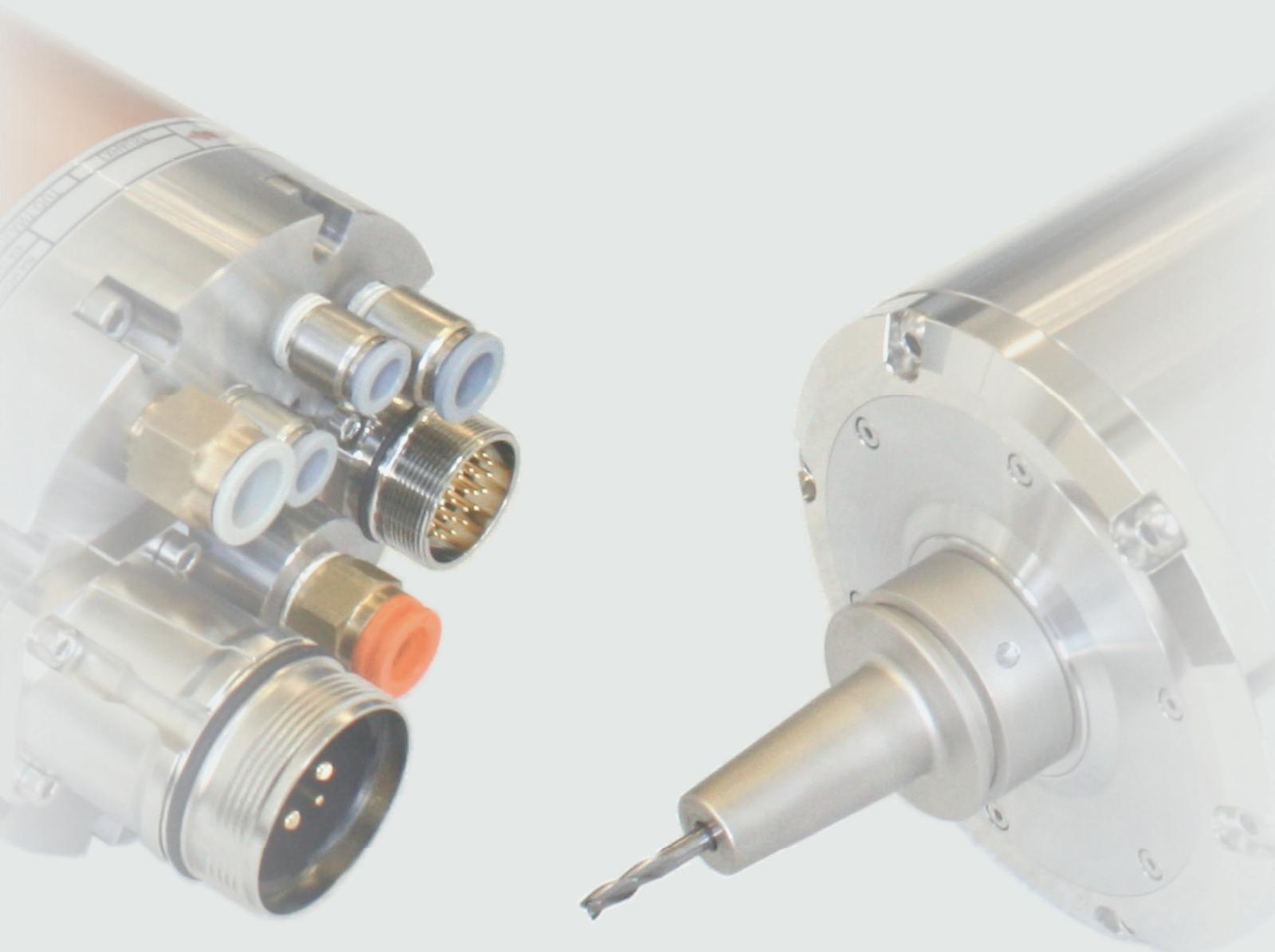




LEVITRON

NON-CONTACT PRECISION MOTION

UASD-H40A (HSK-E40, axial spindle connectors)



Levicron

The development, manufacturing, and sales of motor spindle solutions with non-contact bearing technologies for ultra-precision and CNC machining are Levicron's core businesses.

