



Linear Motor Drive / Ultra High-speed / Milling Center

UH430L/UH650L



create your future

UH430L UH650L

*Linear Motor Drive /
Ultra High-speed /
Milling Center*



Sodick started manufacturing high-speed milling machine to respond the customers' demands to realise high-precision electrodes.

After Sodick developed the world's first linear motor drive EDM, the company developed the MC180L, a machining center with linear motor drive, in 2001. In 2007, Sodick launched the best selling linear motor drive milling machine range „HS Series“ which specialized in high-speed milling, aiming to achieve an unrivaled high accuracy and advanced surface quality.

1986

NC Electrode
Milling Machine
APM Series



1987

Machining Center
MC Series

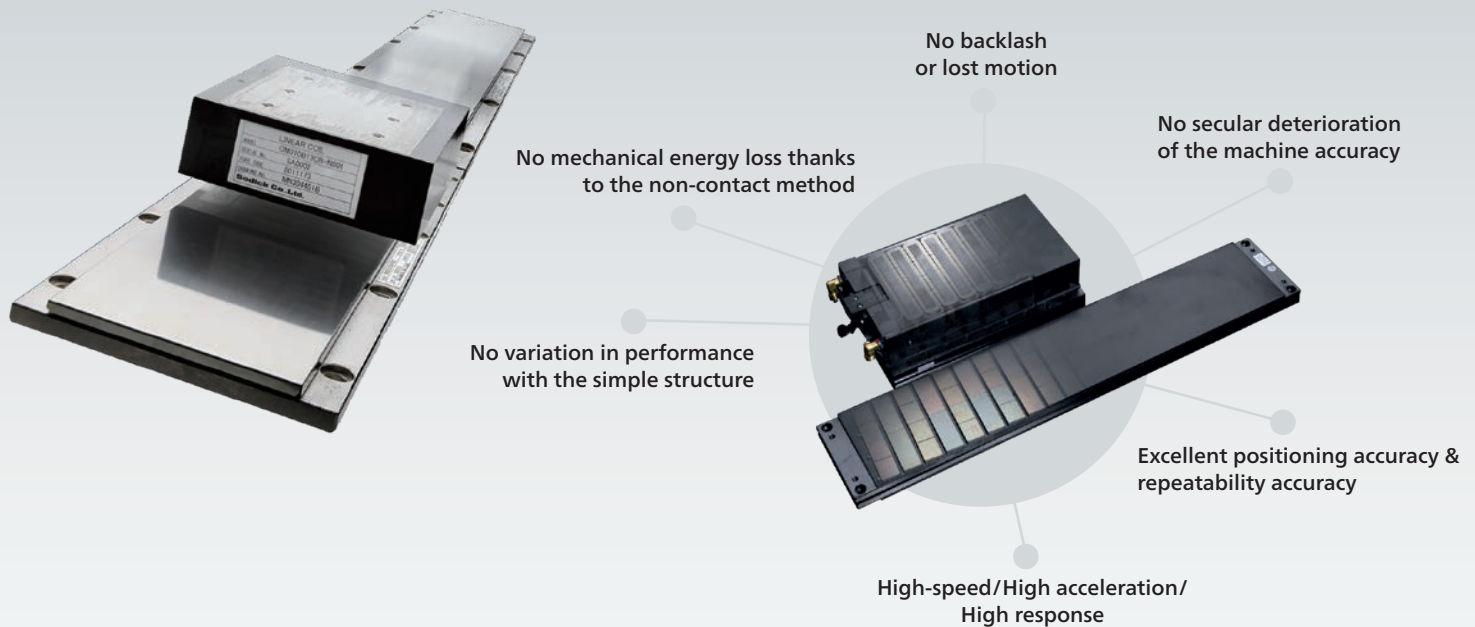


2001

Linear Motor Drive
Machining Center
MC180L



- The simple configuration of the magnet plate and the coil unit maintains high repeatability accuracy with no backlash and without friction.
- Since there is no secular change, stable positioning accuracy of the machining axes can be maintained over a long period.
- Even during high-speed feeds between minute distances, this machine demonstrates the best drive performance for high-speed milling machining without positioning deviation or speed errors.
- It has an innovative designed cooling system; the coolant fluid runs through the linear motor coils. Thanks to this patented cooling system, it can maintain its advanced performance.



Advantages of Sodick Linear Technology

In 1998, Sodick released the world's first linear motor drive die-sinker EDM, and has accumulated our experience, knowhow and reliability over 20 years with total shipments of 50,000 machines. Sodick will continue to improve and develop the in-house made linear drive technologies to realise a machine with optimum manufacturing capabilities.

2005

Linear Motor Drive
Nano Machining Center
AZ150



2007

Linear Motor Drive
High-speed Milling Center
HS Series



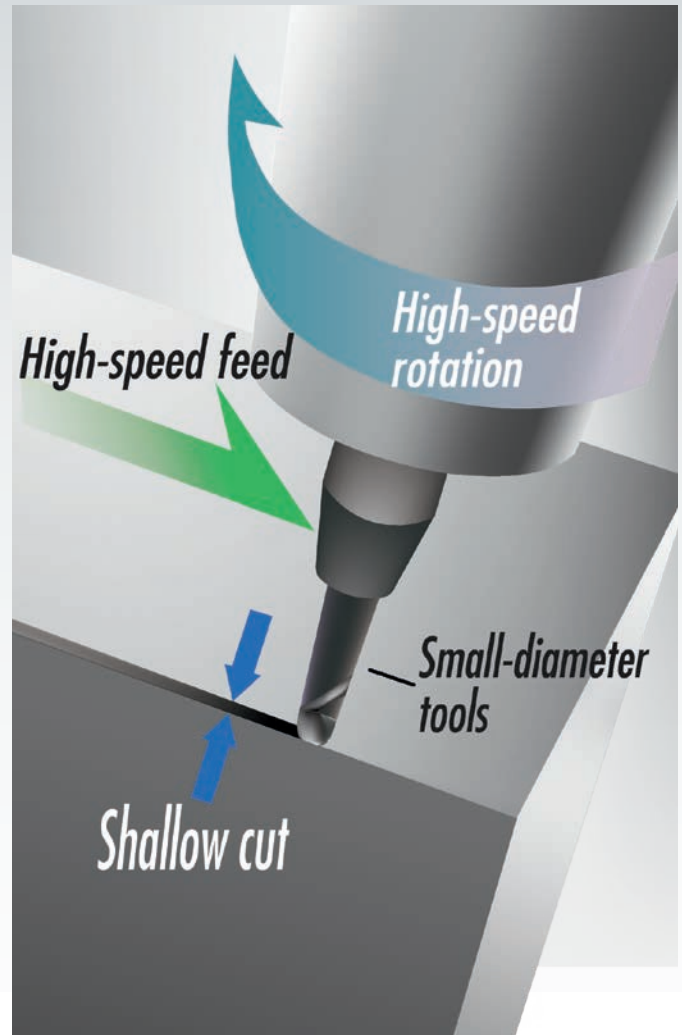
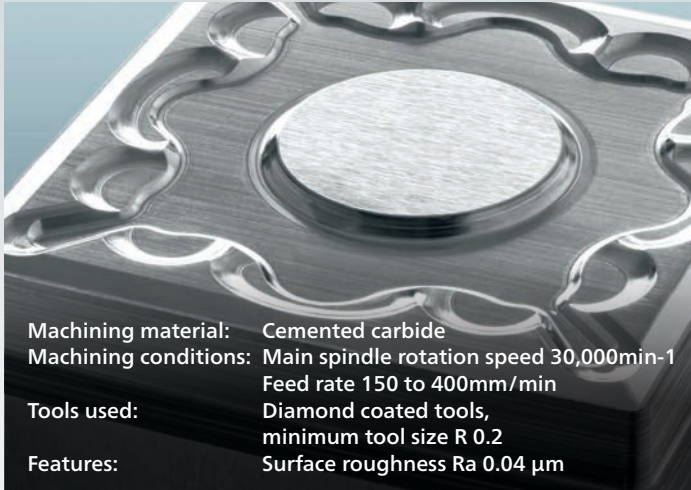
2011

