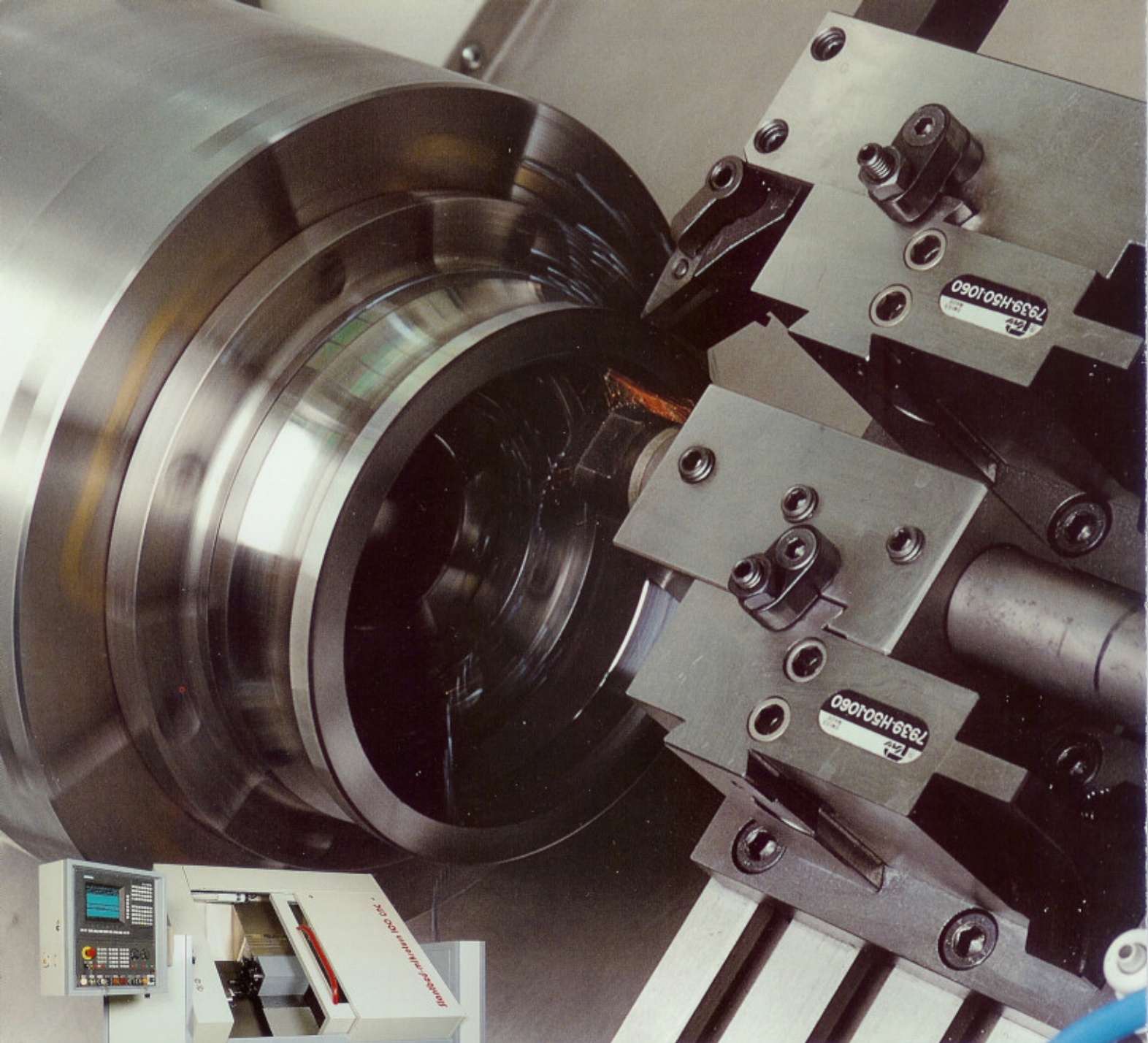




Finish hardturning
Diamond turning
High precision turning

Slantbed-Mikroturn 100 CNC


HEMBRUG
HAARLEM-HOLLAND

Introducing ultra precision technology
in a production environment

Unique design

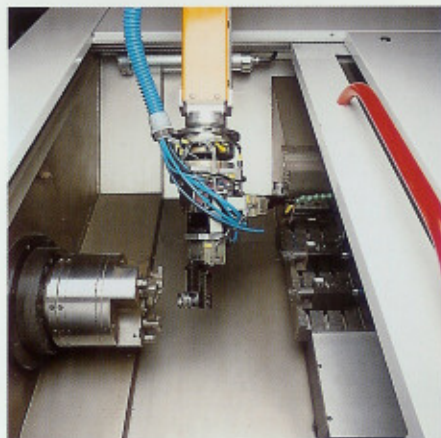


Manual workpiece loading

The name Mikroturn refers to a new generation of highly sophisticated ultra precision lathes. The Slantbed-Mikroturn 100 CNC is a breakthrough in modern design of oil-hydrostatic turning machines in the $0.01\text{ }\mu\text{m}$ (0.4 micron-inch) resolution range. The Mikroturn lathes employ the latest technology and Hembrug know-how in extremely fine turning.

Features

- hydrostatic main spindle, run-out $\leq 0.1\text{ }\mu\text{m}$
- hydrostatic slides, repeatability $\pm 0.1\text{ }\mu\text{m}$
- natural granite base with an integrated vibration damping system
- CNC-system resolution $0.01\text{ }\mu\text{m}$ (0.4 micro-inch)
- heat & vibration generating peripherals are isolated from the machine



Automatic workpiece handling

High precision turning