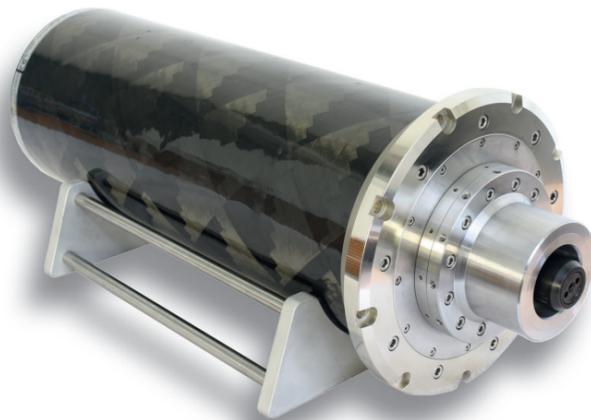
At Levicron, bespoke proven analytical methods and simulation tools for structural analysis and fluid dynamics complement sound practical experience of spindle development and production. Together with the first-ever aerostatic tool spindle comprising an industrial taper interface (HSK) and full CNC functionality, products from Levicron are now used for CNC-machine precision parts with optical surface finish all around the world.

Our requirements for our products and those of our customers prevent the use of off-the-shelf components. Therefore, not only the patented bearing technology and patent-pending spring-free HSK taper clamping systems can be found in our motor spindles, but also in-house developed motor, encoder and tool clamping solutions.

A vertical manufacturing integration of more than 90 % incorporates CNC turning, -milling, -diamond machining, -cylindrical/ bore grinding, -wire cut EDM, and bespoke machining solutions. You can find all our sophisticated production tests and dynamic balancing methods under one roof.

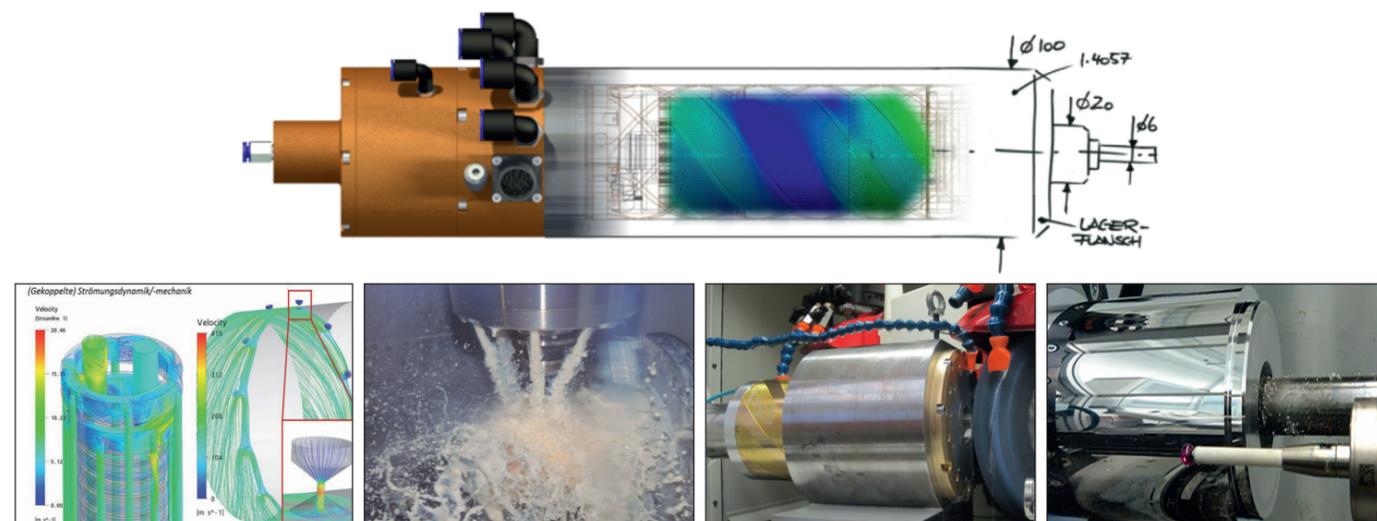
The quality, speed, and accuracy of Levicron spindles and the requirements coming from the applications are used to make it necessary to develop bespoke encoder and motor solutions as well as solutions for HSK tool clamping, HSK tool holding, and others. Because of their unique performance and functionality, some solutions have been made available for our customers as off-the-shelf items.