Linear Motor Drive
Ultra High-speed Machining Center
TT1-400A



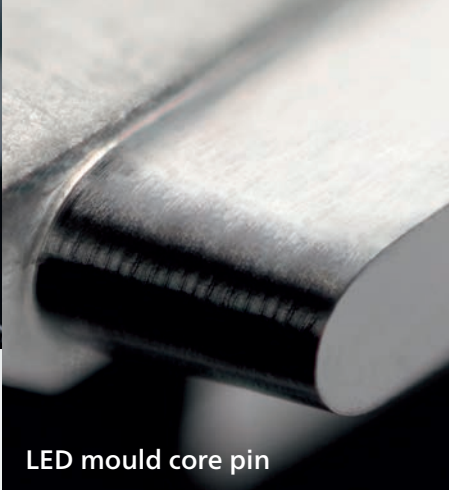
High-Speed Milling

High speed milling is a very efficient process, where a small diameter tool can be used in a very stable rigid spindle. This minimizes deflection, improves accuracy and reduces vibration. It also enables very high linear feeds with shallow cuts, unlike conventional milling which dynamically cuts deeper with more force. Therefore high speed milling greatly reduces distortion, improves accuracy and tool life. In order to realise these points it is necessary to have highly rigid spindle with advanced control system.

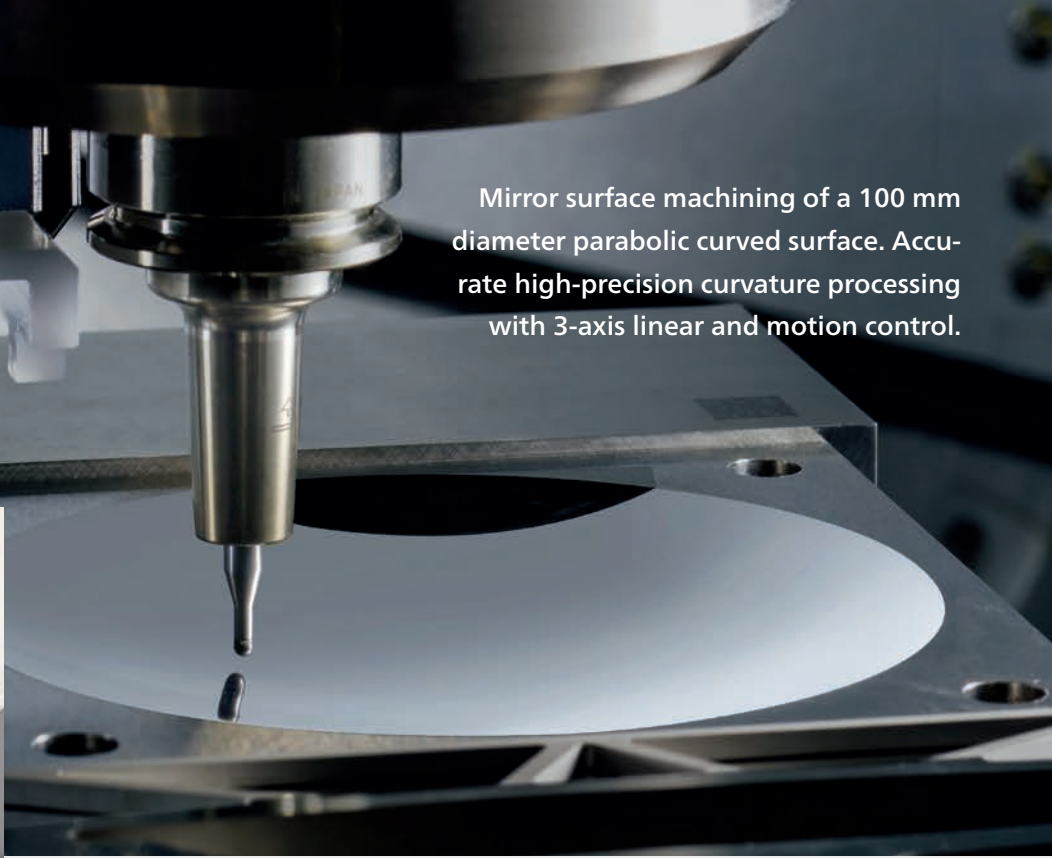


The advantage of high-speed milling is the high quality machining of complicated minute and small shapes. The machining process is often used in the machining of mold parts for forming components such as small optical components that require high precision and high-quality surface conditions and for which applying polish machining is difficult, or for narrow-pitch and low-profile multi-core connectors that are installed in compact portable communication equipment like smart phones.

Mirror surface machining of a 100 mm diameter parabolic curved surface. Accurate high-precision curvature processing with 3-axis linear and motion control.