Apart from hardened steel and non-ferro materials, the Slantbed-Mikroturn 100 CNC can be successfully used for high precision turning of materials such as stainless steel, cast iron, plastics, graphite, 'green' ceramics, composites, etc. Numerous economic applications can be found in general workshops and mass production facilities.

Finish hardturning

The Slantbed-Mikroturn 100 CNC is specially developed for finish hardturning of precision steel workpieces having a hardness of HRC 50-70. Finish hardturning is a new technology, replacing time consuming and costly grinding operations.

For finish hardturning the Mikroturns are tooled with advanced cutting tools, such as CBN, mixed ceramics and Cermets. Mikroturn lathes are in use for fine machining of automotive parts, bearing rings, tools, injection moulds, hydraulic valves, etc.

Values for dimensional accuracy IT 3-5 ($2\text{ }\mu\text{m}$), geometrical accuracies $\leq 0.5\text{ }\mu\text{m}$ and for surface finish N 3-9 ($R_a = 0.1\text{ }\mu\text{m}$) have been obtained.

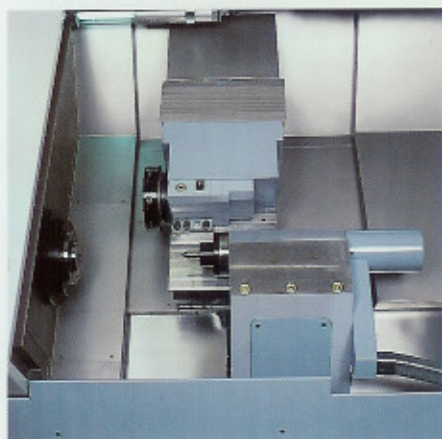
Bearing parts



Automotive parts

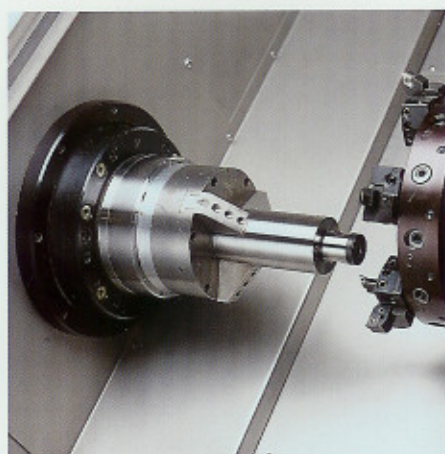
The Slantbed-Mikroturn 100 CNC is the state-of-the-art for finish hardturning, diamond turning and high-precision turning of workpieces requiring a high surface finish, as well as very stringent requirements of dimensional and geometrical accuracy.

