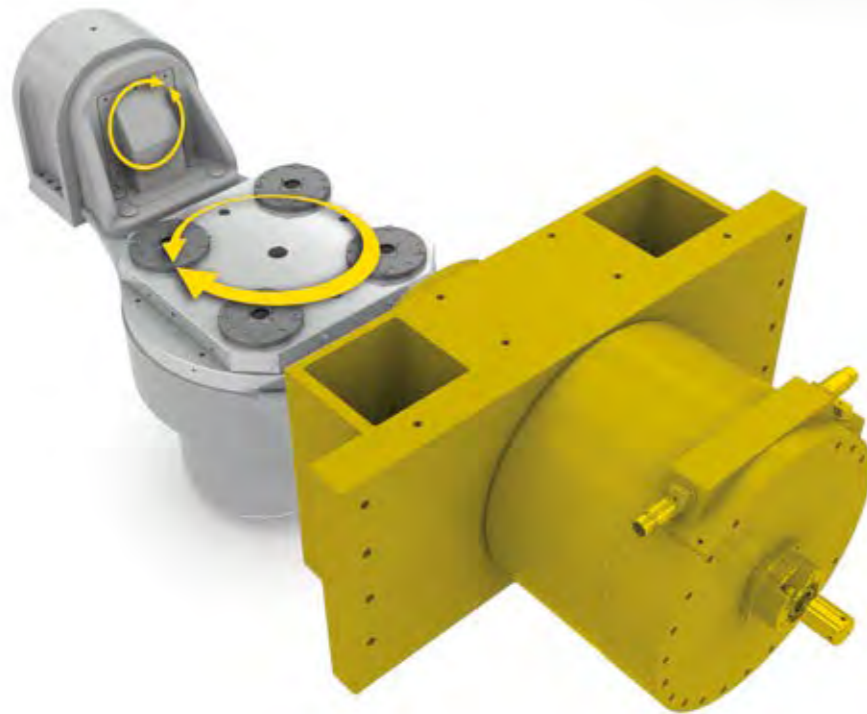
4<sup>th</sup>/5<sup>th</sup> axis - energetically efficient force application

## Optional gear or torque drive



### Geared swivel axis / Torque rotation axis

for high-precision machining



### Torque swivel axis / Torque rotation axis

for high feed rates during  
simultaneous machining



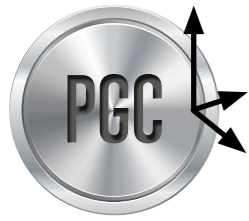
### Intelligent load movement

The 4<sup>th</sup>/5<sup>th</sup> axis is designed for up to 500 kg payload. The available work space is utilised ideally with the central arrangement and low position of the swivel axis. The swivel angle of up to 200° enables optimal machining conditions from all sides.



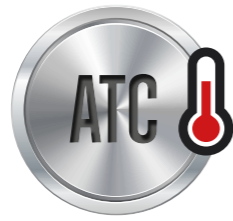
Guaranteed accuracy

## Precision features



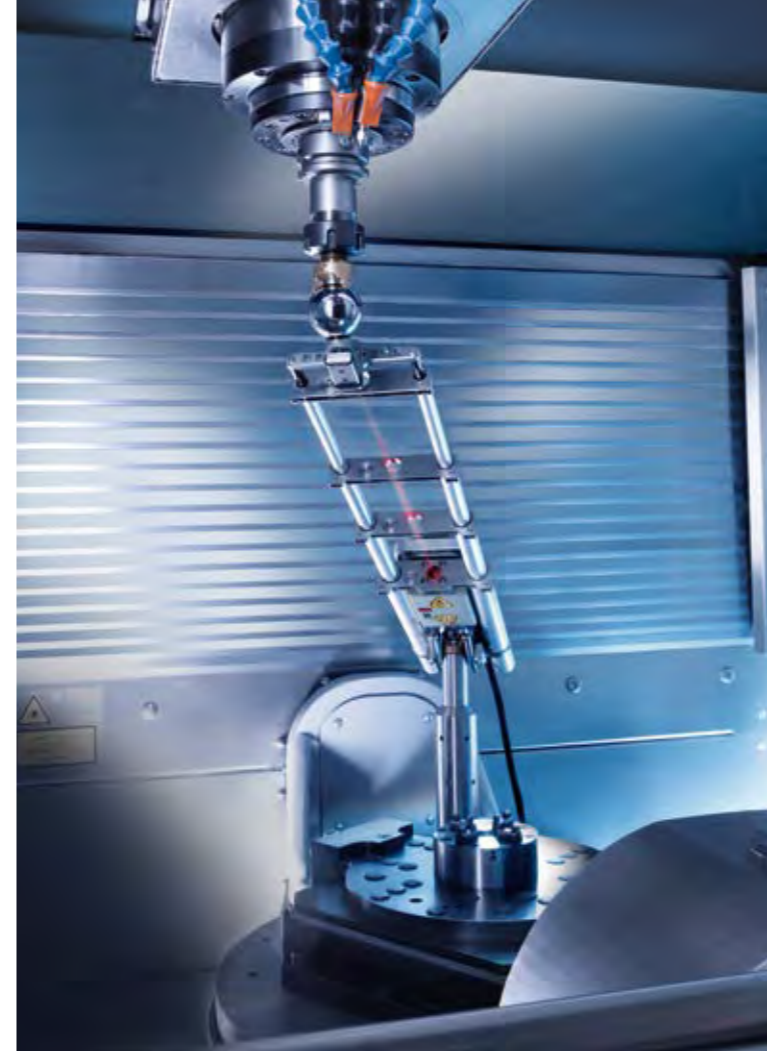
### PGC - Position- & geometric-compensation