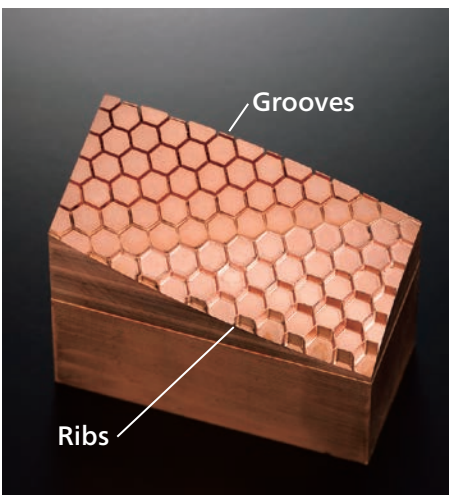
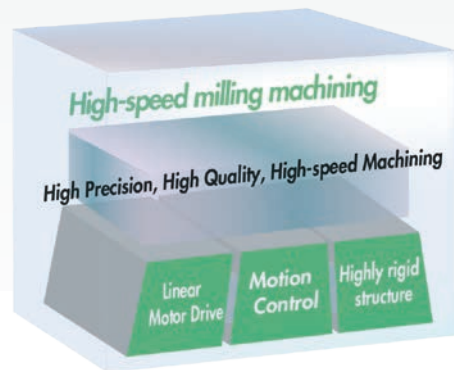
LED mould core pin



For machining precise shapes, the tool path needs the ability to suddenly change direction in a split second over a minute distance. Therefore a high precision control is required to handle predetermined machining speed instantaneously, while still maintaining dimensional 3D tolerances, that is possible thanks to the linear motor technology. All machining axes are comprehensively balanced with perfect synchronization in the control which is enabled by a highly rigid structure without vibration.

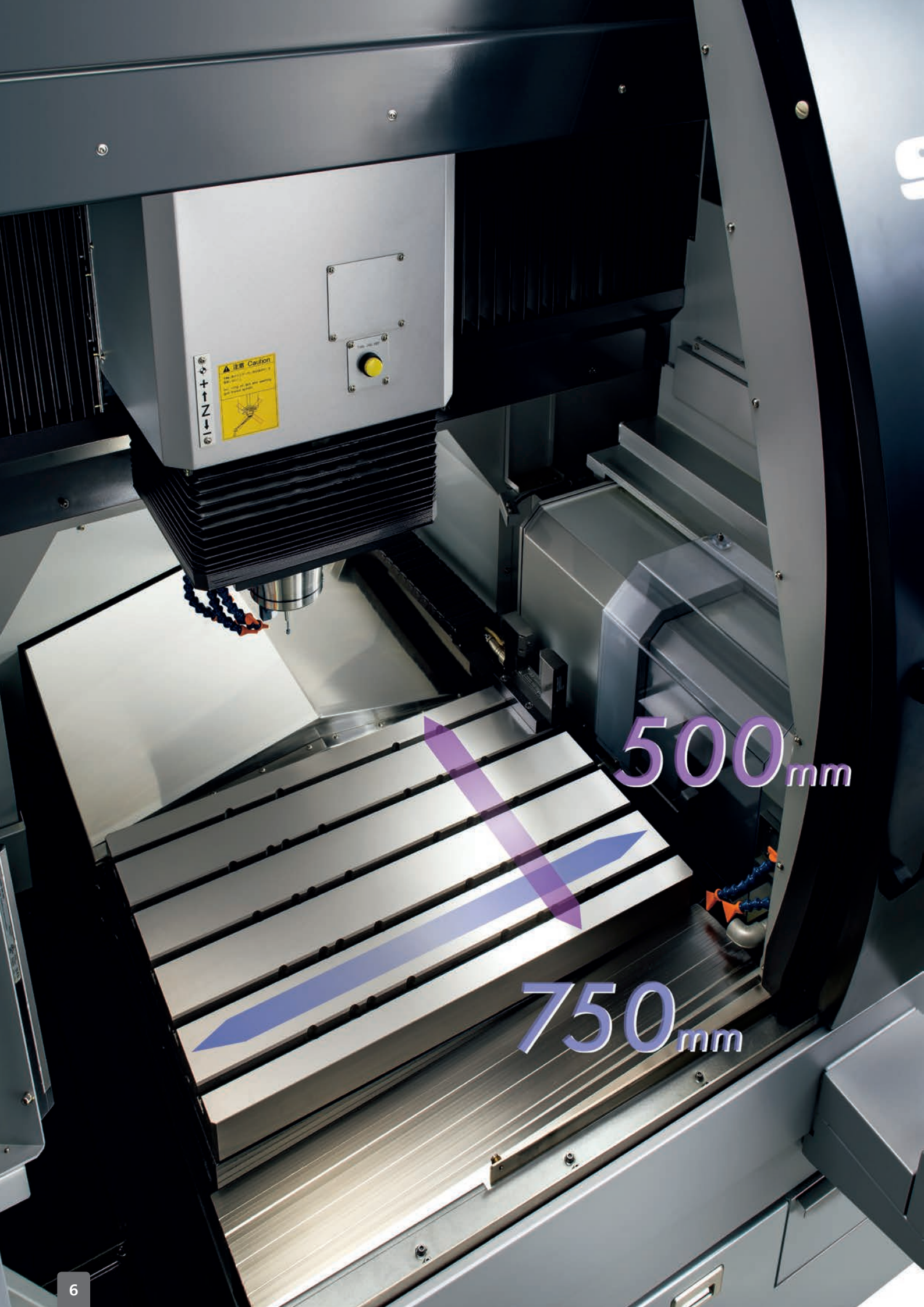


LED mould model
Core pin tip 64-point machining



3D electrode with honeycomb shape

Machining material: Cu
Machining time: 2 Hrs. 27 Min.
Machining conditions: Main spindle rotation speed 20,000 to 35,000min⁻¹
Feed rate 300 to 4,500mm/min
Tools used: Ball end mill R1.5
Ball end mill R0.5×3.0
Ball end mill R0.3×2.5 (ribs)
Ball end mill R0.2×2.5 (grooves)
Characteristics: Ribs = Width 0.1mm, Maximum height 2.5mm
Grooves = Width 0.4mm, Maximum depth 2.5mm