The Mikroturn machines are built to achieve ultimate precision and productivity. Unique features of the Slantbed-Mikroturn 100 CNC are machine stiffness in combination with extremely high machine accuracy as well as superb damping properties.



Tailstock support for
work between centers
(optional)

Tools, moulds



Chucker version
(standard)

Diamond turned parts

Diamond turning

Extremely fine results in ultra precision turning can be achieved on non-ferro materials (aluminium, brass, nickel, etc.) with diamond turning.

Precision parts, such as VTR-drums, copier drums, mirrors, air & hydrostatic bearings, moulds, etc. are submicron machined on the Slantbed-Mikroturn 100 CNC using natural or industrial diamond tools.

Values for dimensional accuracy IT 0-3 ($1\text{ }\mu\text{m}$), geometrical accuracies $\leq 0.25\text{ }\mu\text{m}$ and for surface finish N 1-3 ($R_a = 0.01\text{ }\mu\text{m}$) have been obtained.

Hydraulic parts



Example on brass
workpiece

Roundness $0.08 \mu\text{m}$
(3.2 micro-inch)

Example on aluminium
workpiece

Surface finish
 $R_a = 0.007 \mu\text{m}$
(0.28 micro-inch)



Test on 300 hardened steel workpieces

Workpiece **Material: 100Cr6, HRC 60**
Dimensions: $\varnothing 16 \times 50 \text{ mm}$

Clamping **Precision 3-jaw chuck, air operated**

Cutting tool **PCBN, CCMW09T308-F with toolnose
radius $r_t = 0.8 \text{ mm}$**

Cutting technology **Cutting speed: $v_c = 160 \text{ m/min}$**
Feed: $f = 0.05 \text{ mm/rev.}$
Depth of cut: $a_p = 0.05 \text{ mm}$

Finish hardturning **Finish cut from $\varnothing 15.800 \times 15 \text{ mm}$
to $\varnothing 15.700 \times 15 \text{ mm}$**

Results **Excellent surface finish**
 $R_z = 0.5 - 1.5 \mu\text{m}$
**No white layer or other surface
damages detected**

**Dimensional accuracy without
compensation, spread (6s) $5.8 \mu\text{m}$**

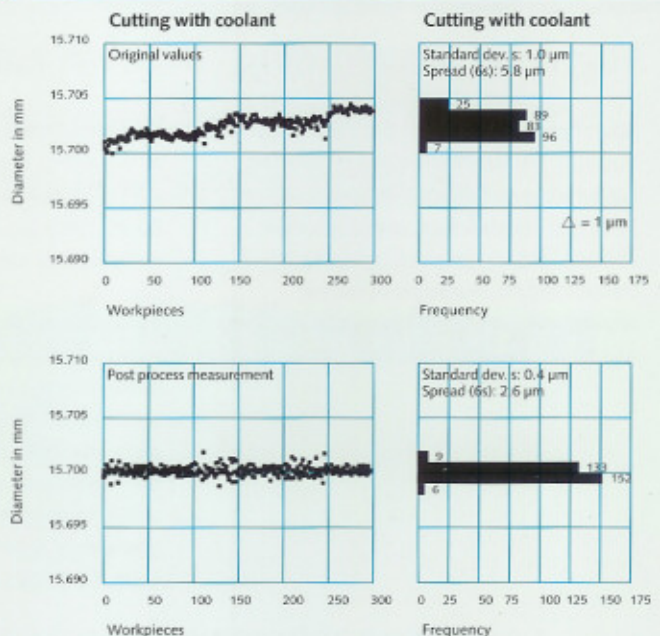
**Dimensional accuracy assuming post
process control, spread (6s) $2.6 \mu\text{m}$**