- Precision assembly followed by geometric error compensation of the linear axes using calibrated measuring standards
- Compensation of the positioning accuracy of the linear axes by laser interferometer
- Automated measurement procedures for continuous testing of the results obtained



### ATC - Automatic temperature-drift-control

- Room temperature compensation to reduce thermal displacements
- Permanent monitoring of various component temperatures
  - Full enclosure of the machine cabin



### IPR - Increase precision and repeatability

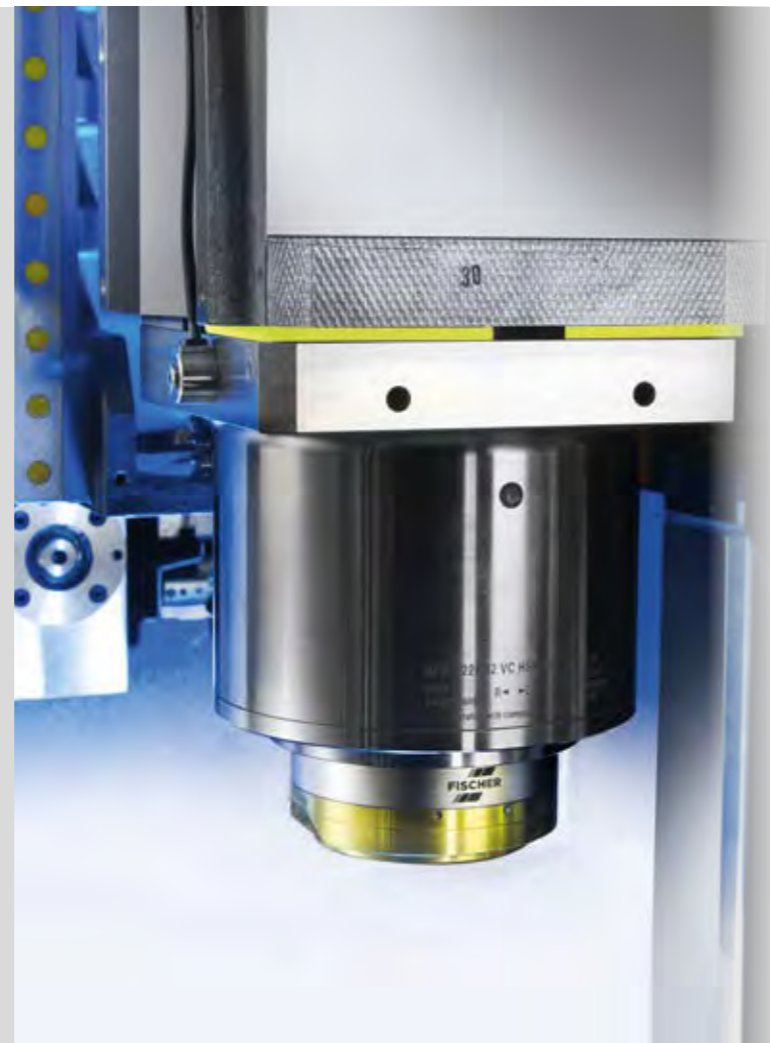
Space compensation using the most advanced laser measuring equipment over the entire movement range

Our precision features increase the application precision and repeatability of the machine. These are further enhanced by geometric and thermal fine-tuning in the subsequent working environment of the machine. IPR – a guarantor for highest precision over the entire travel distances.



### PSC - Precision spindle compensation

Various options for cooling of the geometry- and temperature-compensation for the machine and milling spindle, ensure maximum machining accuracy over the entire movement range of all 5 axes.



## Precision cycles



### OPS-INGERSOLL Tool Centre Cycle Cycle 320

- Standardised calibration of the machine with its components (laser, infrared measuring probe, 5-axis TCP)
- Maximum ease of use and simple handling
- Documentation of all measured values with the evaluation for fast analysis function
- Quick-check of the TCP in progress



### OPS-INGERSOLL Advanced Motion Control Cycle 332

- Whether fast or precise, motion control optimised for the respective machining task
- Highest contour accuracy for HSC machining
- Optimum speed for roughing operations



More possibilities...

