Grease Replenishing System for High-Speed Spindles
Fine-Lub II

Faster and firmer, with improved comfort. A new system that dramatically increases grease lubrication performance.
Machine tools should require less maintenance, allowing around-the-clock use. Working conditions should be safe and comfortable for people on the job.

Redesigning the spindle lubrication system makes it all possible.

The world’s first system to convert the high-speed spindles of machining tools from oil lubrication to grease lubrication ensures cleanliness, saves energy and provides more than 10,000 hours of maintenance-free performance.

Until recently, high-speed spindles have used oil-air or oil-mist lubrication. Current worldwide concern for the environment requires a new system that reduces noise and oil mist while supporting clean working conditions and energy efficiency. In response to this demand, NSK has developed Fine-Lub II, the world’s first grease replenishing system for high-speed machining tool spindles. Fine-Lub II utilizes an external control device to feed grease into bearings at regular intervals, enabling more than 10,000 hours of maintenance-free performance at maximum continuous rotation speed. In addition to saving energy and providing a cleaner working environment, Fine-Lub II also increases the operating life of grease. NSK’s new technology unites the spirit of innovation with concern for the environment and humane working conditions.

Advantages of the Fine-Lub II System

- **High-speed, long-life performance through grease lubrication**
  Fine-Lub II provides grease lubrication for high-speed spindles that formerly used oil-air or oil-mist lubrication systems. Fine-Lub II can provide more than 10,000 hours of maintenance-free performance, even for BT40 machining centers continuously operating at 20,000 min⁻¹. The new system dramatically boosts grease lubrication reliability by feeding grease at regular intervals.

- **Clean working conditions**
  The new system helps maintain clean, environmentally safe working conditions; oil mist is no longer released into the air.

- **Low noise**
  Unlike oil-air lubrication, Fine-Lub II does not require constant air feeding and thereby eliminates irritating wind noise, reducing it by 3 to 5 dB at 20,000 min⁻¹, compared with oil-air lubrication.

- **Energy savings**
  Unlike oil-air lubrication, Fine-Lub II does not require constant air feeding. Air for piston drives is only fed at regular intervals for significantly reduced machinery operating cost and substantial energy savings.
High-speed spindles that formerly used oil can now use grease. NSK’s proven expertise makes it possible.

Fine-Lub II provides grease lubrication for high-speed spindles and increases lubrication reliability. NSK technology leads a new era in lubrication.

Fine-Lub II feeds a small amount of grease into high-speed rotating bearings at regular intervals and discharges old grease through an optimally shaped spacer to a grease storage tank located in the housing. This technology delivers the world’s first grease lubrication system for the high-speed spindles of machining tools, while at the same time, increases the operating lifetime of grease. This revolutionary product completely transforms the perception of grease lubrication. Fine-Lub II leads a new era in grease lubrication, making it faster and firmer, with improved comfort.

Realizing grease lubrication with longer operating life

The operating lifetime of grease is several hundred hours during continuous rotation at a speed of 1.8 $\text{M} \cdot \text{min}^{-1}$ (400,000 $\text{min}^{-1}$). Fine-Lub II was developed with the goal of feeding in an appropriate amount of grease—according to rotation speed and bearing size—to avoid seizing, thereby ensuring more than 10,000 hours of maintenance-free performance.

Preventing temperature rise associated with the discharge of lubrication by controlling the amount of grease

Feeding too much grease into the inside of a bearing can cause temperature rise by grease churning. To prevent this, Fine-Lub II features a built-in device to ensure an appropriate amount of grease is discharged.

### The Structure for Feeding Grease to Bearings

**Cross-section of spindle**

- Storage groove for discharging grease
- Replenishing groove
- Housing
- Spacer for discharging grease

**Bearing shape designed specifically for grease replenishing**

- Grease replenishing method
  A small amount of grease is fed into a spinning bearing, at regular intervals, through a grease inlet located near the outer ring raceway. This grease feed is controlled in small amounts to prevent temperature rise of the bearing.

- Grease discharging method
  A specially shaped spacer for grease discharge, located at the counter-bore side, directs old grease into a storage race, preventing it from re-entering the inside of the bearing.