Source **Fraunhofer Institute for Production
Technology, Aachen, Germany**
(Dr. K-F. Koch)

Surface finish

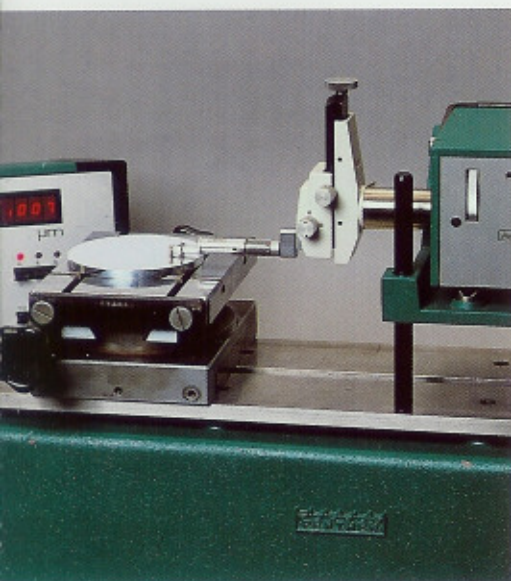


Dimensional accuracy



Natural granite base

The steel machine frame is filled with concrete and supports the natural granite base. The granite base weighs over 2.5 tons and is the reference plane for the headstock, slide assembly and (optional) tailstock. Between granite base and machine frame a system of vibration dampers is mounted, which blocks all vibrations over 7 Hz. The granite is protected by contactless stainless steel guarding. Good chip removal and accessibility are provided by the 45° slantbed design.



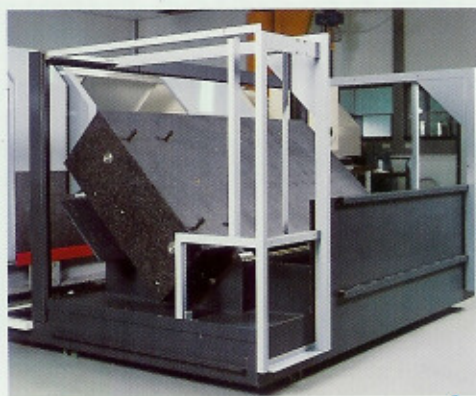
CNC-system, resolution 0.01 μm

The CNC system consists of a modern control with a resolution of 0.01 μm and digital interface for drives and main spindle and slide AC-motors. The CNC control easily reflects oscilloscope functions and graphics on the screen. The digital drive package in combination with 0.01 μm resolution gives a high dynamic response. This results in a very low circle form error and excellent step response for an improved surface finish during linear and circular interpolation.