Although Levicron had to reinvent the wheel more than once, our customers can confirm that our wheels run smoother and faster than others. As a result, tool and work-holding spindle solutions for turning, milling, and grinding can provide the customer with unique thermal stability and robustness at shaft dynamics, errors in shaft motion, and speeds that have not been available so far.



Levicron

All in house developed and manufactured Ultra Precision Technology for CNC Machining



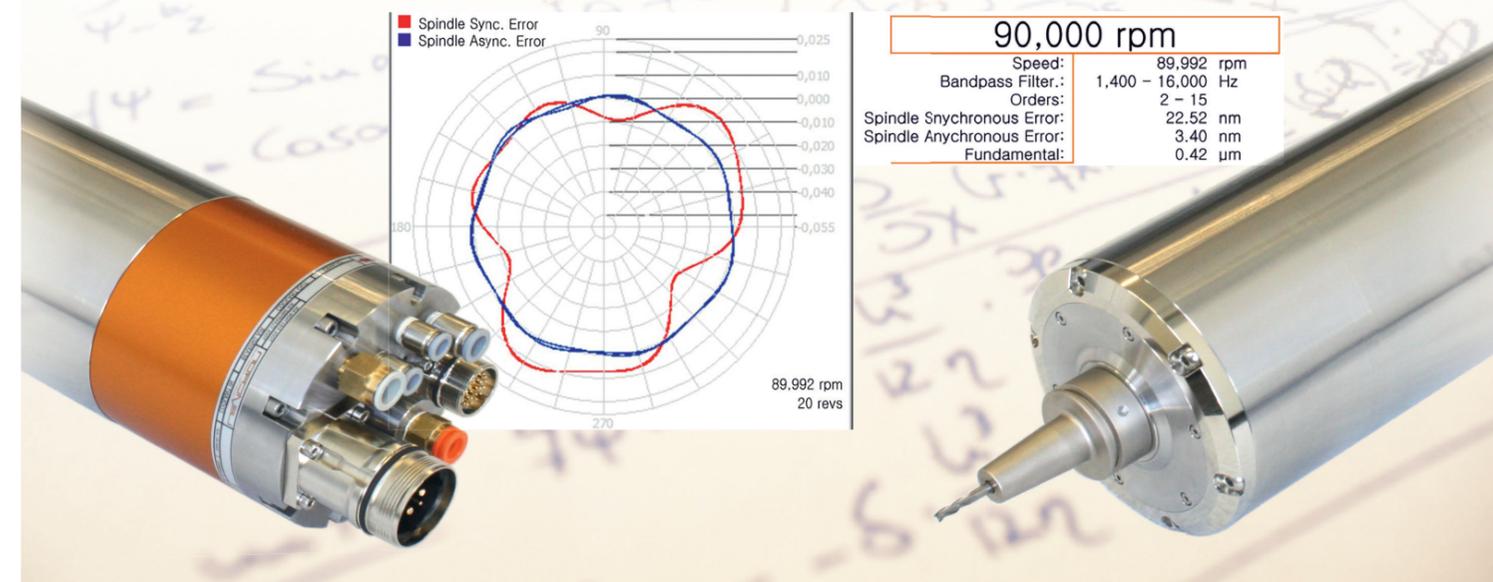
Why aerostatic bearing systems for tool and work-holding spindles?

Although it is difficult to believe for many engineers that the radial stiffness of our tool and work-holding spindles is comparable with the radial stiffness of actual roller-bearing spindles, the axial stiffness can even be higher. Compared to the tiny Hertzian contact in a roller bearing, ultra-thin bearing gaps combined with a large bearing surface lead to a comparable bearing stiffness. Combined with our high-pressure aerostatic bearing technology, it leads to even higher load capacities. Also, bearing gaps with only a few microns in width allow very high shear velocities and compensate for shape errors. This averaging effect of the air film between the shaft and the bearing allows a shaft rotation more controlled than the sum of all shape errors.

