CENTERS FOR 5-AXIS MACHINING

NBH 630 5X/800 5X/1000 5X
The economic 5-axis machining is found in all industrial areas today. With two different concepts NBH machining centers can also be used for machining of complex workpieces, e.g. for multi-sided machining, bores and surfaces in different solid angles and freeform surfaces.

**ADVANTAGES:**
- Complete machining in one clamping (5-sided machining in one clamping)
- Optimised precision and accuracy, as re-clamping is not necessary
- Reduction of unit costs as resetting to other machines is not required
- Reduced need for fixtures
- Use as positioning axis or for simultaneous machining
- Large range of workpieces, materials from light metals to titanium, Inconel and hard metal cutting are possible
- High tool capacity and convenient set-up thanks to one-of-a-kind tool magazine technology

**FIELDS OF APPLICATION OF THE NBH 5X**
- 5-sided machining of cubic workpieces in mechanical engineering
- Complete machining of precision parts with low shape and position tolerances for engines and transmission automotive and non-automotive applications
- 5-sided machining with long and heavy tools as well as fatigue tools with large diameters when machining gear-box housings
- More efficient production due to 5-sided machining with a reduced number of clamping and higher machining accuracy owing to lower clamping errors in fitting and pump industry
- High surface quality of workpieces for die and tool production
- Integral components made of aluminium (high performance) and high-strength connection parts made of titanium or Inconel (high torque) with material removal volumes of up to 90% in aerospace industry

**YOUR ADVANTAGES AT A GLANCE**
- Machine concepts tailored towards optimised part costs
- Complete NBH 5-axis machine in line with your specific requirements
- Robust machine design ensures reliable, long-lasting precision in production
- Excellent accessibility to all modules provides easy set-up, operation and service
- High technology competence
- Long-term security for your investment
- Easy operation and service
- Easy integration in flexible pallet storage systems and automation systems

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WITH THE NEWLY AVAILABLE 5-AXIS MACHINES, THE WIDE RANGE OF ADVANTAGES OF THE NBH SERIES IS BEING ENHANCED BY THE FOLLOWING BENEFITS:

• Reduction of unit costs due to complete 5-sided machining in one clamping
• Extraordinary chip removal rate when roughing and high surface quality when finishing thanks to extremely high retention forces in the rotary axes
• Extremely high dimensional stability of the workpiece due to thermally stable machine as standard configuration
• Large range of workpieces, materials from light metals to titanium, Inconel and hard metal cutting are possible
• High tool capacity and convenient set-up thanks to one-of-a-kind tool magazine technology
• Perfect ergonomic accessibility during operation and maintenance

YOUR ADVANTAGES AT A GLANCE:

• Universal machining center with swivel head, swivel axis arranged in 45°
• High holding torque during simultaneous machining thanks to innovative electromechanical gear technology in swivel head and NC rotary table
• Standard accuracy package for minimizing temperature affects due to cooled servo motors, ball screw nuts and gears ensure maintained precision and process reliability
• Optimized machine bed, chip removal to the rear
• New, dual-walled, closed and extremely stable machine base
• Workpiece set-up during machining cycle via 180° pallet changer
• Optional direct loading of the machine without pallet changer, optimal use as system machine in powertrain segment
• Modular tool magazines available for a great variety of production requirements, ranging from 60 to 300 tool locations
Single cast, self-supporting machine bed
Dual-wall cast machine base
Digital drives, water-cooled servo motors
Safe and easy chip removal towards rear of machine
Swivel head with working spindle
(Further information page 7)

NC rotary table with gear
• High holding torque during simultaneous machining
• Highly precise positioning
• High dynamics with rapid traverse up to 40 rpm

Pallet changer
• Fast 180° swivel changer, changing time approx. 13 s
• Set-up during machining cycle
• Rotary set-up station

Modular tool magazine
• Disc-type magazine (60 tool locations)
• Disc-type magazine (120 tool locations)
• Hüller Hille cassette magazine
• (up to 300 tool locations)
• Standard patented tool cone cleaning using metal blades integrated in the tool handling device

Tool changer
• Fast electromechanical tool changer with automatic mechanical locking when swivelling,
  Swivel time vertical-horizontal approx. 1.2 s,
  Chip-to-chip time (VDI 2852) approx. 4.8 s

Automation
• Uncomplicated connection to flexible pallet storage and automation systems
• Fully compatible with already supplied systems thanks to uniform interface