### Comparison of grease lifetime

<table>
<thead>
<tr>
<th>Grease lifetime, hrs</th>
<th>Conventional lubrication</th>
<th>Grease replenishing lubrication</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,000</td>
<td></td>
<td></td>
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<tr>
<td>10,000</td>
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</table>

*Operation in excess of 10,000 hours at a speed of 1.8 $\text{M} \cdot \text{min}^{-1}$ is equivalent to more than five years of machinery durability.

### 0.02 cc of replenishing grease

- Replenishing the grease in the bearings

### 0.30 cc of replenishing grease (2% of spatial volume)

- Replenishing the grease in the bearings

### 0.55 cc of replenishing grease (5% of spatial volume)

- Replenishing the grease in the bearings

**Test conditions:**

- Bearing number: 65BNR10HTDB
- Preload in mounted condition: 320N (with position preload)
- Belt-driven rotation speed: 22,000 $\text{min}^{-1}$
- Housing was not cooled

**Temperature increase at outer ring, $\text{˚C}$**

- 0.02 cc of replenishing grease
- 0.30 cc of replenishing grease
- 0.55 cc of replenishing grease

**Grease lifetime, hrs**

- 200
- 600
- 1,000
- 10,000
- More than 10,000 hours
How to set up Fine-Lub II
The Fine-Lub II grease replenishing system is designed to allow freedom of configuration, vertically or horizontally, anywhere.

* Selection guide for bearings with grease lubrication
Bearing types are based on preload method and rotational speed.

ROBUST Series spindle bearings: high-speed precision specially designed for Fine-Lub II
The ROBUST Series bearings realize long life through special grease replenishing features
To realize high-speed, long-life grease lubrication, the low heat generating ROBUST Series bearings incorporate a grease replenishing system that provides a grease inlet at an optimal position on the outer ring. Unlike oil-air lubrication, phasing work and O-rings are not necessary.

MTE grease for machining tools
The MTE grease, which is sealed within the Fine-Lub II, was originally developed by NSK for high-speed, heavy load applications and is used extensively in machining tools. Due to the lower degree of isolation of the base oil, MTE grease is ideal for pressure-feed replenishing.

Allows replenishment of grease
Fine-Lub II can be used continuously by replenishing its MTE grease (sold separately).

Optional parts

<table>
<thead>
<tr>
<th>Parts No.</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREASE-MTE 100G</td>
<td>MTE grease (100 g)</td>
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<tr>
<td>EGJ-01</td>
<td>Male/female joint for grease replenishing</td>
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</table>

Fine-Lub II Specifications

<table>
<thead>
<tr>
<th>Model Number</th>
<th>2P1</th>
<th>4P2</th>
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</thead>
<tbody>
<tr>
<td>Discharge amount (cc/cycle)</td>
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<td>P1</td>
</tr>
<tr>
<td></td>
<td>0.02</td>
<td>P2</td>
</tr>
<tr>
<td>Code number</td>
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</tbody>
</table>

System Diagram

Dimensions

Model Number

<table>
<thead>
<tr>
<th>EQU</th>
<th>2P1</th>
<th>Two P1 ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQU</td>
<td>4P2</td>
<td>Four P2 ports</td>
</tr>
<tr>
<td>EQU</td>
<td>6P1</td>
<td>Six P1 ports</td>
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</table>

Air feeding pressure

<table>
<thead>
<tr>
<th>Fine-Lub II Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air feeding pressure</td>
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<tr>
<td>Discharge amount</td>
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<tr>
<td>Tank capacity</td>
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<tr>
<td>Monitoring function</td>
</tr>
<tr>
<td>Pipe length</td>
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<tr>
<td>Sealed-in grease</td>
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</tbody>
</table>

System Diagram

Pressure switch (for air monitoring)

Wiring

Air pipe

Grease replenishing device

Spindle

Grease replenishing pipe

预留图示

Oil pipe for air feeding

Teflon tube for grease replenishing

Resin pipes for air feeding

Air intake opening 1

Air intake opening 2

Grease outlet

Grease replenishing opening plug

Pressure switch

Level switch (to monitor remaining grease amount)

Inscription number

Grease outlet

Pipe length

Discharge amount

Grease replenishing device

Fine-Lub II can be used continuously by replenishing its MTE grease (sold separately).