注意 Caution
● 必ず安全装置を確認してください。
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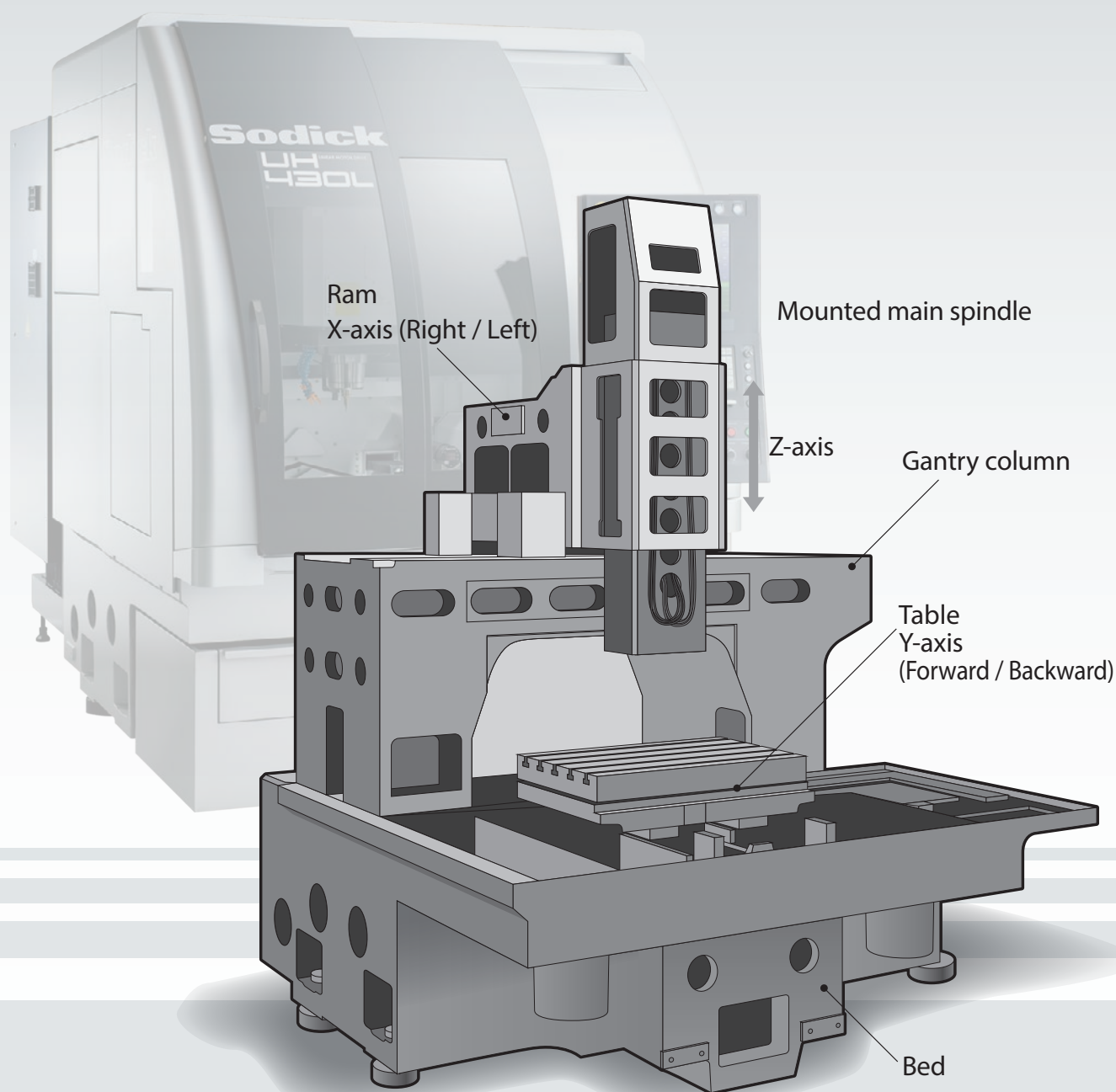
500 mm

750 mm

Highly Rigid Machine Structure

UH series features a rigid and stable casting structure to realise high level of acceleration and accuracy

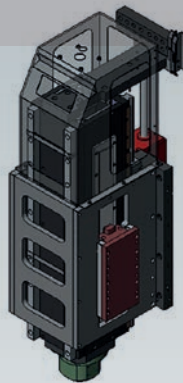
- Spontaneous operating environment to improve workability
- Symmetrical gantry design to minimise the thermal deformation while maximising the machine posture



The Spindle

Weight saving head that employs CFRP (UH430L with E25G spindle only)

Z-axis head weight reduced by **41%**



Increased acceleration without vibration

In the case of a head weight reduction by CFRP adoption, even with a setting of maximum acceleration that is much higher than usual, a uniform high quality surface with no waviness and shortened machining time can be achieved.

Performance evaluation of adopted CFRP weight saving head

Conventional

CFRP head



Workpiece material: Aluminum
Workpiece material: 50x50x50mm
Machining process: Rough → Semi-finish → Finish
Tool: Ball end mill R2
Rotation speed: 25,000min⁻¹
Feed rate: 5,000mm/min

Evaluation of accuracy of upper surface quality and circumference of a 5 mm diameter cylinder

Conventional

CFRP head

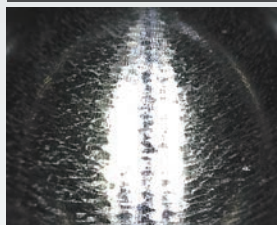
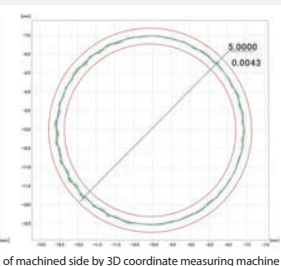
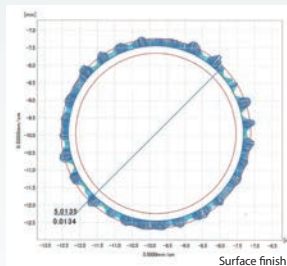


Photo of tip portion magnified 60 times



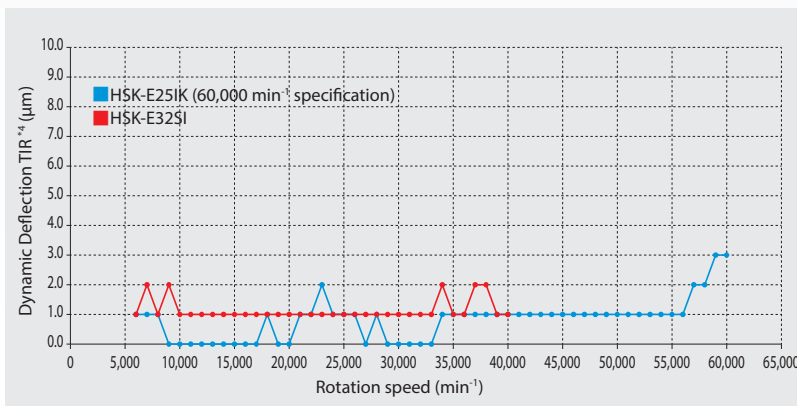
Surface finish of machined side by 3D coordinate measuring machine

Maximum acceleration **0.2G**

Highly rigid spindle

Equipped with a high-speed rotation and highly rigid spindle which adopted a shrink fit type dual face contact HSK type holder. Sodick offers a line-up of two types spindles, including one type for the HSK-E25 type and one type for the HSK-E32 type to respond extensive machining needs.