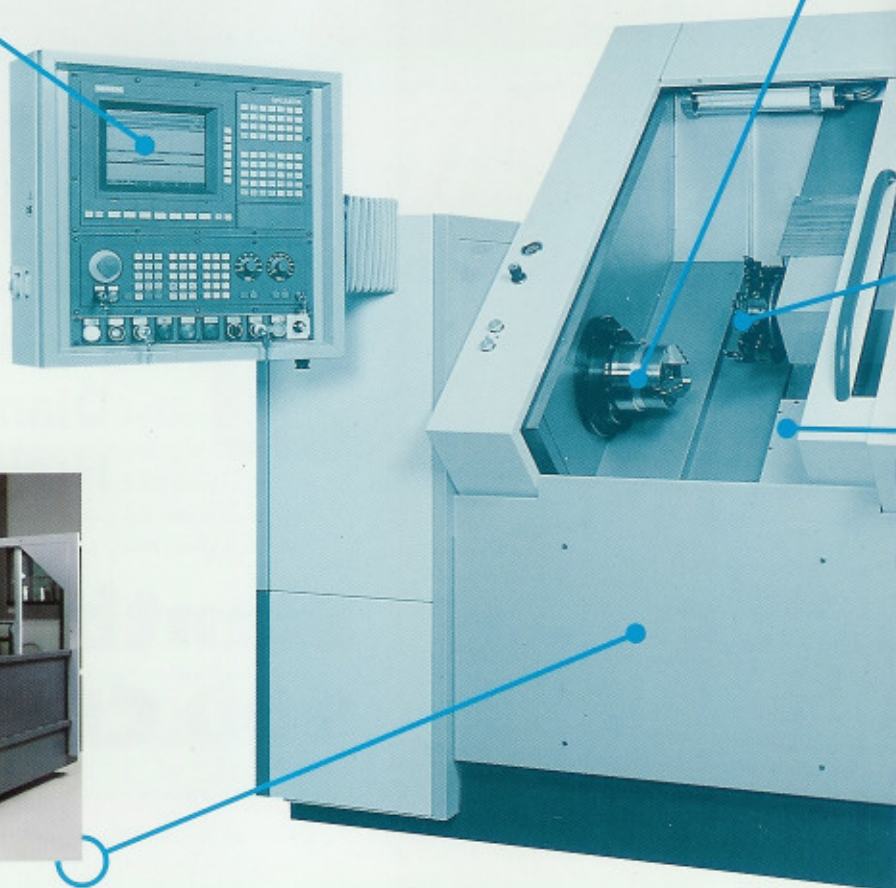
CNC-system, resolution 0.01 μm



Hydrostatic main spindle, run-out $\leq 0.1 \mu\text{m}$



Natural granite base



Hydrostatic main spindle

The main spindle is supported by two hydrostatic bearings, one combined axial/radial front bearing and one radial rear bearing giving an excellent 'free of wear' spindle run-out of better than $0.1 \mu\text{m}$. The hydrostatic bearings have air labyrinth sealing rings to prevent dust from penetrating the bearings from the outside and hydraulic oil leakage from the bearings from the inside.

The main spindle with standardised spindle nose provides the possibility of using various workpiece holding devices such as pneumatic collet or 3-jaw chucks, electric permanent magnetic chucks, vacuum chucks or other clamping fixtures.

Depending on the application and workpiece range hydrostatic main spindle versions are available up to 4,000 rpm, 6,000 rpm or even 10,000 rpm.

The direct drive has C-axis control and is driven by a brushless 7.5 kW motor.

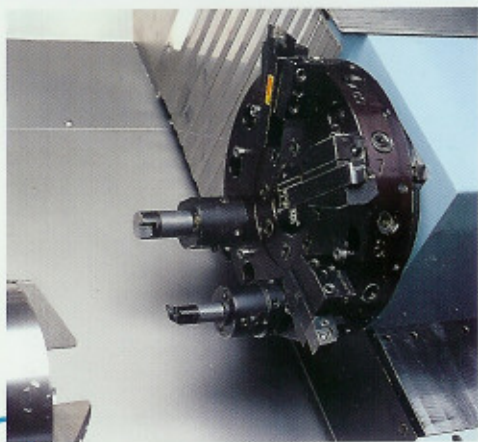
Tool turret (optional)

The vertical tool turret has a fast bi-directional electric drive and features a tool plate for 8 stationary tools. As an option driven rotary tools can be used in combination with the standard C-axis. Tool location is in accordance with DIN 69880 (VDI-standard).

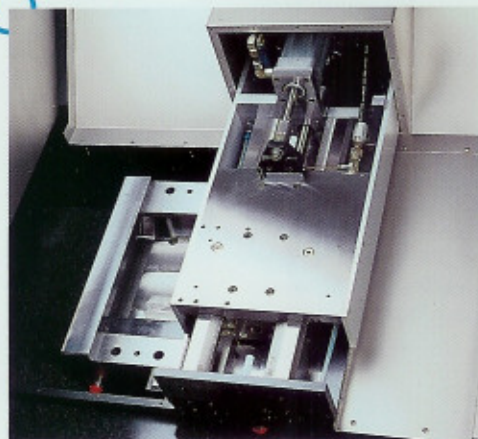
A 12-position tool turret as well as linear tooling are available as an option.

