High-speed Integrated Motor Spindle for Machining Centers

Spindles with ISO-40 equivalent taper deliver high-speed performance of operating speeds up to 20 000 min⁻¹ while reducing energy consumption and noise using NSK's new grease replenishing system.

For more information about NSK products, please contact:
World-class performance with the highest available speed

The highly functional High-speed Integrated Motor Spindle for Machining Centers maximizes the machining ability of Class #40 high-speed machining centers. NSK realized the world’s highest speed performance of 20,000 min⁻¹ by thoroughly developing heavy cutting ability, ultra low noise, and lower environmental load.

1. Best-in-class speed
   NSK’s ROBUST Series bearings and FANUC’s integrated, high-performance motor deliver the highest speed for this class of spindle. The maximum speed of 20,000 min⁻¹ (\(6.7 \times 10^6\)) was achieved under position-preloaded grease lubrication.

2. Ultra low noise
   NSK’s design technology combined with its outstanding bearing technology and proven expertise result in ultra low noise of 69 dB with reduced vibration at 20,000 min⁻¹.

3. Low environmental load
   Air consumption was cut back by 70% with oil consumption brought down to zero, significantly reducing both energy consumption and waste.

4. Wide-range heavy cutting
   Boasting high-speed performance of 500 cm²/min for steel and 3,700 cm²/min for aluminum, NSK Integrated Motor Spindle supports the machining of dies and aluminum parts over a wide range of machining performance, from low to high speeds.

NSK’s ROBUST Series bearings and FANUC’s integrated, high-performance motor deliver the highest speed for this class of spindle. The maximum speed of 20,000 min⁻¹ (\(6.7 \times 10^6\)) was achieved under position-preloaded grease lubrication.

Bearing technology + design technology
Up to 20,000 min⁻¹ (\(6.7 \times 10^6\)) under position-preloaded grease lubrication.

NSK’s design technology combined with its outstanding bearing technology and proven expertise result in ultra low noise of 69 dB with reduced vibration at 20,000 min⁻¹.

Design technology + lubrication technology
69 dB at 20,000 min⁻¹

Air consumption was cut back by 70% with oil consumption brought down to zero, significantly reducing both energy consumption and waste.

Bearing technology + built-in motor technology
Steel: 500 cm²/min
Aluminum: 3,700 cm²/min

Boasting high-speed performance of 500 cm²/min for steel and 3,700 cm²/min for aluminum, NSK Integrated Motor Spindle supports the machining of dies and aluminum parts over a wide range of machining performance, from low to high speeds.

Bearing technology + lubrication technology
Air consumption reduced by 70%
Oil consumption reduced to zero

The highly functional High-speed Integrated Motor Spindle for Machining Centers facilitates heavy cutting ability, ultra low noise, and low environmental loads far beyond conventional high-speed spindles by combining NSK’s premier technologies in bearings, lubrication, integrated motor utilization, and design.

Design technology

Bearing technology

Bearing technology + built-in motor technology

Steel: 500 cm²/min
Aluminum: 3,700 cm²/min

Bearing technology + built-in motor technology

Steel: 500 cm²/min
Aluminum: 3,700 cm²/min

MACHINING CENTER
Integrated Motor Spindle
High-speed Integrated Motor Spindle

Superior machining performance in Class #40
Wide range of machining performance for extensive machining needs, from low-speed heavy cutting to high-speed machining.

Improved grease life
Continuous fresh supply of lubricant to components improves grease life.

Ultra low noise
Eliminates grating wind noise caused by oil-air lubrication and reduces noise level to as low as 69 dB at 20 000 min⁻¹.

Built-in motor structure results in low vibration
Direct-drive system with no gears or couplings produces low vibration.

Highly functional integrated motor delivers strong output
Motor mounted with FANUC NC gives the highest possible motor performance.

New grease replenishing system supports 10 000 hours of maintenance-free performance
NSK’s new proprietary, environmentally friendly grease replenishing system automatically delivers a small quantity of grease into the bearing interior at intermittent intervals.

Reduced energy consumption
With air consumption lowered by at least 70%, as little as 50 NL/min of air is required.

Environmentally sound
No oil is consumed, and therefore no oil particles are released into the air.

Built-in motor structure results in low vibration
Direct-drive system with no gears or couplings produces low vibration.

Low vibration
Provides improved quality in cut surface and extends tool life.

Simplified assembly
Incorporating spindle shaft and motor into single unit eliminates need for centering and aligning spindle shaft and motor.

Easier maintenance
Unique cartridge structure allows components to be quickly replaced.

Highly functional integrated motor delivers strong output
Motor mounted with FANUC NC gives the highest possible motor performance.

