Hembrug

Finish Hard Turning Machines

The **hard turning** company

HEMBRUG
MACHINE TOOLS

Hembrug
The Hard Turning Company

Hembrug has developed and manufactured hydrostatic ultra precision turning machines for over 45 years.
As turning specialists we are well known for product innovation and customized solutions in the field of hard turning.
The strength of the organization lies in dedicated engineering, expertise in electronics, pneumatics and oil hydrostatics as well as the commitment of our employees.

Our history
We have always believed in hard turning

Hembrug designed and built the first ultra precision turning machine with hydrostatic bearings 45 years ago. The application was aluminium memory discs that needed a smooth surface finish. This machine for diamond turning had superior static and dynamic stiffness and thermal stability. As from the introduction of CBN cutting tools, Hembrug started the investigation of finish hard turning within sub micron tolerances on a Mikroturn® machine. Our machine concept proved right and a new product/market opportunity was created. Finish hard turning has evolved into a simple, reliable and innovative process and is increasingly gaining ground at the cost of grinding technology.
With Hembrug finish hard turning technology many costly and time consuming cyclindrical grinding operations can be easily replaced, without losing part quality.

1679-1968
In 1679 the Dutch government founded the Ordnance factory "Artillery Inrichtingen" (A.I.) for the production of ammunition. A.I. started producing machine tools which they required for their own production. A.I. started selling machine tools to 3rd parties under the Hembrug name. More than 10,000 machines have been supplied world wide since then.

1989-1999
1989 was the start of the development of finish hard turning within submicron tolerances on the Mikroturn® series. This resulted in the development of the Mikroturn® 100 designed to machine medium sized workpieces in 1994. The Mikroturn® 100 series is still being sold world wide today.

1969-1988
The company started the development of a turning machine with hydrostatic bearings under the registered name Mikroturn®. First application: computer memory disc that needed a very smooth surface finish. In 1982 Hembrug was privatized and decided to focus completely on the development, assembly and marketing of precision lathes.

1999 to present
In 1999 the first Vertical Mikroturn® was introduced to machine hardened parts up to ø 1,000 mm. In 2004 we designed a 4-axis version allowing a cycle time reduction of up to 40%. The horizontal Mikroturn® Twin Spindle, introduced in 2011, allows cycle-time improvements of up to 30% and production improvements up to 100% when compared to single spindle lathes. Mikroturn® 500 XL (large and heavy parts) and Mikroturn® 200L (long shafts) have been successfully introduced to serve specific customer needs.

What is **finish hard turning?**

Finish hard Turning refers to the process of single point cutting of hardened parts having hardness between 55 and 68 HRC within the 2 micron range. It's a simple, reliable and innovative process and is increasingly gaining ground at the cost of grinding technology. In particular for applications where the manufacturer needs to reduce change over times.

With the Hembrug finish hard turning technology the more costly and time consuming cyclindrical grinding operations can be easily replaced, without losing part quality.

Achieved tolerances in hardened steel 68 HRC and up to ø 1,500 mm

- Surface finish tolerances (Ra) : 0.1 - 0.4 µm
- Shape accuracies : 0.1 - 2 µm
- Dimensional accuracies : 2 µm

Finish hard turning offers siginificant **advantages** over cylindrical grinding

Cost **saving**

Multiple operations can be done in one set-up which eliminates the need for a multi-step grinding process that historically would involve two or three seperate operations. One turning machine performs all the operations.

Environmental **friendly**

Hard turning is a dry and environmental green process due to the absence of grinding fluids and grinding sludge.

Narrow **tolerances**

Finish hard turning allows machining of parts in one set up resulting in narrow tolerances especially for concentricity, squareness and roundness.

More **flexibility**

With a single point standard CBN tool and clamping set-up a wide variety of parts with different contours and sizes can be machined. This provides more flexibility in production enviro-ments and reduces change over time.

Higher **productivity**

Finish hard turning ensures more material removal per machining cycle than grinding. This makes hard turning up to 3 to 4 times faster over cylindrical grinding.