Technical benefits	Customer benefits
<ul style="list-style-type: none"> Higher speeds: speeds of up to 100,000 rpm with HSK-E25 tool holders Significantly more minor synchronous and asynchronous spindle errors: dynamic run-out values < 0.5 micron and errors in shaft motion of < 30 nm at any speed Thermal stability: spindle soak time < 5 min., axial shaft growth < 5 micron, X/ Y stability < 0.5 micron Wear-free and stable operation even at top speed Modular and service-friendly cartridge design Oil and grease-free operation 	<ul style="list-style-type: none"> Higher productivity and reduced tool wear Remarkably better surface finishes in any material; suitable for ultra-precision machining Stable operation at any speed with no time limit Cost-effective assembly due to a modular spindle design Oil- and grease-free operation suitable for medical parts and applications within the food industry

Solutions from Levicron - bespoke solutions to not compromise accuracy and performance:

- Patented bearing technology for outstanding shaft errors in motion, minimized air consumption & spindle stiffness
- Patented automatic and spring-less tool interface for DIN69893 (HSK) taper clamping to give the exceptional shaft dynamics and reliability
- Bespoke iron-less motor solutions for ultra-precision machining & high-power motor options
- In-house developed integral encoder systems with a reduced number of parts and a reduced size compared to industry-standard
- DIN69893 (HSK) tool holder series UTS-x for ultra-precision machining



UASD-H40A

Full-range high-pressure aerostatic tool spindle with automatic spring-less HSK-E40 tool interface.

Description

Roughing with a 10 mm tool in steel and yet having a long-term stable 60,000 rpm for ultra-precise finish machining with the optical quality provided by one spindle would allow the end customer to machine precision dies on a single machine. The **UASD-H40A** achieves this goal.

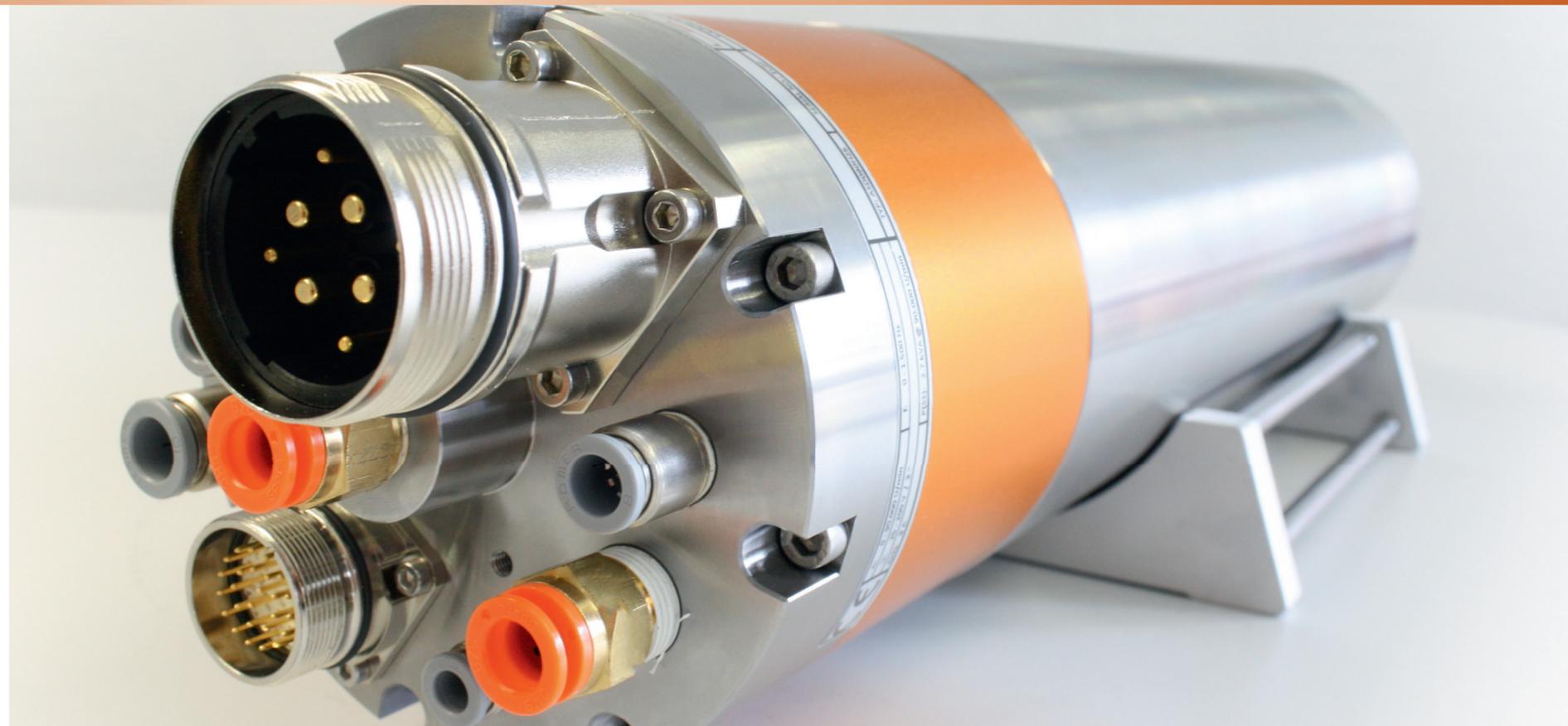
On the one hand, Levicron's patented high-pressure aerostatic bearing system allows radial and axial loads of up to 400 kg on the tool. At the same time, it offers its little sister's usual low power dissipation level and ultra-precise properties, „ASD-H25“ with HSK-E25 tool clamping.