# The high performer for flexible use



Benefit from our experience. Our **Competition-Line** machines convince with their flexible equipment possibilities.

Due to its concept and flexibility, the **Competition-Line** allows highly dynamic milling of graphite, steel or non-ferrous metals, both in dry and wet machining.

## The machines of the Competition-Line are all-rounders for areas such as:



Tool and mould construction



Pressing and metal forming



Production



Aerospace technology



Medical technology

... and more precise work!

# Specialists in top precision



**5-axis simultaneous machining** with a precision of **less than 10 µm** during active temperature control of all drive components

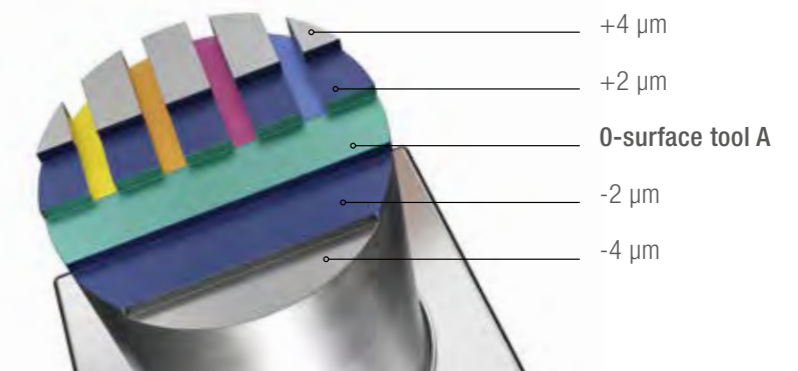
The new **ACTC** (Active-Component-Temperature-Control) regulates the temperature of additional machine components, for absolute thermal stability to increase machining precision and surface quality on the workpiece.

With the **HEIDENHAIN CTC** option, acceleration-dependent errors are compensated in order to further increase the surface quality and accuracy of the workpiece. Special setup cycles support the operator in setting up the kinematics and document the behaviour of the machine and the environment.

## Precision applications

Economical and reliable milling with absolute precision, with the best surfaces and the highest repeatability; this is what you can achieve with our newly developed **Precision-Line** milling machines for machining precision parts in tool and mould making and in production.

- Tool B, 10.500 rpm + 1 µm
- Tool B, 21.000 rpm + 1 µm
- Tool B, 31.500 rpm + 1 µm
- Tool B, 42.000 rpm + 1 µm



# HIGH SPEED *EAGLE* Competition- and Precision-Line

These high-quality options are included in the standard scope of both, **HIGH SPEED *EAGLE* Competition-Line** and **Precision-Line** machines:

- BLUM Laser LC50-DIGILOG
- Infrared measuring probe RENISHAW OMP 400
- EcoTec energy saving function
- Handwheel HEIDENHAIN HR510
- Prepared for automation
- HEIDENHAIN TNC 640 control incl. 19" Touchscreen
- Vibration damped polymer concrete bed
- Sealed, absolute HEIDENHAIN linear encoders
- Full enclosure with dust- and liquid-proof guides and drive elements
- LED workroom light



3-axis precision application



## OPS-INGERSOLL High Precision Cycle Cycle 330

Automatic stabilisation of thermally induced spindle displacement in the selected tolerance band.



High speed symbiosis

# Perfectly matched for each other

## HEIDENHAIN



### TNC 640 - Control unit of the latest generation

With strategies especially optimised for HSC and 5-axis machining, top results are achieved even with workpieces having different sizes. The specific concept of the V-Line in combination with the new features of the control unit, enables outstanding surfaces and precision with simultaneous optimisation of the machining time.





Individual for every application

# Cooling lubricant concepts and chip disposal



- Knoll coolant management
- Internal coolant supply and workspace flushing
- Scrap chain conveyor
- Belt filter
- Additional maintenance system for wet machining of graphite
- Heating and cooling systems
- Optimal design for your machining tasks



Wet machining of graphite



Variable and compact coolant management system in various expansion stages

New technologies for optimal results

# Innovative cooling lubricant options

## Aerosol Master®

**The formula for ATS:**  
**Avoid heat instead of defending it.**

An extremely fine aerosol is created from smallest quantities of lubricant. This is constantly regulated and supplied to the tool blade without any loss. Optimal lubricant particle application effectively reduces the development of friction heat.



Work image: Knoll

## Chip removal

Chips are immediately and permanently blown away from any position by a precisely directed strong air jet. The free machining area generates optimum conditions for the tool blade and workpiece.