Variation within **3 micron**

Finish hard turning of cylindrical rollers

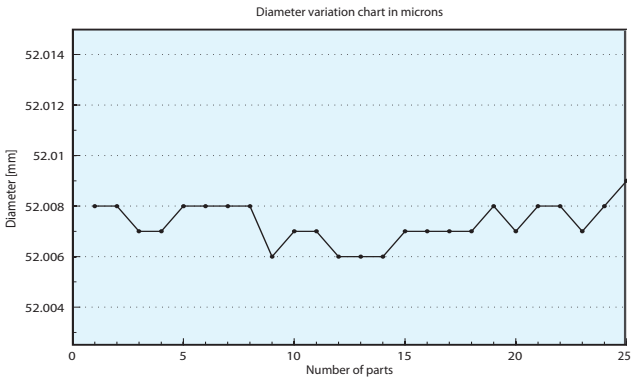
Size: 52 x 80 mm, Material: 100Cr6, Hardness: 60 HRC,
Stock: 0.3 mm. An acceptance test of 25 parts shows a diameter variation within 0.003 mm
Size min. 52,006 mm
Size max. 52,009 mm

Form accuracies

Roundness error	< 0.27 µm
Flatness face	< 0.23 µm
Run-out face	< 0.23 µm

Surface finish Ra

Faces	< 0.2 µm
O.D./Crown	< 0.4 µm



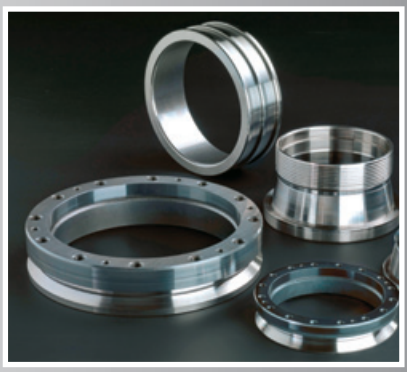
Examples of finished hardturned parts

The Mikroturn® machines can be used for a wide range of parts that fit within the maximum turning diameter of the horizontal (max ø 450 mm) or vertical machines (max ø 1,500 mm).

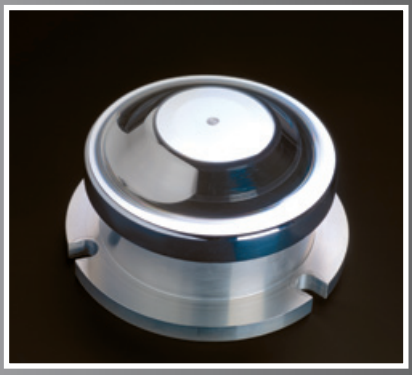
We have developed hundreds of applications for manufacturers throughout the high precision industry. New applications and machine options, some of them in combination with grinding or polishing are constantly added to the program.