Modern, powerful CNC control
• Siemens Sinumerik 840D sl
• 19-inch monitor, ergonomically adjustable control panel

Tool cassette magazine with 3 cassettes available as an option
TECHNOLOGICAL MACHINE HIGHLIGHTS FOR EFFECTIVE 5-AXIS MACHINING

SINGLE, SELF-SUPPORTING MACHINE BED
- Heavily ribbed, one-piece casting with high damping characteristics
- Calculated with FEM and examined with modal analysis
- Free chip fall
- Optimized chip disposal via two chip grooves integrated in machine bed
- Chip removal to the rear, chip conveyor behind machine frame space
- Optimal impermeability and accessibility due to cast-on console for switch cabinet and additional units

DUAL-WALL CLOSED MACHINE BASE
- Externally ribbed, dual-wall cast machine base
- Calculated with FEM and examined with modal analysis
- Thermosymmetric structure

ROBUST GUIDANCE SYSTEM
- Profile rail guides with absolute, direct position measuring system via glass scale
- Height-offset X-guide for optimal absorption of machining forces
- 6 recirculating roller units in Y-guide
- High-rigidity and stick-slip free axis movement

STANDARD ACCURACY PACKAGE FOR TEMPERATURE COMPENSATION
- Coolant semi-motors and ball screw nuts
- Coolant gears
- Spindle displacement sensor
- External coolant temperature control [option]
- Efficient compressor cooling aggregate

TECHNOLOGICAL FEATURES OF THE SWIVEL HEAD
- Infinitely variable swivel range from 0° up to -225°, horizontal = 0°, vertical = -180°
- Complete swivel range throughout the entire travel range in the X-axis (partly limited for NBH 800 5X)
- High holding torque during simultaneous machining thanks to innovative electromechanical gear technology
- Cooled drives and gears
- Coolant swivel head housing (GGG 60)
- Spindle displacement sensor
- Optimized swivel head design, interference contours on spindle housing minimized

PROCESS MONITORING [OPTION]
- In-process tool breakage monitoring in the tool magazine area
- Laser tool measurement in working area
- Extendable laser unit protected in closed housing
- Dynamic tool measurement horizontal and vertical at machining speed
- Comprehensive measuring cycles: e.g. tool length, radius, shape inspection, single cutting edge control, run-out, wear, drill breakage, measuring, checking, correcting
- Workpiece measurement
- Measuring probe with infrared or radio transmission of the measured values for measuring of workpieces and/or clamping fixtures within working area

MODERN ERGONOMICS AND PERFECT ACCESSIBILITY
- Excellent accessibility to XXL workspace thanks to side two-part doors
- Crane loading from above at the set-up station and in the working area
- Working area due to optimal operation doormachine roof construction
- Two-piece control console which can be perfectly adjusted to the operator

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THE SWIVEL HEAD INSTALLED IN NBH 630 5X IS ALSO USED IN NBH 800 FOR SIMULTANEOUS 5-AXIS MACHINING. THANKS TO THE HIGHLIGHTS OF THIS SWIVEL HEAD AND THE TECHNOLOGICAL ADVANTAGES OF THE 4-AXIS NBH 800 THE NBH 800 5X WITH PALLET SIZE UP TO 1000 X 1000 MM IS A REAL UNIVERSAL MACHINING CENTER:

- Reduction of unit costs due to complete 5-sided machining in one clamping
- Extraordinary chip removal rate when roughing and high surface quality when finishing thanks to extremely high retention forces in the rotary axes
- Large range of workpieces, materials from light metals to titanium, Inconel and hard metal cutting are possible
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• Optimized machine bed, chip removed to the rear

• Dual-walled, closed and extremely stable machine base

• Workpiece set-up during machining cycle via 180° pallet changer

• Optional direct loading of the machine without pallet changer, optimal use as system machine in powertrain segment

• Modular tool magazines available for a great variety of production requirements, ranging from 60 to 300 tool locations

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Closed, double-walled and optimally ribbed machine column

Machine bed with gantry drive in Z-axis and 4 integrated chip grooves for optimal chip removal

Swivel head with working spindle

Torque table, direct driven rotary axis

Pallet changer
  • Fast 180° swivel changer, changing time approx. 20 s
  • Set-up during machining cycle
  • Rotary set-up station

Tool changer
  • Fast electromechanical tool changer with automatic mechanical locking when swivelling
  • Swivel time vertical/horizontal approx. 1.2 s
  • Chip-to-chip time (VDI 2852) approx. 5.9 s