Dynamic deflection accuracy improved by **50%**



*4. TIR: Total Indicator Reading: Full volume of dial gauge where the measurement portion is rotated once centered on a reference axis

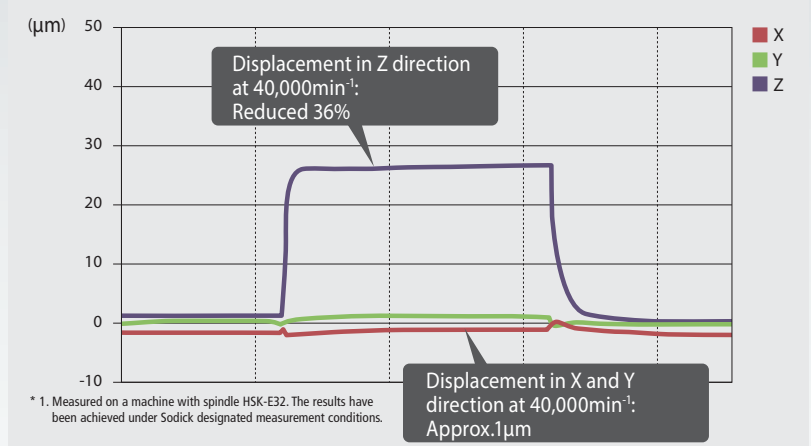
Mechanical Advantages

Changing the material of the main parts from conventional casting to CFRP* greatly reduced the weight of the Z-axis, and also reduced the operating weight of the X-axis which supports the Z-axis. The reduced load on the X-axis realized a favorable balance with the Y-axis, and improved the comprehensive dynamic and static characteristics of all three axes of the linear motor drive.

*Carbon Fibre Reinforced Plastic

Unique cooling system

Reduction of heat generation of the linear motor with a method of directly cooling the coil unit. Thermal displacement is drastically reduced due to Sodick's own spindle of which the internal structure and cooling circuit is thoroughly verified.

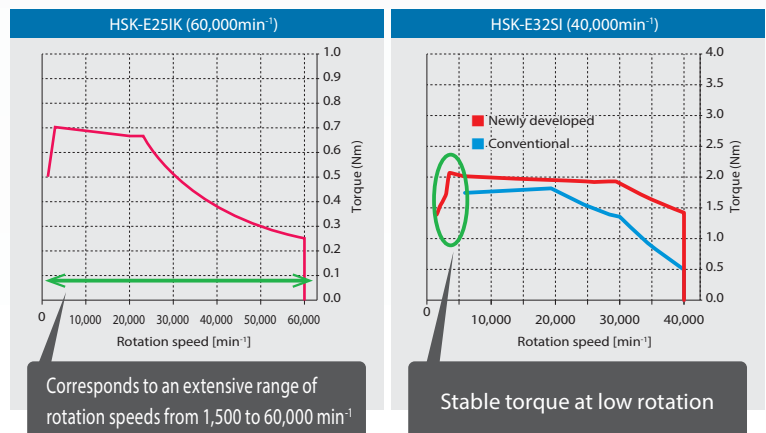


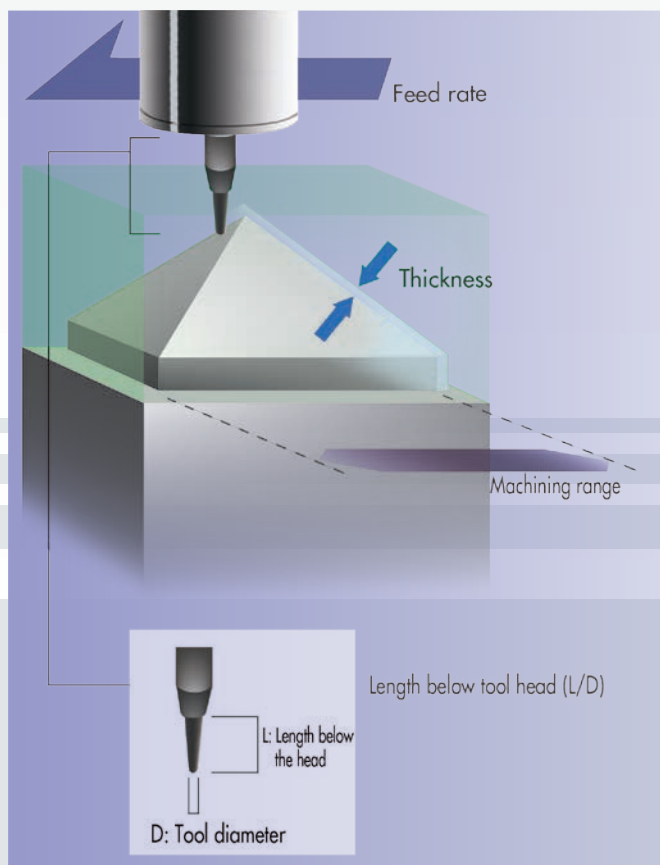
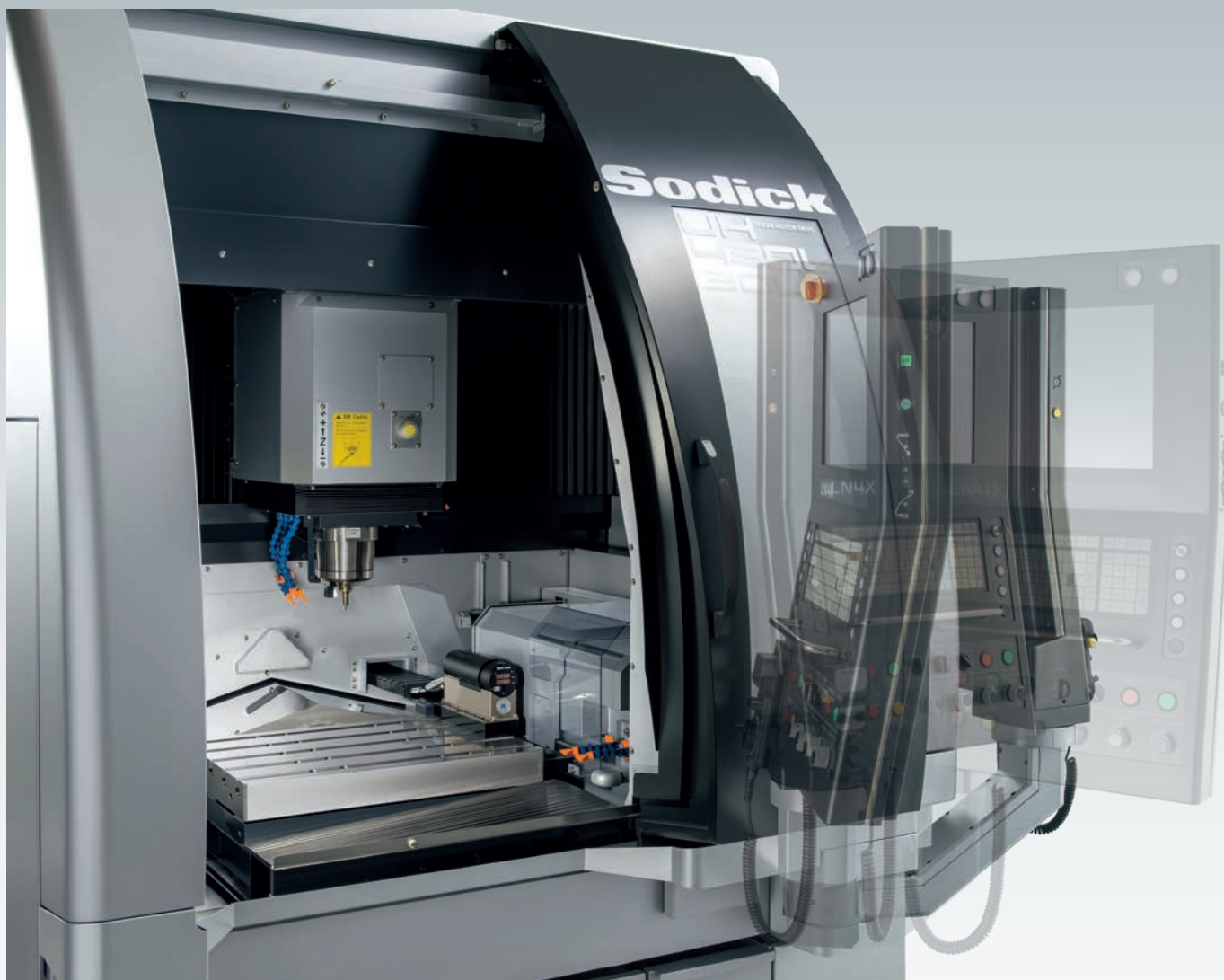
Thermal displacement
Reduced by **36%^{*1}**