What is the added value?

Compared to a hydrostatic bearing principle, which is characterized by excellent surface generation, the user benefits from further advantages.

In addition to the same load capacities, a significant saving in energy consumption (with even 50% higher maximum speeds), peripheral costs, and service, the elimination of complicated sealing also result in a much simpler and more compact design.

The spindle is enclosed in a housing with a standard diameter of 120mm, an in-house developed springless **HSK-E40** tool clamping system, and a specially developed aerostatic rotary union for vacuum, air, and KSM up to 80bar, **the first full-range tool spindle** for roughing and high-speed cutting with **HSK-E40** results in speeds of up to 60,000 rpm.



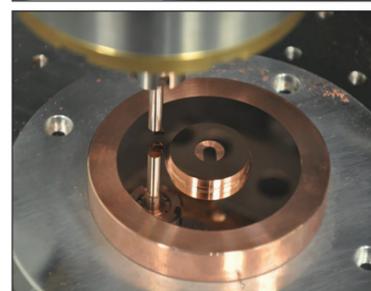
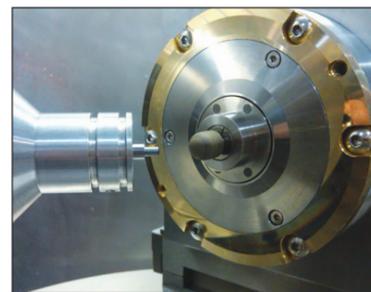
- > **True full-range** ...from roughing to high-speed finishing
- > **Wear-free** ...patented aerostatic bearing system
- > **60% energy saving** ...compared to a hydrostatic spindle
- > **Ultra-sonic safe** ...bearing and tooling system

