Lubrication Unit NSK K1™
Used on NSK Linear Guide™, Ball Screws and Monocarrier™

Twenty 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 lubrication 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.

You can achieve the following:
- Long-term maintenance-free (cost reduction)
- Long life under severe environments
- Environmentally sound clean lubrication system

Lubricant oil and polyolefin combined and molded into one unit
- Containing 70% of lubrication oil
- Supplies lubricant oil for long periods of time

NSK K1 lubrication unit equipped with an NSK linear guide, ball screw and Monocarrier is an outstanding new lubrication material.

You want to reduce the workload and cost of replenishing oil and grease…

We want to eliminate piping for oil supply…

We cannot suspend our production line for replenishing oil…

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

Comparison test between NSK K1 and standard seal
Sample: LH30 (slight preload)
Lubrication: 1) Only NSK K1
2) No lubricant
Load: None
Speed: 60 m/min
Stroke: 750 mm

Sample: Shaft dia. 20 mm, lead 20 mm
Lubrication: 1) Only NSK K1
2) No lubricant
Load: None
Speed: 4,000 min⁻¹
Stroke: 450 mm

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 |
| Lubrication: 1) AS2 Grease (packed before operation only) |
| 2) AS2 Grease (packed before operation only) + NSK K1 |
| 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 |

Test result: abrasion on nut grooves of a ball screw (perpendicular surface) (Running distance: 1,864 km)

(1) Without NSK K1
(2) With NSK K1

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

Abrasion around 5 to 6 µm (normal abrasion conditions)

Use of the NSK K1 lubrication unit has reduced abrasion of ball screws by 75%.

3 A Clean Lubrication System That is Environmentally Friendly

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

**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.

**Adjacnet areas for NSK K1 installed linear guide**

NSK K1 installed linear guide

Replenishing grease is not required, so machines are kept clean.

**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 end seal (rubber).

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.

Features of NSK Linear Guides for Sanitary Environments

- The highest grade of category H1 grease of USDA standard is used for NSK K1 lubrication unit.
  *Category H1: Lubricants permitted for use where there is possibility of incidental food contact
  *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 draining and scattering, and maintains a clean environment.

The table below shows available models.

<table>
<thead>
<tr>
<th>Series</th>
<th>Model</th>
<th>Model</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH Series</td>
<td>NH15, NH20, NH25, NH30, NH35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NS Series</td>
<td>NS15, NS20, NS25, NS30, NS35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LW Series</td>
<td>LW17, LW21, LW27, LW35</td>
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<tr>
<td>PU Series</td>
<td>PU09, PU12, PU15</td>
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<td></td>
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<tr>
<td>LU Series</td>
<td>LU09, LU12, LU15</td>
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<tr>
<td>PE Series</td>
<td>PE09, PE12, PE15</td>
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<tr>
<td>LE Series</td>
<td>LE09, LE12, LE15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miniature LH Series</td>
<td>LH12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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>Operating conditions</th>
<th>Sample No.1</th>
<th>Sample No.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubrication</td>
<td>AV2 grease (prepacked only)</td>
<td></td>
</tr>
<tr>
<td>No.1: Double seal + Protector (no NSK K1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.2: NSK K1 attached + Single seal + Protector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tested on the same welding machine in automotive production line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample No.1: 10.5-month operation</td>
<td></td>
<td></td>
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<tr>
<td>Sample No.2: 36-month operation</td>
<td></td>
<td></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

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
- Long-term maintenance free ➞ Reduced maintenance cost
- Better for the environment ➞ NSK K1 reduces lubricant consumption, minimizes waste oil

Comparison of lubricant consumption

Estimated oil consumption in the test equivalent to 5 years running (for 4 LH445 slides)

- 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

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>Load (9 800 N/one ball slide)</th>
<th>Feed</th>
<th>Contamination</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>LY45BN</td>
<td>Grease: AV2</td>
<td>24 m/min</td>
<td>FC640 particles 115 MESH (125 µm or less) added at 5% (by weight)</td>
<td>2 days in coolant (ball grooves of rail are immersed) 5 days no coolant</td>
</tr>
<tr>
<td>NC Lathes</td>
<td>Stroke: 400 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telescopic cover for horizontal machining center</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser processing machines (X and Y axes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pallet changer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water jet cutter</td>
<td></td>
<td></td>
<td></td>
<td></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 -> NSK K1 reduces lubricant consumption, minimizes waste oil

Comparison of lubricant consumption

Estimated oil consumption in the test equivalent to 5 years running (for 4 LA4S slides)

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

<table>
<thead>
<tr>
<th>Sample</th>
<th>Feed rate</th>
<th>Stroke</th>
<th>Lubrication</th>
<th>Load</th>
<th>Wood chip contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>LH53AN</td>
<td>20 m/min</td>
<td>400 mm</td>
<td>Standard double seal - AV2 grease</td>
<td>490 N per one ball slide</td>
<td>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.</td>
</tr>
<tr>
<td>NSK K1 + AV2 grease</td>
<td></td>
<td></td>
<td></td>
<td>[High volume of chips]: A = 145 mm (width) × 700 mm (length)</td>
<td></td>
</tr>
<tr>
<td>NSK K1</td>
<td></td>
<td></td>
<td></td>
<td>[Medium volume of chips]: A = 170 mm (width) × 700 mm (length)</td>
<td></td>
</tr>
</tbody>
</table>

Test results (high volume of chips)

Running test in wood chips

Wood chips

NSK K1

Standard double seal

Running distance, km

0 1 000 2 000 3 000 4 000 5 000 6 000

Running distance, km

0 1 000 2 000 3 000 4 000 5 000 6 000

NSK K1

Standard double seal

NSK K1

Standard double seal

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: LS90
Speed: 36 m/min

Good Operability (Stable Dynamic Friction Force)
Dynamic friction force is 1/3 of fluorine type grease (at 20 m/min).
Test conditions
Sample: LS20AL
Preload: 0.2

Applications
- LCD substrates polishing machines
- LCD glass substrates transporting machines
- Thin film processing equipment for semiconductors
- Washing machines
- Automatic wafer mounters
- Wafers and wafer polishing machines
- Carrier arm section of logic handler
- CMP

Comparison of particle emission characteristics

High Performance Lubrication - Maintenance free
Over 30 000 km running with only NSK K1.
Improved performance can be expected when used with the LG2 Grease.

Endurance test without additional lubrication
Test conditions
Sample: LH30AN
Preload: Z1, Z3
Speed: 200 m/min 60 m/min
Stroke: 1 800 mm 750 mm
Load: 63 N/1 ball slide None

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

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
Preload: Z1
Load: 4700 N per one ball slide
Stroke: 400 mm
Speed: 24 m/min
Lubrication: Grease full pack
(Consistency: 290,
Viscosity: 580 cSt)
Water exposure: Run in water 1 day per week.

Change of oil supply of NSK K1 and dynamic friction force
Test conditions
Sample: LH30AN, preload Z1 (only with NSK K1)
Stroke: 800 mm
Speed: Average 38.4 m/min
Load: None

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