Modular tool magazine
  • Disc-type magazine (60 tool locations)
  • Disc-type magazine (120 tool locations)
  • Hüller Hille cassette magazine (up to 300 tool locations)
  • Standard patented tool cone cleaning using metal blades integrated in the tool handling device

Automation
  • Uncomplicated connection to flexible pallet storage and automation system
  • Fully compatible with already supplied systems thanks to uniform interface

Modern, top-performing CNC control
  • Siemens Sinumerik 840D sl
Horizontal machining center type NBH 630 5X NBH 800 5X

**Working range**
- X-axis
  - NbH 630: 1000
  - NbH 800: 1400
- Y-axis
  - NbH 630: 850 [1050] 1100 [1400]
  - NbH 800: 1050 [1400]
- Z-axis
  - NbH 630: 1150
  - NbH 800: 1800
- Swing circle diameter (limited)
  - NbH 630: 900 [1150] 1300 [1600]
  - NbH 800: 1150 [1600] 1350 [1750]
- Fixture height
  - NbH 630: 1350
  - NbH 800: 1500

**Position measuring system**
- Glass scales type
- Direct

**Positioning error** (DIN ISO 230-2)
- A
  - NbH 630: 0.006
  - NbH 800: 0.007

**Pallet / rotary table**
- Pallet clamping surface
  - NbH 630: 630 x 630 [800 x 800]
  - NbH 800: 800 x 800 [1000 x 1000]
- Max. pallet load
  - NbH 630: 1500
  - NbH 800: 2000
- NC rotary table, smallest fraction
  - NbH 630: 0.001
  - NbH 800: 0.001
- Rotary speed B-axis
  - NbH 630: 40
  - NbH 800: 25
- Pallet changing time
  - NbH 630: approx. 13
  - NbH 800: approx. 20

**Swivel head spindle**
- Swivel range, horizontal
  - NbH 630: 0° up to -225 0° up to -225
  - NbH 800: 0° up to -225 0° up to -225
- Positioning accuracy (DIN ISO 230-2)
  - NbH 630: arc sec 10
  - NbH 800: arc sec 10
- Rapid traverse swivel axis
  - NbH 630: rpm 40
  - NbH 800: rpm 40
- Speed range max.
  - NbH 630: 10,000
  - NbH 800: 10,000
- Spindle power
  - NbH 630: 100% / 40% duty kW 30 / 38
  - NbH 800: 100% / 40% duty kW 30 / 38
- Torque
  - NbH 630: 100% / 40% duty Nm 286 / 378
  - NbH 800: 100% / 40% duty Nm 286 / 378
- Tool taper type
  - NbH 630: HSK 100
  - NbH 800: HSK 100
- Internal coolant supply spindle
  - NbH 630: [option] bar 40 [70]
  - NbH 800: [option] bar 40 [70]

**Feed / rapid traverse**
- Feed force X-, Y-, Z-axis
  - NbH 630: approx. kN 15 / 15 / 20
  - NbH 800: approx. kN 20 / 10 / 20
- Feed range X-, Y-, Z-axis
  - NbH 630: mm/min 0 – 60,000
  - NbH 800: mm/min 0 – 40,000
- Rapid traverse X-, Y-, Z-axis
  - NbH 630: m/min 60 / 60 / 60
  - NbH 800: m/min 40 / 40 / 40
- Acceleration X-, Y-, Z-axis
  - NbH 630: m/s² 7 / 7 / 7
  - NbH 800: m/s² 4 / 4 / 4

**Tool magazine**
- Locations number
  - NbH 630: 60 or [120]
  - NbH 800: 60 or [120]
- Tool diameter max.
  - NbH 630: 125
  - NbH 800: 125
- ... adjacent tool locations empty
  - NbH 630: mm 325
  - NbH 800: mm 325 [400] 1)
- Tool length max.
  - NbH 630: 600
  - NbH 800: 800 2)
- Tool weight max.
  - NbH 630: 40
  - NbH 800: 40 [50]
- Tilting moment max.
  - NbH 630: Nm 50
  - NbH 800: Nm 50 [100]
- Chip-to-chip time, tools up to 6 kg (VDI 2852)
  - NbH 630: approx. s 4.8
  - NbH 800: approx. s 5.4