Stable torque output

Outputs stable rotation torque from low to high rotation. The torque was increased 17% compared to conventional low rotation range of the HSK-E32SI, and generates three times more torque compared to conventional spindle at 40,000 RPM, so that direct milling can be applied to very hard materials.

Spindle Torque
increased by **17%**





► *Select four steps*

- STEP1 Residual margin
- STEP2 Length below tool head (L/D)
- STEP3 Machining range
- STEP4 Cutting feed rate

Q Number according to the tool path strategy

► *Fine adjustment of machining parameters*

With SEPTune, it is possible to optimise the parameters and tolerances to achieve the best possible result.

Q Number is in the header of NC codes

Machine starts

LN4X – NC unit

- The NC unit in-house developed by Sodick with improved machining quality thanks to high response of drive system
- New control interface with easy usability
- Processing support system "SEPTune"

"New screen design" – Clear visibility and direct operation



"LN4X" equipped with a high-speed CPU and optimized multi-core resources. The speed of analysis and execution of the NC program has been improved. In addition, renewing the operation screen, clear visibility and intuitive direct operation are possible. Equipped with many new functions such as 3-D graphic display.



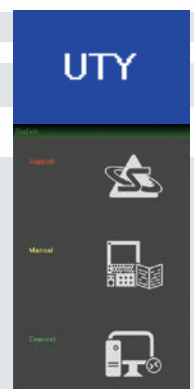
SEPTune

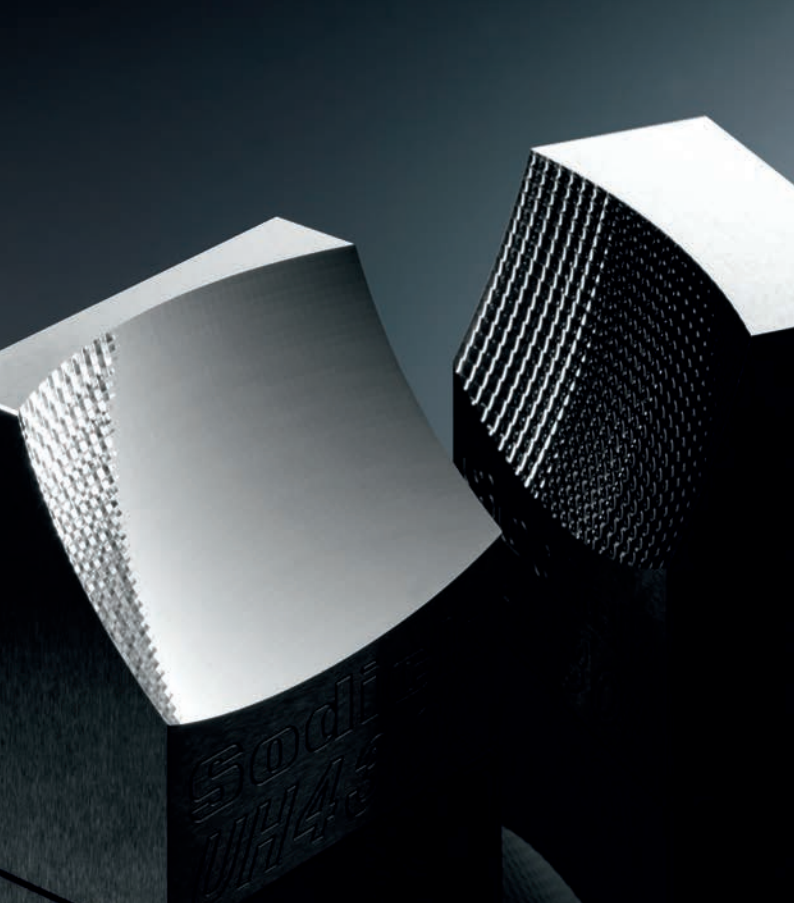
Supports easy selection of the optimum cutting operation conditions, and parameter setting.

Processing support system SEPTune pursues ease of use by adopting modern graphic design. Optimum processing parameters are provided for a machining process with a simple operation that requires only 4 steps of machining information.



UTY stores the electronic copy of the operation, code and message manuals.





