Lubrication Unit NSK K1™
Used on NSK Linear Guides™, Ball Screws and Monocarriers™

Fifteen years of proven efficiency in providing lubrication

Lubrication unit NSK K1™ for food processing and medical equipment is also available.
Lubrication Unit NSK K1™

- NSK K1 lubrication unit equipped with an NSK linear guide, ball screw and Monocarrier is an outstanding new lubrication material.
- A Newly developed porous synthetic resin contains large volume of lubricant oil that seeps out and enhances lubricating function.

NSK K1 lowers machine operation cost, and reduces impact on the environment.

NSK K1 is a lubrication device which combines oil and resin in a single unit. The porous resin contains a large amount of lubrication oil. Touching its surface to the raceway of a rail close to the ball contact point NSK K1 constantly supplies fresh oil which seeps from the resin.

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- A Newly developed porous synthetic resin contains large volume of lubricant oil that seeps out and enhances lubricating function.

You can achieve the following:

- Long-term maintenance-free (cost reduction)
- Long life under severe environments
- Environmentally sound clean lubrication system

Lubrication system equipped with the NSK K1 lubrication unit is maintenance free for more than five years or 10,000 kilometers.

A lubrication system equipped with the NSK K1 lubrication unit is maintenance free for more than five years or 10,000 kilometers.

Installation to linear guide

Clamping ring

End seal

Ball slide

End cap

Protective cover

NSK K1

Features of NSK Linear Guides equipped with NSK K1

With the NSK-K1 lubrication unit, maintenance is unnecessary for more than five years or 10,000 km.

Simply attach the unit inside the standard end seal.

The NSK K1 lubrication unit is also available for use with food machinery, medical equipment and peripherals in environments with strict hygienic or sanitation restrictions. See page 5 for details.

Ball Screws equipped with NSK K1

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Simply attach the unit inside the standard end seal.

The NSK K1 lubrication unit is also available for use with food machinery, medical equipment and peripherals in environments with strict hygienic or sanitation restrictions. See page 5 for details.

Comparison test between NSK K1 and standard seal

<table>
<thead>
<tr>
<th>Sample: LH310 (slight preload)</th>
<th>Lubrication:</th>
<th>Load:</th>
<th>Speed:</th>
<th>Stroke:</th>
</tr>
</thead>
<tbody>
<tr>
<td>with NSK K1</td>
<td>Only NSK K1</td>
<td>None</td>
<td>60 m/min</td>
<td>750 mm</td>
</tr>
<tr>
<td>No lubricant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Running 15,000 km</td>
<td>Damaged at 7 km</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample: Shaft dia. 20 mm, lead 20 mm</th>
<th>Lubrication:</th>
<th>Load:</th>
<th>Speed:</th>
<th>Stroke:</th>
</tr>
</thead>
<tbody>
<tr>
<td>with NSK K1</td>
<td>Only NSK K1</td>
<td>None</td>
<td>4,000 min⁻¹</td>
<td>450 mm</td>
</tr>
<tr>
<td>No lubricant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Running 20,000 km</td>
<td>Damaged at 8 km</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Advantages:

- A reduction in expenditure on oil or grease cost by making it unnecessary to replenish lubricants for an extended period
- A reduction in personnel costs for regular maintenance
- A reduction in the cost of designing and replenishing piping or equipment, parts expenditures, and lead time for assembly
- A reduction in the cost for coolants and in processing oil waste (No lubricant contamination → Prolonged life of coolants)
2 Long Life even in Severe Environments

Use of the NSK K1 lubrication unit significantly prolongs the life of your machinery, even in severe contaminated environments or undesirable environments for lubrication.

Advantages:
- A reduction in maintenance cost, including repair parts and personnel
- Longer time between repairs → shortened down-time on the production line → improved productivity

Example of severe environments
- Contaminated environments; Machine tools, welding machines, etc.
- Environments where oil- and grease absorbing dust is produced; Woodworking machines, textile machines, papermaking machines, printing machines, etc.
- Environments where lubricant is washed away; Machines that are washed away entirely by water, machines that are exposed to rain or water.

Test result of ball screws in contaminated environments

Sample: Screw shaft dia. 40 mm, lead 10 mm
Circuit: 2.5 x 1
Load: 3.9 kN
Speed: 2 000 min⁻¹ (20 m/min)
Stroke: 340 mm
Contamination: Dropped contaminants onto screw shaft periodically.

FCD45 particle 115 MESH added at coolant (Coolant dilution 30:1)
Volume of contaminant: Coolant 3 600 cm³ + casting particles 1.8 g/day

Abrasion higher than 20 μm (when abrasion is spread all over the grooves)

Abrasion around 5 to 6 μm (normal abrasion conditions)

3 A Clean Lubrication System That is Environmentally Friendly

We want to avoid contamination by oil dispersion...
We don’t like coolant decomposition and odor caused by lubricant falling into coolants.