At a glance, UASD-H40A

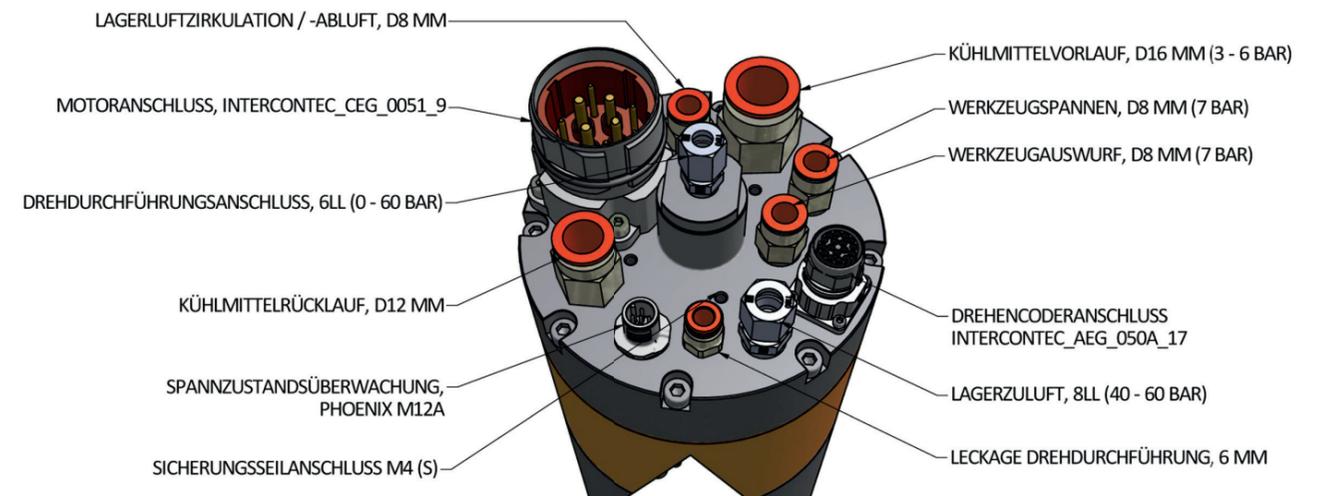
Tool interface	HSK-E40, automatic, spring-less (SLH40)
Body diameter	120 mm
Motor options	3 phases, 2 pole permanentmag. synchronous max. 400 V, 4 Nm / 10.5 kVA S1/ 100%
Motor torque	4 Nm, S1/ 100%
Shaft power	11 kW, S1/ 100%
Angular position control	1 VSS SinCos, 88 lines, zero-flag
Nominal speed	0 - 60,000 rpm
Tool change system	pneumatic, 4bit tool clamp status monitoring, tape cleaning air
Spindle cooling	thin-film liquid cooling
Bearing system	high-pressure aerostatic, 40 -60 bar
Accuracy, dynamics	dynamic tool run-out < 0,5 µm *) Error-motion < 50 nm
Axial shaft growth	< 0,6 µm **)
Cutting fluid feedthrough	2x cooling lubricant nozzles on spindle front (option)
Spindle connectors	axial outgoing (Dmax 100mm)