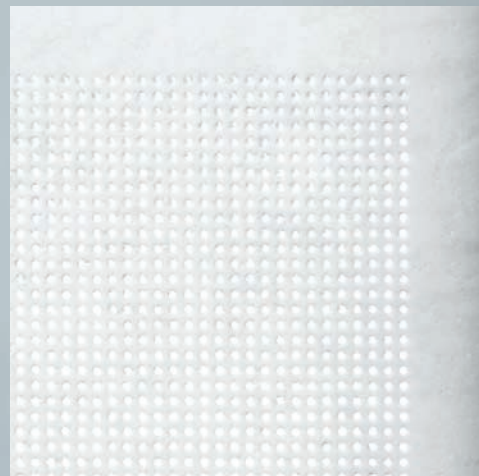
Reflector

Machining material: SKD61 (40HRC)
Machining time: 3 Hrs. 30 Min. (Finishing)
Machining conditions: Main spindle rotation speed 20,000 to 40,000min⁻¹
 Feed rate 4,000 to 2,000mm/min
Tools used: Ball end mill R1.5 to R0.5 Finishing CBN
Features: Thanks to a high-quality surface finish and excellent corner quality achieved by SEPTune intelligent control, it minimises the need of polishing process.



Micro holes in machinable ceramics

Machining material: 20x20x5mm
Machining time: (Center drill)1.43 sec./hole (Drill) 1.93 sec./hole
Machining conditions: Main spindle rotation speed 14,000min⁻¹
 Feed rate 40mm/min
Tools used: Center drill $\Phi 0.08$ mm (for positioning/drilling)
Features: Multiple numbers of holes can be machined with advanced accuracy and precise pitch in highly hard workpiece such as ceramics and super engineering plastics.



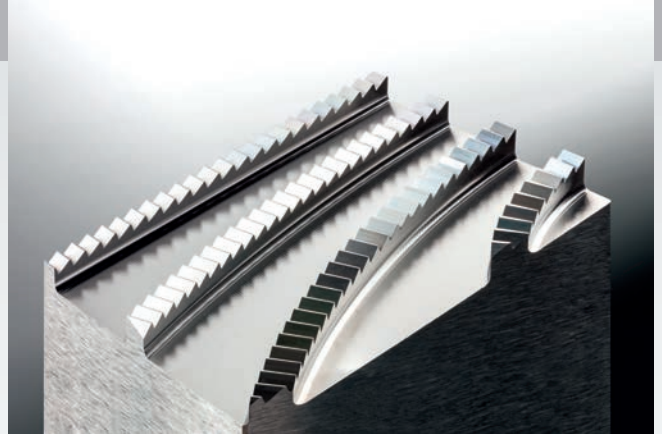
UH Series

Machining Performance

The high-speed milling machining realises the advanced quality machining of complicated minute and small shapes. The machine is widely used for machining mould parts such as forming multi-core connectors with narrow pitch and low profile, and small optical parts that are difficult to polish where both high precision and superb surface quality are required.

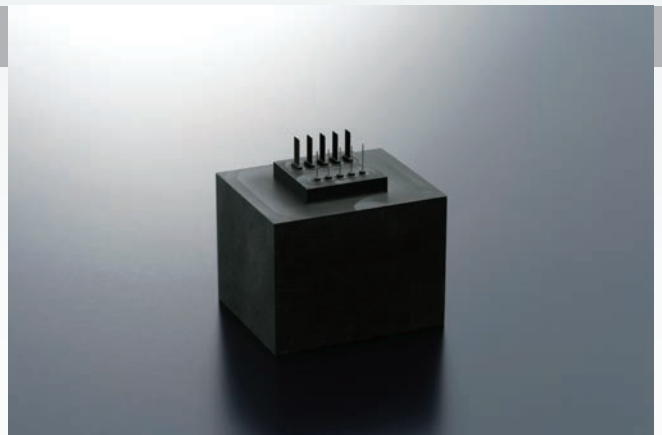
Stepped optical shape

Machining material:	STAVAX (52HRC)
Machining time:	5 Hrs. 29 Min. (Finishing)
Machining conditions:	Main spindle rotation speed 22,000 to 40,000min ⁻¹ Feed rate 350 to 3,000mm/min
Tools used:	Ball end mill R1.5 to R0.05 Finishing CBN ball end mill R0.05
Features:	High-precision and high-quality finish (Ra 0.1 μm or less) Small diameter tool (R 0.05) Mold shapes used for designing automobile headlight trimming.



Graphite thin ribs and pin shape

Machining material:	Graphite TTK8
Machining time:	5 Hrs. 29 Min. (Finishing)
Machining conditions:	Main spindle rotation speed 8,000min ⁻¹ Feed rate 500mm/min
Tools used:	Long neck flat diamond coat
Features:	Rib = Plate thickness 0.05 × Height 2.5 mm Pin = Diameter 0.1 × Height 2.5 mm

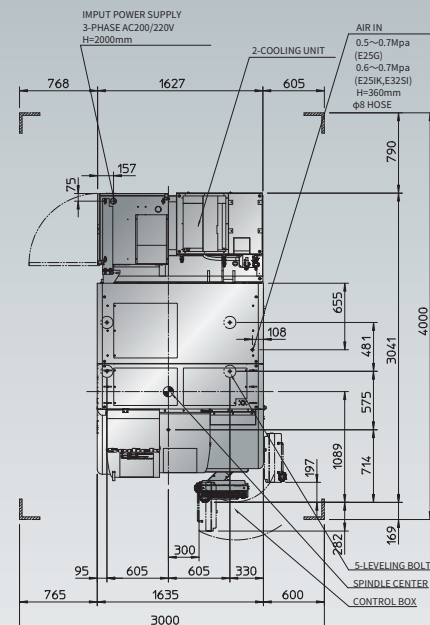
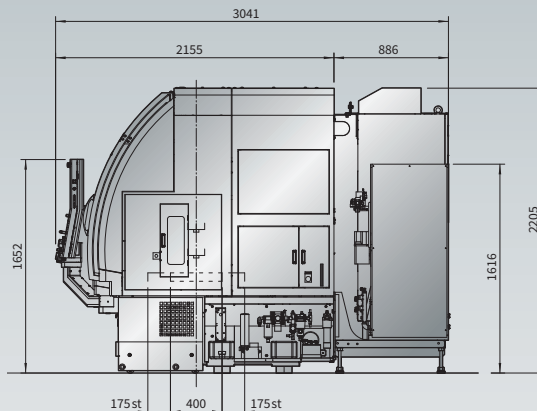
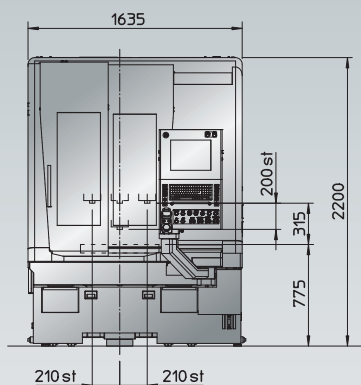


Cutter Shape

Machining material:	STAVAX (52HRC)
Machining time:	2 Hrs. 14 Min.
Machining conditions:	Main spindle rotation speed 40,000min ⁻¹ Feed rate 180 to 2,500mm/min
Tools used:	Ball end mill R0.5×2.5 Ball end mill R0.3×1.5 Finishing CBN ball end mill R0.3×1.5
Features:	High-precision, fine processing (Cutter edge flat end portion: 20 μm)