By using the NSK K1 lubrication unit, you can solve these problems and achieve a clean and environmentally sound machinery/equipment system.

Merit
- Suitable for machinery or equipment used where exposed lubricants should be avoided, such as food processing machinery, medical equipment, or engineering and textile machinery.
- Suitable for machinery or equipment that requires extremely high levels of cleanliness, such as semiconductor and LCD fabrication-related equipment.
- Improvement of work environment

Precautions for handling

To maintain high functionality of the NSK K1, observe the following precautions.
1. Temperature range for use: Maximum temperature in use: 50°C
   Momentary maximum temperature in use: 80°C
2. Chemicals that should not come into contact with NSK K1:
   Do not leave the NSK K1 in an organic solvent, such as hexane and thinner that remove oil, or rust preventive oil that contains white kerosene.

Note: Water-type cutting oil, oil-type cutting oil, mineral-oil type grease and ester-type grease do not damage NSK K1.
The NSK K1 lubrication unit for food processing and medical equipment is a phenomenal new material seal that is safe and secure. The newly developed porous synthetic resin contains abundant lubricant. With the basic functions of highly praised NSK K1 for general industry, more sophisticated materials make it applicable in food and medical equipment. It also offers easy installation, mounted inside the standard seal housing.

Features of NSK K1 Lubrication Unit for Food and Medical Equipment

- Very safe to handle
  - Uses highly safe materials that are compliant with the US Food and Drug Administration’s (FDA) hygiene standards for food additives.
- Environmentally sound
  - The newly developed porous synthetic resin provides a controlled supply of lubricant, preventing the dispersion of oil in sanitary environments.
- Resistant to harsh environments
  - It is durable not only under normal environments, but also under harsh environments, such as machinery submerged in water.

- The highest grade of category H1 grease of USDA standard is used for NSK K1 lubrication unit.
  - USDA: USDA (The United States Department of Agriculture)
  - *Features of grease for food processing machines:
    - This grease is approved by USDA H1, (National Science Foundation [NSF] carries out certification for USDA.)
    - Superb water resistance and antitrust capability
    - Superb wear resistance
    - Applicable for a centralized oiling system

- Appropriate volume of grease
  - A supply of appropriate volume of grease reduces grease drainage and scattering, and maintains a clean environment.

- Reduced expense for lubricants (see graph on the right)
- No or oil or grease supply systems required ➔ Reduced equipment cost
- Improved machine design time and efficiency ➔ No piping design required
- Long-term maintenance free ➔ Reduced maintenance cost
- Better for the environment ➔ NSK K1 reduces lubricant consumption, minimizes waste oil

Applications

- Lifter and carrier / Multi-tier stock systems / Engine/chassis decking systems / Underbody line welding machines / Body line conveyor systems / Marking machines / Material handling systems / Sorting systems / Assembly vibration testers / Assembly machines / Differential gear grinding machines

Introduction of Performance by Use

1 Automotive Manufacturing Equipment

Maintenance Free, Long Life even in Severe Environments

Actual results from welding machines, the most severe environment in automotive plants

<table>
<thead>
<tr>
<th>Ball deterioration</th>
<th>Railway deterioration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample No.1 (without NSK K1)</td>
<td>Sample No.2 (with NSK K1)</td>
</tr>
<tr>
<td>Sample No.1 (without NSK K1)</td>
<td>Sample No.2 (with NSK K1)</td>
</tr>
</tbody>
</table>

Comparison after running

Sample No.1 (without NSK K1): Rail and ball slide raceways and balls showed rust and extensive deterioration
Sample No.2 (with NSK K1): Rail and ball slide raceways and balls had no rust and only slight deterioration

Comparison of lubricant consumption

Estimated oil consumption in the test equivalent to 5 years running (for 4 LH45 slides)

- 0.3 cm³ × 16 h/day × 340 days/year × 5 years × 4 slides = 32,640 cm³
- 59 cm³ × 4 slides = 236 cm³

LH Series: LH12, LH15, LH20, LH25, LH30, LH35
PW Series: PW09, PW12, PW15
LU Series: LU09, LU12, LU15
PE Series: PE09, PE12, PE15
LE Series: LE09, LE12, LE15

The table below shows available models.
Introduction of Performance by Use

2 Machine Tools

High-Load Life Test Using Cutting Coolant which is Contaminated with Cast Iron Particles

3 Samples of different lubricant conditions

<table>
<thead>
<tr>
<th>Sample</th>
<th>Lubricating condition</th>
<th>Condition</th>
<th>Result</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.1</td>
<td>Grease only</td>
<td>No</td>
<td>Yes</td>
<td>36,000 cm</td>
</tr>
<tr>
<td>No.2</td>
<td>NSK K1 + Grease</td>
<td>No</td>
<td>No</td>
<td>19,200 cm</td>
</tr>
<tr>
<td>No.3</td>
<td>Oil only</td>
<td>No</td>
<td>Slight</td>
<td>0.45 cm³ × 144 hr/day</td>
</tr>
</tbody>
</table>