**Tool cassette magazine**
- Locations number
  - NbH 630: 150
  - NbH 800: 200
- Tool diameter max.
  - NbH 630: 125
  - NbH 800: 125
- ... adjacent tool locations empty
  - NbH 630: mm 325
  - NbH 800: mm 325 [400] 1)
- Tool length max.
  - NbH 630: 800
  - NbH 800: 800 2)
- Tool weight max.
  - NbH 630: 40 [50]
  - NbH 800: 40 [50]
- Tilting moment max.
  - NbH 630: Nm 50 [100]
  - NbH 800: Nm 50 [100]
- Chip-to-chip time, tools up to 6 kg (VDI 2852)
  - NbH 630: approx. s 5.4
  - NbH 800: approx. s 5.9

**Machine**
- Control, Siemens Sinumerik type
  - NbH 630: 840D sl
  - NbH 800: 840D sl
- Machine weight
  - NbH 630: approx. kg 25,000
  - NbH 800: approx. kg 42,000

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1) = only in special cassette
2) = possible collision with the maximum interference circle diameter of the fixture
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*(subject to change without notice)*
The concept of the NBH 800 5X / NBH 1000 5X with a stable tilting/rotary table (B- on A-axis) provides the rigid and high accuracy column and spindle arrangement for X- and Y-axis tool movement whilst the workplace is moved by axes Z, A and B. This convincing solution (e.g. boring mill axis arrangement) has proven to be very robust and thermally stable ensuring max. stability and highest accuracy.

Together with the proven components such as all NBH motor and gear spindles and the various Hüller Hille tool magazines the machine can be optimally configured to meet the requested production quality. The unique Hüller Hille cassette magazine can, for example, accommodate up to 800 mm long and up to 50 kg heavy special tools.

The machine is designed for direct loading on the table with clamping fixture or for loading with the proven 180° swivel-type pallet changer.

1. Single cast, self-supporting machine bed
2. Machine column, double-walled and extensively ribbed casting
3. All proven NBH working spindles can be used
4. Optimized chip disposal via four chip grooves integrated in machine bed
5. Tilting/rotary table (B- on A-axis)

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### TECHNICAL DATA

**NBH 800 SX/1000 SX**

**WITH TILTING/ROTARY TABLE**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NBH 800 SX</th>
<th>NBH 1000 SX</th>
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<tbody>
<tr>
<td><strong>Horizontal machining center</strong></td>
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<tr>
<td>Type</td>
<td>NBH 800 SX</td>
<td>NBH 1000 SX</td>
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<tr>
<td><strong>Working range</strong></td>
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<td></td>
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<tr>
<td>X-axis</td>
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<tr>
<td>Y-axis</td>
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<tr>
<td>Fixture height</td>
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<tr>
<td>Position measuring system, scales, threads</td>
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<td>40µ</td>
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<tr>
<td>Tilting angle, tilt</td>
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</tr>
<tr>
<td>Tilt angle (max.)</td>
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<td>11°</td>
</tr>
<tr>
<td>Tilt angle (max.)</td>
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</tr>
<tr>
<td>Tilt angle range (max.)</td>
<td>11° up to 11°</td>
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<td>Rotating angle range</td>
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<td>Rotating angle range</td>
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<td>Travel angle, tilting</td>
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<tr>
<td>Travel angle, tilting</td>
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<tr>
<td>Turning spindle head</td>
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<tr>
<td>Pallet changing time as per ISO 2871</td>
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<td><strong>Motor spindle</strong></td>
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<tr>
<td>Spindle power 100%/40% duty</td>
<td>54 / 66</td>
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</tr>
<tr>
<td>Spindle power 100%/40% duty</td>
<td>37 / 46</td>
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<tr>
<td>Spindle torque 100%/40% duty</td>
<td>2200 / 2600</td>
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<tr>
<td><strong>Feed / rapid traverse</strong></td>
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<td></td>
</tr>
<tr>
<td>Feed force X-, Y-, Z-axis</td>
<td>20 / 10 / 20</td>
<td>20 / 10 / 20</td>
</tr>
<tr>
<td>Feed range X-, Y-, Z-axis</td>
<td>0 – 40 000</td>
<td>0 – 40 000</td>
</tr>
<tr>
<td>Rapid traverse X-, Y-, Z-axis</td>
<td>40 / 40 / 40</td>
<td>40 / 40 / 40</td>
</tr>
<tr>
<td><strong>Tool magazine</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool magazine, locations</td>
<td>60 or 120</td>
<td>60 or 120</td>
</tr>
<tr>
<td>Tool diameter max.</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Tool weight max.</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Machine</strong></td>
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<td></td>
</tr>
<tr>
<td>Machine type</td>
<td>NBH 800 SX</td>
<td>NBH 1000 SX</td>
</tr>
<tr>
<td>Machine weight</td>
<td>42 000</td>
<td>37 000</td>
</tr>
</tbody>
</table>