Automotive parts

Tools, moulds



Bearing Parts



Diamond turning

Hydraulic parts

Roller bearings

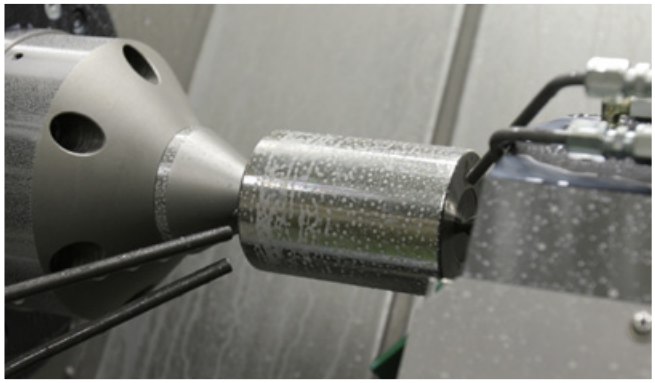
Ball srew nuts

Case study

The London Eye

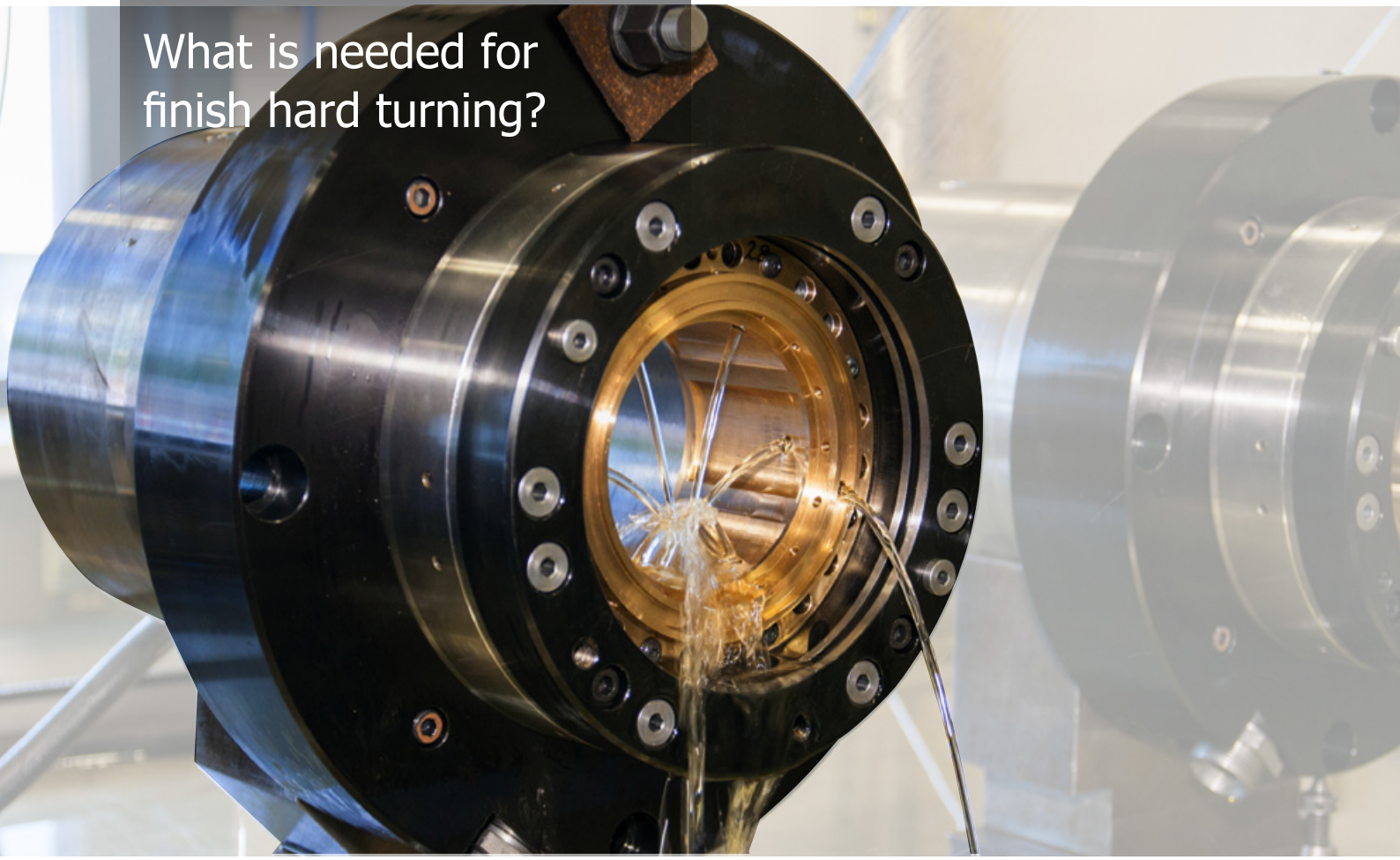
Foto's: Schaeffler AG

In order to safeguard the flawless functioning of the London Eye and Great Beijing Wheel first class bearing components are implemented. The rollers have all been hard turned on hydrostatic Mikroturn® finish hard turning machines.



Technology

What is needed for finish hard turning?