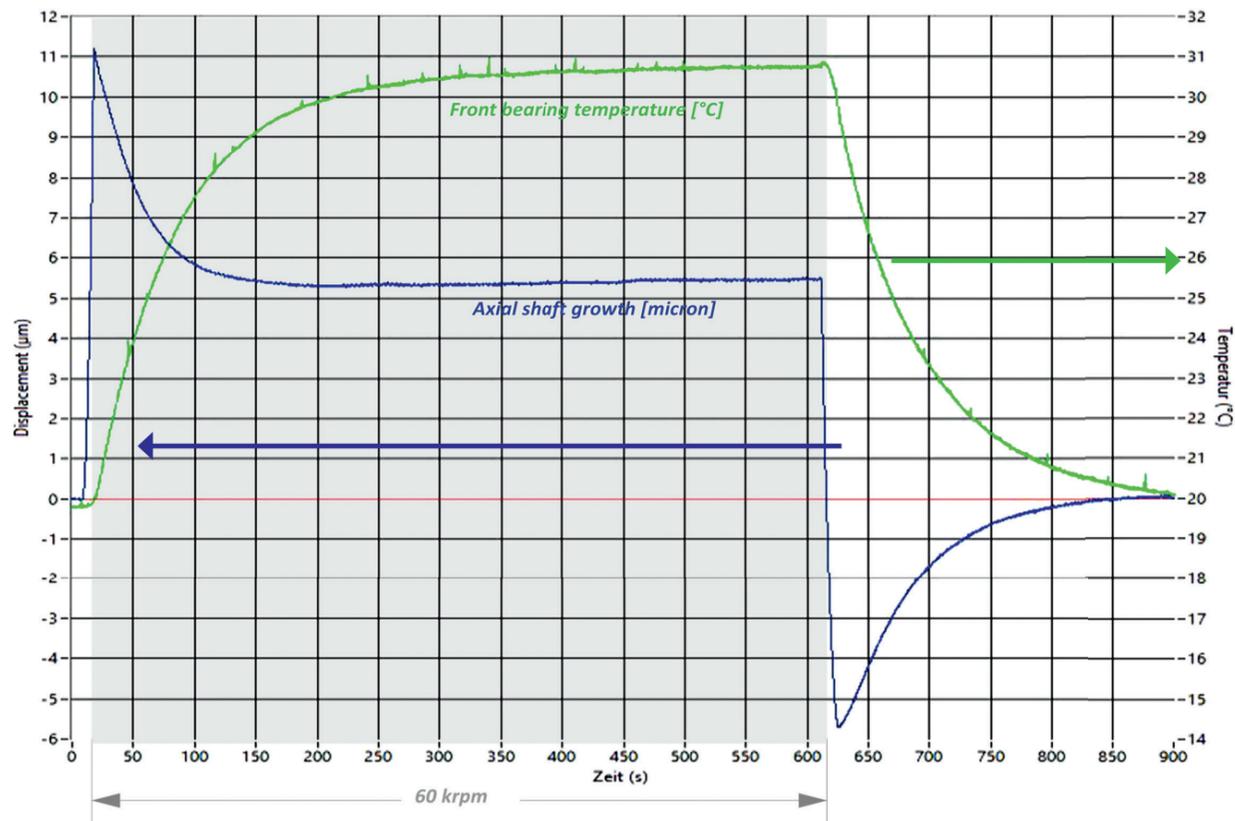
*) if used with tool holder series UTS-40

***) from cold/ standstill to 60,000 rpm/ warmed through



Coolant/ air through shaft (optional)
Patented spring-less HSK-E40 tool clamping
High-pressure aerostatic bearing technology
High-efficient thin-film liquid cooling





UASD-H40A - axial shaft growth (left Y-axis) and front bearing temperature (right Y-axis) with time from cold and standstill to 60,000 rpm and back.

UASD-H25/A and UASD-H40A, a comparison

Similar to our spindle model UASD-H25/A with HSK-E25 tool clamping, our **UASD-H40A** with **HSK-E40** tool interface also features a high-pressure aerostatic bearing system but for 40 - 60 bar supply pressure.

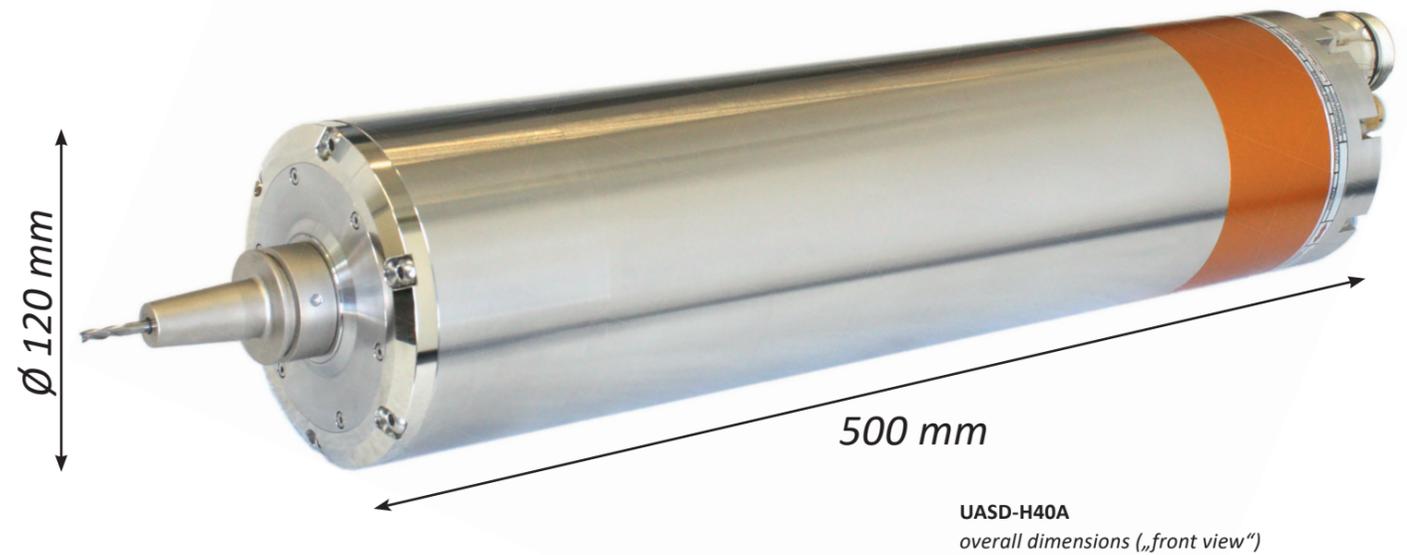
With this technology, both spindle types offer load capacities in the range of hydrostatic spindles but at an accuracy, thermal stability, and speed level of spindles with aerostatic bearings. With oil-hydrostatic bearings, a costly and complex sealing technology is required, and a tremendously high power input at higher rotation speeds, high-pressure aerostatic bearings allow a simplistic design at only a fracture of input power.