Merit

- Reduced expense for lubricants (see graph in the right)
- No oil or grease supply systems required
- Reduced equipment cost
- Improved machine design time and efficiency
- No piping design required
- Better for the environment

Comparison of lubricant consumption

Estimated oil consumption in the test equivalent to 5 years running (for 4 LA45 slides)

<table>
<thead>
<tr>
<th>Lubricant volume, cm³</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.45 cm³ × 144 hr/day</td>
<td>NSK K1 with grease</td>
</tr>
<tr>
<td>110 cm³</td>
<td>Oil lubrication</td>
</tr>
</tbody>
</table>

Applications

- Machining centers
- NC Lathes
- Telescopic cover for horizontal machining center
- Laser processing machines (X and Y axes)
- Pallet changer
- Water jet cutter

3 Woodworking Machines

Long Life even with Wood Chip Contamination

Life is 2 times longer than standard double seals in woodworking machines

Comparison test between NSK K1 and standard double seal

Test conditions

- Sample: LH30AN (Preload Z1)
- Feed rate: 20 m/min
- Stroke: 400 mm
- Lubrication: Standard double seal - AV2 grease
- Load: 490 N per one ball slide

Wood chip contamination: Set the product in the box with bottom area A, then put 240 g of wood chips on the rails. Put back removed wood chips to rails 3 times/day.

<table>
<thead>
<tr>
<th>High volume of chips</th>
<th>Standard double seal</th>
<th>NSK K1 + AV2 grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = 145 mm (width) × 700 mm (length)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Medium volume of chips]</td>
<td>A = 170 mm (width) × 700 mm (length)</td>
<td></td>
</tr>
</tbody>
</table>

Comparison test between NSK K1 and standard double seal

Test conditions

- Sample: LH30AN (Preload Z1)
- Feed rate: 20 m/min
- Stroke: 400 mm
- Lubrication: Standard double seal - AV2 grease
- Load: 490 N per one ball slide

Wood chip contamination: Set the product in the box with bottom area A, then put 240 g of wood chips on the rails. Put back removed wood chips to rails 3 times/day.

Test results (high volume of chips)

- NSK K1: Damaged at 1,000 km
- Standard double seal: Damaged at 7,000 km

Test results (medium volume of chips)

- NSK K1: Damaged at 5,000 km
- Standard double seal: Damaged at 2,800 km

Merit

- No oil or grease supply systems required
- Reduced equipment cost
- Improved machine design time and efficiency
- No piping design required
- Better for the environment
- NSK K1 reduces lubricant consumption, minimizes waste oil

Applications

- Router
- Lumber cutting, groove making machines
- Pre-cutting machines
- Unmanned lumbering machines
**Introduction of Performance by Use**

4 **Semiconductor / LCD Manufacturing Equipment**

**Low Particle Emission**

Combining the NSK K1 with LG2 grease for low particle emission is comparable to using vacuum grease.

Test conditions:
- Sample: LS20
- Speed: 36 m/min

**Good Operability** (Stable Dynamic Friction Force)

Dynamic friction force is 1/3 of fluorine type grease (at 20 m/min).

**Applications**

- LCD substrates polishing machines
- LCD glass substrates transporting machines
- Thin film processing equipment for semiconductors
- Washing machines
- Full automatic wafer mounters
- Washing section of the wafer polishing machines
- Carrier arm section of logic handler
- CMP

5 **Food Processing, Medical/Nursing Equipment**

** keeps Equipment and Adjacent Areas Clean**

Wear life is 3 times longer than normal seals under wet conditions.

**Endurance test in water**

Test conditions:
- Sample: LS30 stainless steel
- Load: 4 700 N per one ball slide
- Stroke: 450 mm
- Speed: 24 m/min
- Lubrication: Grease full pack
- Consistency: 280, Viscosity: 580 cSt
- Water exposure: Run in water 1 day per week.

**Applications**

- Sample preparation systems
- Blood analyzer
- Medical examination tables and bed transfer equipment
- Medical scanner
- Analytic equipment
- Nursing equipment and disabled aids
- Food processing machines
- Food conveyor

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**Comparison of particle emission characteristics**

- NSK K1 + LG2 grease
- Fluorine type grease
- NSK K1 + general grease

**Change of dynamic friction force (100% at the beginning)**

- NSK K1 + LG2 grease
- Fluorine type grease
- NSK K1 + general grease

**Applications**

- Sample: LH30AN, preload Z1 (only with NSK K1)

**Change of oil supply of NSK K1 and dynamic friction force**

- Test conditions:
  - Sample: LH30AN, preload Z1 (only with NSK K1)
  - Load: Average 38.4 m/min
- Lubrication: Grease full pack

**Applications**

- Sample preparation systems
- Blood analyzer
- Medical examination tables and bed transfer equipment
- Medical scanner
- Analytic equipment
- Nursing equipment and disabled aids
- Food processing machines
- Food conveyor
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www.nsk.com

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