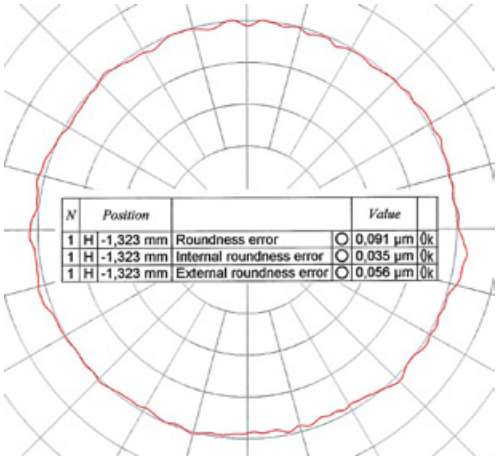


Hydrostatics for the main spindle and guideways

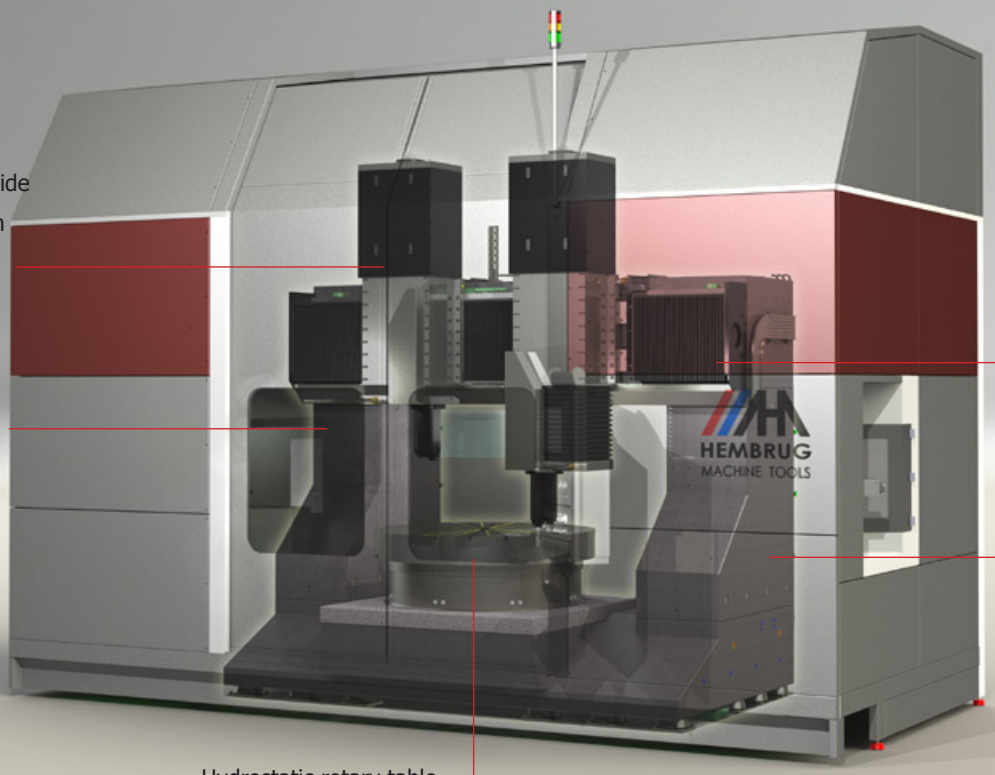
High accuracy on precision parts can only be achieved with suitable machine concepts. Besides the tooling system and machine base, a superb static and dynamic stiffness of the main spindle and guideways is required.
The hydrostatic system in the Hembrug Mikroturn® series is superior to any conventional bearing system and offers significant advantages.

- A new continuous oil film over the entire length of the guideways and bearing elements provides excellent damping properties and a high static and dynamic stiffness.
- The absence of metal contact and thus wear ensures a long and reliable machine life and low operational costs.
- The temperature controlled oil flow guarantees thermal stability.
- Due to the absence of the stick-slip effect smallest incremental steps of 0.01 microns are possible.

Due to the absence of metal contact and thus wear the Hembrug main spindles have, in principle, an infinite life. The chart shows a run-out of the main spindle of 0.09 micron at 3,200 rpm. This run-out accuracy was measured on a 17 year old Super-Mikroturn®. Hembrug main spindles are specified to have a maximum run-out of 0.1 micron.



Vertical-Mikroturn® 1500 V4



Natural granite machine base

During the cutting of hardened steel parts high process forces are generated. These have to be absorbed by the machine tool system. That is why natural granite has been selected as base material. Natural granite offers much higher stiffness than polymer concrete or other base materials. It is corrosion and stress free and has a low thermal expansion coefficient resulting in superior thermal stability. The natural granite machine base is isolated from the shop floor by vibration dampers.

High **resolution**

Hembrug Mikroturn® machines are equiped with a Siemens 840D sl CNC control having 0.01 micron resolution, Heidenhain linear measuring systems and digital interface for drive package of main spindle and slides. The digital drive package in combination with 0.01 micron 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.

Thermal stability

The thermal stability of the machine is guaranteed by a constant oil flow of which the temperature is kept at 20° ±0.2 degrees Celsius.

Turn key solutions

for 24/7 production

The Mikroturn® hard turning machines can also be equiped with automated part handling and post process measuring equipment. All solutions are based on proven technology and combine the advantages of the hard turning process with the efficiency of automation.

Process know-how

Technology transfer, application know-how at the highest level

Hembrug engineers have developed hundreds of applications and the company possesses a wealth of knowledge on part holding, programming, selection of tools and the cutting process in particular. Every day new applications are added. Through a customized training we let you become familiar with the machine and we walk step by step through the hard turning process. This ensures that after the machine installation you are always capable of getting the full potential out of the machine and the advantages that the hard turning process has to offer. In addition to customized training courses Hembrug also offers basic training courses. All training courses are organized at the Hembrug application centre in Haarlem.