## Cooling

At the same time, the compressed air ensures uniform and permanent cooling of all cutting edges. Friction pressure is greatly reduced, thereby protecting tools and significantly extending their service life. In complete dry processing!

## Lubrication

Depending on the requirements and material, the air can be enriched with an aerosol-quality lubricant. Each particle of the targeted lubrication arrives at the interface without segregation. Components come out of the machine dry and can be further processed immediately without cleaning and reworking.



Work image: MHT

## Process safety MHT medium distributor

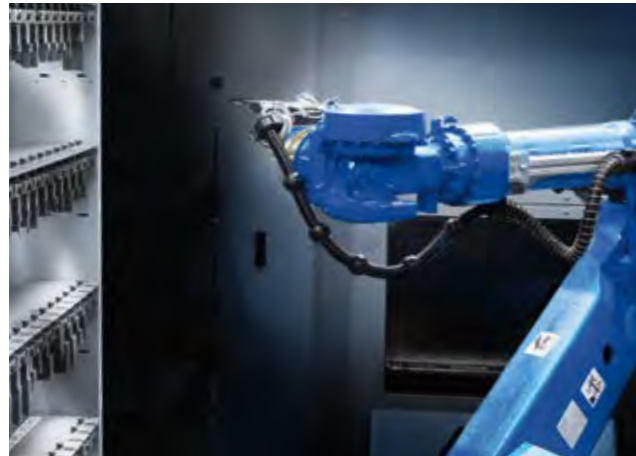
**The alternative for cooling lubricants, minimum quantity lubrication and internal coolant supply**

Compressed air is used to generate an air jacket along the cutting edges to the machining point, which cools, can be mixed with an aerosol-quality lubricant and removes chips from the machining point.



Completely from one source

# Flexible automation solutions



## Connection of handling systems

All of our machines are prepared for automation, whether as a single machine, as a cell, or line automation.

## Optimal accessibility

The possibility of loading with tools and workpieces from multiple sides offers ideal conditions for compact automation solutions without limiting the operator's accessibility to the work space.



## Fully equipped production plant:

- HIGH SPEED *EAGLE* V9
- HSK A63, 24.000 rpm
- 4<sup>th</sup>/5<sup>th</sup> axis with direct drives for highly dynamic simultaneous machining operations
- Workpiece changer
- Identification via RFID chips
- Tool changer, 30 positions internal, 181 positions external
- Full coolant management 1.200 litres

Industry 4.0

# Be prepared for tomorrow, today



With Industry 4.0 and the IoT, standardised interfaces are becoming increasingly important, e.g. when implementing requirements from the areas of process automation and condition monitoring.

With the HEIDENHAIN OPC UA NC Server, the TNC 640 offers a standardised interface for accessing data and functions of the control. OPC UA is a platform-independent communication standard according to IEC 62541 that meets many Industry 4.0 requirements:

- High data security
- Platform independence
- Scalability in horizontal and vertical communication

## Reduce basic energy consumption, conserve resources, save money.

EcoTec thinks and regulates for you and is designed to ensure that energy is only consumed when it is actually needed. It monitors and regulates optionally selectable warm-up programs, programmable wake-up functions, idle states after program end, and much more. Intelligently designed to reduce energy consumption to an absolute minimum!





# Service management

FAST  
DIRECT  
FLEXIBLE  
PERFECT



## Spare parts

As a guarantee of the availability of your machines, a rapid and flexible supply of spare parts is of essential importance to your economic success. Thanks to our comprehensive stock of spare parts, we can react to your requirements on short notice.

## Application support

An important part of the OPS-INGERSOLL service spectrum is the know-how transfer of our application technology. Our team of experts consists of experienced tool and mould makers, who will advise and support you in the implementation of your technical requirements.

## Maintenance

Regular maintenance intervals reduce downtimes and increase reliability and thus the service life of your machines.

## Training

In our training and technology centre, we have the facilities to provide you with theoretical and practical training to refine your expertise and operator skills. Benefit from the know-how of our experts!



## The Success Factory

Outstanding customer solutions are created here. This is where passionate and experienced mechanical engineering experts live. This is our home!

## Quality finale

Well thought-out, highly efficient production processes assure the high quality of all machines from the design to the delivery. This assures enthusiastic customers!







# The **EXPERT** Principle

Complete process  
performance

The 4 success factors for profitable  
process organisation:

- 1 *EAGLE* technologies
- 2 Automation solutions
- 3 Process experts
- 4 Application know-how



**OPS**  **INGERSOLL**  
Fly with the eagle!

OPS-INGERSOLL Funkenerosion GmbH • Daimlerstraße 22 • 57299 Burbach, Germany  
Telephone: +49 (0) 2736 446-0 • E-Mail: [info@ops-ingersoll.de](mailto:info@ops-ingersoll.de)  
[www.ops-ingersoll.de](http://www.ops-ingersoll.de)