Specification UH430L



Machine Tool

Drive method (X, Y, Z)	Linear motor drive method
Each axis movement amount (X, Y, Z)	420×350×200 mm
Main spindle speed	6,000 to 40,000 min ⁻¹ HSK-E25G (Grease lubrication)
	6,000 to 40,000 min ⁻¹ HSK-E32FP (Oil air lubrication)
Tool holder type	Dual face contact holder HSK
Distance from table surface to spindle nose	115 to 315 mm
Table size	600×400 mm
Maximum loadable mass	100 kg
Distance from floor to table work surface	775 mm
Machine tool dimensions (Including power supply unit)	1635×3041×2205 mm
Machine installation dimensions	3000×4000 mm
Total machine weight	6000 kg

Automatic tool changer (ATC)

Tool selection method	Turntable fixed address method
Tool storage capacity	20 tools (E25), 16 tools (E32)
Max tool length	100 mm (E25)/110 mm (E32)

Chip tank

Tank capacity	130 liter
Cleaning fluid	Water-soluble coolant

Semi-dry machining system

Cutting fluid	Vegetable oil
Cutting fluid consumption	0 - 50 mL/h (Semi-fixed adjustable type by throttle valve)
Mist particle size	About 3 μm
No. of jet nozzles	2 nozzles
Cutting fluid storage capacity	1.2 liter
Operating pressure range	0.2 - 0.7 MPa

Power requirements

Total power input	25 kVA
Input power supply	AC200V/220V±5% 50/60Hz±2%
Air pressure	0.5 to 0.7 MPa (E25G)
	0.6 to 0.7 MPa (E32FP)
Air consumption	400 NL/min (E25G)
	700 NL/min (E32FP)

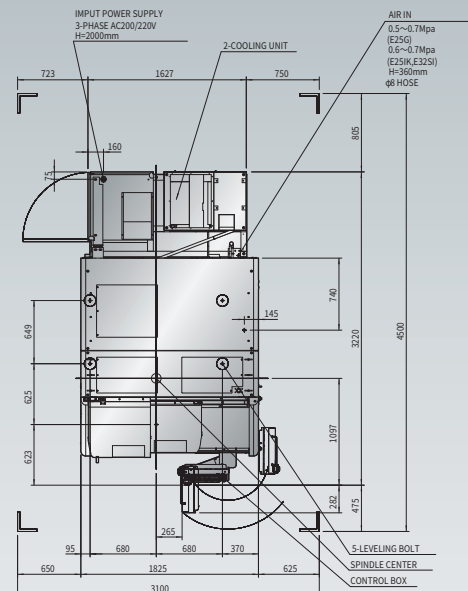
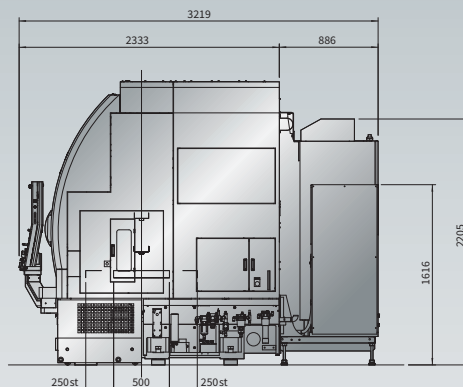
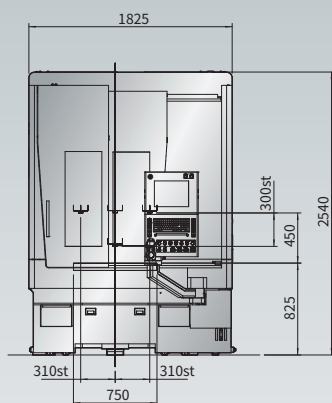
NC unit (LN4X)

Control axes	4 axes X, Y, Z, Spindle axis
Simultaneous control axes	Max. 4 axes
Min. setting unit	0.00001 mm/0.000001 inch
Min. travel unit	0.00001 mm/0.000001 inch
Max. command value	±99999.99999 mm/ ±9999.99999 inch
Display	15" LCD color display (TFT)

Standard accessories

- Blum measurement system
- ATC magazine guard
- ATC auto door
- Cooling system for each axis
- Scale feedback (X/Y/Z)
- Mist machining system
- Work light
- Renishaw touch sensor
- Ethernet communication (10BASE-T/100BASE-TX)
- Automatic lubrication
- Manual pulse generator
- Chip bucket
- Simulation function "MotionExpert®-S"
- Operation status collection utility S-Viewer

Specification UH650L



Machine Tool

Drive method (X, Y, Z)	Linear motor drive method
Each axis movement amount (X, Y, Z)	620×500×300 mm
Main spindle speed	6,000 to 40,000 min-1 HSK-E25G (Grease lubrication)
	6,000 to 40,000 min-1 HSK-E32FP (Oil air lubrication)
Tool holder type	Dual face contact holder HSK
Distance from table surface to spindle nose	150 to 450 mm
Table size	750×500 mm
Maximum loadable mass	150 kg
Distance from floor to table work surface	825 mm
Machine tool dimensions (Including power supply unit)	1825×3220×2540 mm
Machine installation dimensions	3100×4500 mm
Total machine weight	8000 kg

Power requirements

Total power input	30 kVA
Input power supply	AC200V/220V±5% 50/60Hz±2%
Air pressure	0.5 to 0.7 MPa (E25G)
	0.6 to 0.7 MPa (E32FP)
Air consumption	400 NL/min (E25G)
	700 NL/min (E32FP)

Automatic tool changer (ATC)

Tool selection method	Turntable fixed address method
Tool storage capacity	20 tools (E25), 16 tools (E32)
Max tool length	100 mm (E25)/110 mm (E32)

Chip tank

Tank capacity	165 liter
Cleaning fluid	Water-soluble coolant

Semi-dry machining system

Cutting fluid	Vegetable oil
Cutting fluid consumption	0 - 50 mL/h (Semi-fixed adjustable type by throttle valve)
Mist particle size	About 3 μm
No. of jet nozzles	2 nozzles
Cutting fluid storage capacity	1.2 liter
Operating pressure range	0.2 - 0.7 MPa

NC unit (LN4X)

Control axes	4 axes X, Y, Z, Spindle axis
Simultaneous control axes	Max. 4 axes
Min. setting unit	0.00001 mm/0.000001 inch
Min. travel unit	0.00001 mm/0.000001 inch
Max. command value	±99999.99999 mm/ ±9999.99999 inch
Display	15" LCD color display (TFT)



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