Engineering focus on today's and future demands

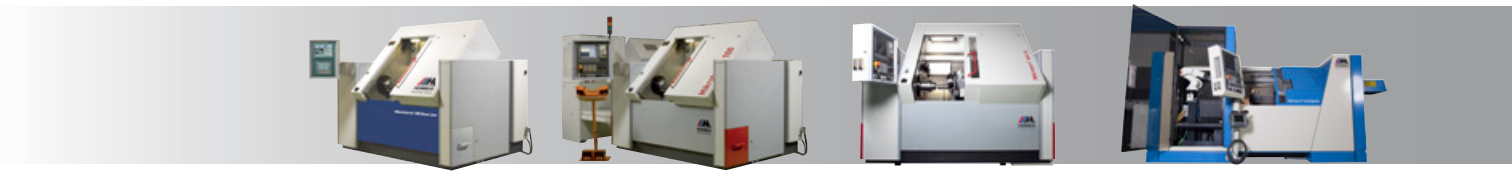
The world around us is changing rapidly. In order to meet today's and future customer demands, the Hembrug engineers are permanently facing new challenges. New demands on productivity, safety, cost saving, precision and environment are met by development of modern machine tools. From dual spindle design to hybrid machine concepts that combine turning and grinding or polishing operations: no effort big enough to serve our customers' needs. Hembrug Machine Tools: always a few steps ahead of the competition.

Hembrug **Sales** and **Service** close to the customer

In offering a full service package Hembrug aims to support the customer from transport, commissioning, process development, operator-, programmer- and maintenance training to long term supply of spare parts and after sales service. Also inquire after our possibilities for retrofit on older machines.

Made in The Netherlands

Hembrug Mikroturn® machines are built to order at the Hembrug facility in The Netherlands. All hydrostatic key components are produced in house.



Hembrug Mikroturn® Horizontal series

Specifications	Base Line	100	200 L	500 XL	Twin
Max. turning diameter	ø 380 mm	ø 380 mm	ø 380 mm	ø 500 mm	ø 100 mm
Max. turning length	350 mm	350 mm	700 mm	500 mm	50 mm
Max. part weight	50 kg	50 kg	50 kg	300 kg	1 kg
Max. spindle speed	4,000 rpm	2/4/8,000 rpm	4,000 rpm	2,000/1,200 rpm	8,000/10,000 rpm
Nominal torque	50/100 Nm	50/100 Nm	50/100 Nm	249/300 Nm	50 Nm
Run-out main spindle	0.15 µm	0.1 µm	0.1 µm	0.1 µm	0.1 µm
Z-Axis travel	350 mm	350 mm	750 mm	750 mm	350 mm
X-Axis travel	240 mm	240 mm	210 mm	400 mm	260 mm
Repeatability guideways +/–	0.1 µm	0.1 µm	0.1 µm	0.1 µm	0.1 µm
Rapid traverse rate	10 m/min	10 m/min	30 m/min	30 m/min	30 m/min
Max. feed rate	0-10 m/min	0-10 m/min	0-30 m/min	0-30 m/min	0-30 m/min
CNC resolution	0.1 µm	0.01 µm	0.01 µm	0.01 µm	0.01 µm
Positioning accuracy	1 µm	1 µm	1 µm	1 µm	1 µm

Hembrug Mikroturn® Vertical series

Specifications	650 V	800 V	1000 V	1000 V4	1500 V4
Max. turning diameter	650 mm	800 mm	1.000 mm	1.000 mm	1.500 mm
Max. turning length	350 mm	350 mm	350 mm	350 mm	350 mm
Max. workpiece weight incl. chuck	800 kg	800 kg	2,000 kg	2,000 kg	3,000 kg
Max. spindle speed	1,200 rpm	600 rpm	200 rpm	200 rpm	200 rpm
Nominal torque	270 Nm	300 Nm	800 Nm	800 Nm	1,200 Nm
Run-out main spindle / rotary table	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm
Z-Axis travel	400 mm	400 mm	400 mm	400 mm	400 mm
X-Axis travel	700 mm	700 mm	700 mm	750 mm	750 mm
Repeatability guideways +/–	0.1 µm	0.1 µm	0.1 µm	0.1 µm	0.1 µm
Rapid traverse rate	10 m/min	10 m/min	10 m/min	10 m/min	10 m/min
Max. feed rate	0-10 m/min	0-10 m/min	0-10 m/min	0-10 m/min	0-10 m/min
CNC resolution	0.01 µm	0.01 µm	0.01 µm	0.01 µm	0.01 µm
Positioning accuracy	1 µm	1 µm	1 µm	1 µm	1 µm

Represented by:

ISO9001 CERTIFIED

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