Cool running
Adopts optimum core shape design and state-of-the-art low iron loss material. Current ripple is lowered with HRV2 control.

Winding switching system
Winding switching system supports a wide power band range, from low to high speeds.

NSK’s state-of-the-art precision bearing technology
Incorporates the ROBUST Series, proven bearings for machine tools. Ceramic balls are used for higher speed, high rigidity, and high reliability.

Cool running
Optimization of internal design realizes cool running.

Improved anti-seize property
Improved heat robustness to handle changes in ambient temperatures.

Ceramic ball
Adopts a high-precision ceramic ball for the rolling element to provide high speed, high precision, and high rigidity.

Work material: S50C
Rotational speed: 1 200 min⁻¹
Metal removal rate: 504 cm³/min

Work material: A5052
Rotational speed: 8 000 min⁻¹
Metal removal rate: 3 780 cm³/min

Work material: A5052
Rotational speed: 20 000 min⁻¹
Metal removal rate: 2 500 cm³/min
High-speed Integrated Motor Spindle

The following numbers will be included in the specification drawing of supplied products. When ordering, please mention the reference numbers for the product you would like to purchase.

Monitor switch
0: None   1: Monitor switch
2: Upper and lower position limits of the tool releasing cylinder
Monitor switch/Upper and lower position limits of the tool releasing cylinder

Seal
0: Standard seal

Coolant (Option)
0: None   1: Through-spindle coolant
2: Flood coolant nozzle
3: Through-spindle coolant / Flood coolant nozzle

Lubrication system
0: Packed grease   1: Automatic grease replenishment

Motor model
11: \(\alpha_{112S/20\,000} \)
12: \(\alpha_{112L/20\,000} \)

Flange
0: Standard position   1: Special position

Spindle taper/rotational speed
0: BT40/15,000   1: BT40/20,000
3: HSK-A63/15,000   4: HSK-A63/20,000

Reference number example:
11 00 1 3 4 6-14 drill thru 20 c'bore, 13 depth

**Specifications of High-speed Integrated Motor Spindle**

**Advantages of all-in-one spindle unit**

**Discrete components**
- Order
- Collection of components
- Assembly
- Adjustment
- Mounting on main machine

**All-in-one-unit**
- Order
- Mounting on main machine

**Reduced production lead time**
- Significantly reduces time from order to completion of spindle adjustment.
- Also reduces running stock.

**Curbs maintenance costs**
- Spindles can be used for different machines in the factory.
- Reduces spare unit inventory.

**Tool holder**
BT40/HSK-A63

**Tool clamping unit**
Equipped with a spiral disk spring to maintain balance, and a monitor switch for checking tool presence.

**Tool releasing cylinder**
Equipped with switches for upper and lower position limits.

**Completely prevents coolant intrusion**
Quaduple structure consists of the labyrinth seal, the sealing spacer, the air seal, and the slinger seal.

**Rotary union**
Supplies through-spindle coolant under high pressure (7 MPa). Also suitable for MQL processing.

**Tool releasing cylinder**
Equipped with switches for upper and lower position limits.

**Flood coolant nozzle**
Nozzles mounted in six locations. Primarily effective for horizontal machining centers.

**Tool clamping unit**
Equipped with a spiral disk spring to maintain balance, and a monitor switch for checking tool presence.

**Rotary union**
Supplies through-spindle coolant under high pressure (7 MPa). Also suitable for MQL processing.

**Advantages of all-in-one spindle unit**

**Dimensions**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Type S Standard</th>
<th>Type L Standard</th>
<th>Type L High-speed</th>
<th>Type S High-speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool shank</td>
<td>BT40/HSK-A63</td>
<td>←</td>
<td>←</td>
<td>←</td>
<td>←</td>
</tr>
<tr>
<td>Rotational speed</td>
<td>(min⁻¹)</td>
<td>15 000</td>
<td>20 000</td>
<td>15 000</td>
<td>20 000</td>
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<tr>
<td>Output (short time/continuous)</td>
<td>(kW)</td>
<td>18.5 [10 min] /11</td>
<td>22 [15 min] /18.5</td>
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<td>←</td>
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<tr>
<td>Torque</td>
<td>(N·m)</td>
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<td>←</td>
<td>118</td>
<td>←</td>
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<tr>
<td>Boundary dimension</td>
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<tr>
<td>(D_1) (mm)</td>
<td>210</td>
<td>←</td>
<td>230</td>
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<tr>
<td>(D_2) (mm)</td>
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<td>(D_3) (mm)</td>
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<td>(D_4) (mm)</td>
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<td>(L) (mm)</td>
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<tr>
<td>(L_4) (mm)</td>
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<td>←</td>
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<td>←</td>
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</tr>
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