UASD-H25A and UASD-H40A, test results

		UASD060H25A	UASD060H40A
Tool interface	[-/-]	HSK-E25	HSK-E40
Body diameter	[-/-]	100 mm	120 mm
Bearing air supply pressure	[bar]	20 - 30 *)	40 - 60 **)
Speed	[rpm]	0 - 60,000	0 - 60,000
Shaft power, S1/ 100%	[kW]	4.1	10.5
Static radial ult. load capacity at the spindle nose	[N]	900 (275 %)	2,500
Static ult. load capacity	[N]	1,300 (255 %)	3,000
Static radial stiffness at the spindle nose	[N/ µm]	83 (202 %)	100
Static axial stiffness	[N/ µm]	120 (180 %)	120
Static air consumption	[NI/ min]	90 (180 %)	220
Dynamic tool run-out	[µm]	< 0.3	< 0.4
Shaft error in motion	[nm]	< 28	< 35

*) values are taken at 20 bar supply pressure

***) values are taken at 6 bar supply pressure



Data Sheet UASD-H40A

		UASD060H40A
General	Body diameter	[mm] 120
	Total length	[mm] 500
	Weight	[kg] 32
	Speed	[rpm] 60,000
Tool clamping	Tool interface	[-] HSK-E40, spring-less
	Operation	[-] pneumatic
	Clamping / eject Pressure	[bar] 8
Motor	Type	[-] 3 Phases, BL-DC, synchronous
	Constant torque	[Nm] 4.0
	Poles	[-] 2
	max. Phase voltage, RMS	[V] 360
	Rated current	[A] 41
	Peak current, RMS	[A] 60
	Shaft power	[kVA] 10.5
Rotary encoder	Type	[-] incremental
	Lines	[-] 96
	Signal A/B	[-] SinCos, 1 VSS
	Zero flag	[-] yes (digital/ analog)
Bearing system	Bearing air supply pressure	[bar] 40 - 60 (ECO: 10), 30 optional
	Air cleanliness, ISO8573	[-] 2
	Static radial zero position stiffness at the spindle nose	[N/µm] > 110 *)
	Static radial load capacity at the spindle nose	[N] > 2,500
	Static axial zero position stiffness	[N/µm] > 180 *)
Shaft feedthrough	Axial load capacity	[N] > 3,000
	Air consumption	[NI/min] < 230
	Medium	[-] Vauum, Air, Fluids
Stability and precision	Medium pressure	[bar] < 70% bearing pressure
	Taper run-out TIR	[nm] < 100
	Shaft error in motion	[nm] < 50
	Dynamic tool run-out *)	[µm] < 1 **)
	Spindle soak time	[min] < 6
	Axial shaft growth	[µm] < 5

*) including bearing and material stiffness

**) if used with the UTS-40 tool holder series



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