Hydrostatic X-Z slides

Both slides are supported by hydrostatic 'free of wear' flat guideways, giving 'zero-friction' construction and an extremely accurate repeatability of $\pm 0.1 \mu\text{m}$. The slides are controlled by brushless motors with precision ball screws and equipped with air-sealed precision scales.



Tool turret (optional)



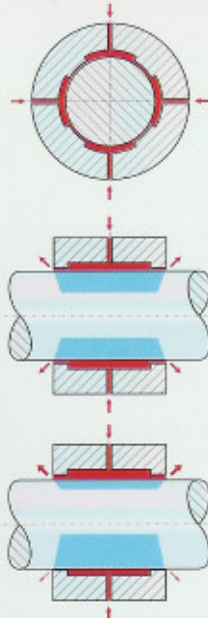
Hydrostatic X-Z slides,
repeatability $\pm 0.1 \mu\text{m}$

The principle of the hydrostatic bearing

Cross section of hydrostatic bearing

Longitudinal section of hydrostatic bearing

Longitudinal section showing reaction to displacement



■ oil
■ pressure

Hydrostatic bearings and guideways

- Excellent running accuracy
- Superb damping properties
- High stiffness, independent of speed
- No wear, ever lasting high accuracy
- 'Zero-friction', no stick-slip
- Good thermal stability
- No need for additional lubrication
- Improved tool life



Natural granite machine base

Natural granite machine base

- Good damping properties
- High thermal stability
- High static & dynamic stiffness
- Free of stress
- Corrosion free, non magnetic

Finish hardturning replaces grinding

- For improved productivity
Drastic reduction in cycle time, sometimes up to 80%
- For improved accuracy
OD, ID & facing in one set-up
No clamping errors
Good concentricity
- For improved flexibility
Making use of full CNC capabilities
Defined single point cutting tool
Reduced set-up times
- For improved environmental aspects
In many cases dry cutting
No disposal of grinding sludge

Technical data

Max. workpiece diameter for chucking applications

ø 310 mm

Max. diameter center workpieces (with tailstock)

ø 125 mm x 350 mm long

Hydrostatic main spindle, speeds up to
main drive power
spindle run-out

4,000, 6,000 or 10,000 rpm
7.5 kW
≤ 0.1 µm

Hydrostatic longitudinal and cross slides, repeatability
rapid traverse at 0.01 µm resolution

± 0.1 µm
10 m/min

32-Bit CNC system, resolution

0.01 µm

Tooling system

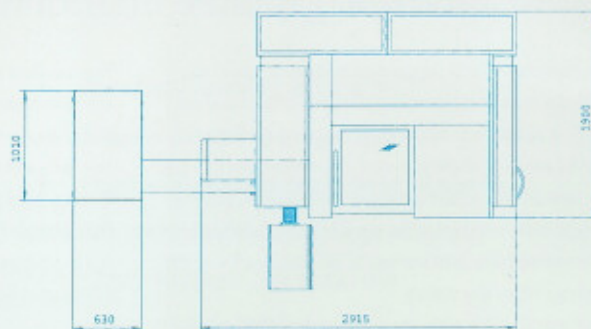
8 or 12 pos. tool turret
or linear tooling

Aerostatic tailstock spindle run-out

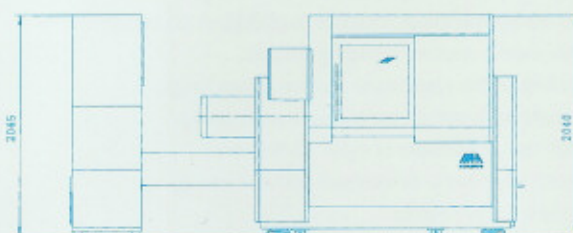
≤ 0.1 µm

Tailstock slide, stroke

590 mm



Top view



Front view

Options



Tailstock



Precision chucks



Vacuum clamping



Magnetic clamping device



Tool turret



Linear tooling



Tool measurement



Workpiece measurement



Automatic door



Automatic part handling system



Spraymist installation



Chip conveyor

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