**Subject to change without notice**
The NBH 1000 5X is equipped with a 5-axis machining center that can be optionally equipped with a tilt head (A-axis) with a powerful geared spindle (1390 Nm). Due to its stiff structure and high performance, a wide range of applications is covered. Workpiece materials range from plastics (Composite), aluminum, steel to titanium, inconel and hard metal cutting are possible. The swivel range of the A-axis is from -120° to +60°.

Here again, the machine is based on the 4-axis NBH 1000 with all technological advantages. In addition, the column of the machine is equipped at the rear with a profile guideway to support the tilt head.
#### TECHNICAL DATA

**NBH 1000 5X WITH TILT HEAD**

<table>
<thead>
<tr>
<th>Technical/Technical data</th>
<th>Type</th>
<th>NBH 1000 5X</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working range</strong></td>
<td></td>
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</tr>
<tr>
<td>X-axis</td>
<td>mm</td>
<td>1800</td>
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<tr>
<td>Y-axis</td>
<td>mm</td>
<td>1400</td>
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<tr>
<td>Z-axis</td>
<td>mm</td>
<td>1800</td>
</tr>
<tr>
<td>Swing circle diameter (limited)</td>
<td>mm</td>
<td>1700 (2000)</td>
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<tr>
<td>Positioning accuracy, linear axes</td>
<td>mm</td>
<td>0.002</td>
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<tr>
<td>Absolute position accuracy</td>
<td>mm</td>
<td>0.005</td>
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<tr>
<td>Feed / rapid traverse</td>
<td></td>
<td></td>
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<tr>
<td>Feed force X-, Y-, Z-axis</td>
<td>kN</td>
<td>20 / 10 / 20</td>
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<tr>
<td>Feed range X-, Y-, Z-axis</td>
<td>mm/min</td>
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<tr>
<td>Rapid traverse X-, Y-, Z-axis</td>
<td>m/min</td>
<td>40 / 40 / 40</td>
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<tr>
<td>Acceleration X-, Y-, Z-axis</td>
<td>m/s²</td>
<td>4 / 4 / 4</td>
</tr>
<tr>
<td>Tool magazine</td>
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<tr>
<td>Tool magazine locations</td>
<td>number</td>
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<tr>
<td>Tool diameter max.</td>
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<td>125</td>
</tr>
<tr>
<td>Tool length max.</td>
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<td>600</td>
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<tr>
<td>Tool weight max.</td>
<td>kg</td>
<td>40</td>
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<tr>
<td>Tilting moment max.</td>
<td>Nm</td>
<td>50</td>
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<tr>
<td>Chip-to-chip time, tools up to 6 kg (VDI 2852)</td>
<td>approx. s</td>
<td>6.8</td>
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<tr>
<td>Tool loading/unloading station</td>
<td>number</td>
<td>1 [4]</td>
</tr>
<tr>
<td>Tool cassette number</td>
<td>[3] [4] [6]</td>
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</tr>
<tr>
<td>Tool locations number</td>
<td>[150] [200] [300]</td>
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</tr>
<tr>
<td>Tool diameter max.</td>
<td>mm</td>
<td>125</td>
</tr>
<tr>
<td>Tool length max.</td>
<td>mm</td>
<td>800</td>
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<tr>
<td>Tool weight max.</td>
<td>kg</td>
<td>50</td>
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<tr>
<td>Tilting moment max.</td>
<td>Nm</td>
<td>100</td>
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<tr>
<td>Chip-to-chip time, tools up to 6 kg (VDI 2852)</td>
<td>approx. s</td>
<td>6.5</td>
</tr>
</tbody>
</table>

**Machine**

- Control: Siemens Sinumerik type 840D sl
- Space requirement basic machine, L x W x H m: 9.1 x 5.7 x 4.3
- Machine weight approx. kg: 44 000

#### Machine bed with gantry drive in Z-axis and 4 integrated chip grooves for optimal chip removal.

- Machine bed with gantry drive in Z-axis and 4 integrated chip grooves for optimal chip removal.

- NBH 1000 5X WITH TILT HEAD

- Closed, double wall and optically rigid machine column with additional profile geometry at rear to support the tilt head.

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