LUBRICATION UNIT NSK K1™
USED ON NSK LINEAR GUIDES™, BALL SCREWS, AND MONOCARRIERS™

Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com
NSK K1™ lubrication unit equipped on a NSK linear guide, ball screw or Monocarrier™ is an outstanding new lubrication method. 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.

You can achieve the following:
- Long-term maintenance-free (cost reduction)
- Long life in 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 (Service life: in excess of 100,000 hours)

NSK Linear Guides equipped with 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™
Long-Term Maintenance Free (Cost Reduction)

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

**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)

**Comparison test between NSK K1™ and standard seal**

<table>
<thead>
<tr>
<th>(1) Linear guide</th>
<th>(2) Ball screw</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample:</strong> LH30 (slight preload)</td>
<td><strong>Sample:</strong> Shaft dia. 20 mm, lead 20 mm</td>
</tr>
<tr>
<td><strong>Lubrication:</strong></td>
<td><strong>Lubrication:</strong></td>
</tr>
<tr>
<td>1) Only NSK K1™</td>
<td>1) Only NSK K1™</td>
</tr>
<tr>
<td>2) No lubricant</td>
<td>2) No lubricant</td>
</tr>
<tr>
<td><strong>Load:</strong> None</td>
<td><strong>Load:</strong> None</td>
</tr>
<tr>
<td><strong>Speed:</strong> 60 m/min</td>
<td><strong>Speed:</strong> 40 m/min</td>
</tr>
<tr>
<td><strong>Stroke:</strong> 750 mm</td>
<td><strong>Stroke:</strong> 450 mm</td>
</tr>
</tbody>
</table>

---

*Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com*
Long Life 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.

Note: Rust preventive treatment is required for corrosive environments.

Test result of ball screws in contaminated environments

Sample: Screw shaft dia. 40 mm, lead 10 mm
Circuit: 2.5 × 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™
Abrasion higher than 20 µm (when abrasion is spread all over the grooves)

(2) With NSK K1™
Abrasion around 5 to 6 µm (normal abrasion conditions)

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

**Adjacent areas for NSK K1™ installed linear guide**

![NSK K1™ installed linear guide](image)

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 safe and secure. NSK K1™ FDA-compliant material is used for the lubrication unit, so it is used without concern for food processing and medical equipment.

- 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 submersed 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 antirust 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>NH Series</th>
<th>NH12, NH15, NH20, NH25, NH30, NH35</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS Series</td>
<td>NS15, NS20, NS25, NS30, NS35</td>
</tr>
<tr>
<td>LW Series</td>
<td>LW17, LW21, LW27, LW35</td>
</tr>
<tr>
<td>PU Series</td>
<td>PU09, PU12, PU15</td>
</tr>
<tr>
<td>LU Series</td>
<td>LU09, LU12, LU15</td>
</tr>
<tr>
<td>PE Series</td>
<td>PE09, PE12, PE15</td>
</tr>
<tr>
<td>LE Series</td>
<td>LE09, LE12, LE15</td>
</tr>
</tbody>
</table>

*Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com*
Introduction of Performance by Use: Automotive Manufacturing Equipment

Maintenance Free, Long Life even in Severe Environments

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

Operating conditions:
Sample: LH300200ELC1-PCZ
No.1: Double seal + Protector (no NSK K1™)
No.2: NSK K1™ attached + Single seal + Protector
Tested on the same welding machine at the same place in automotive production line
Sample No. 1: 10.5 month operation
Sample No. 2: 13 month operation

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 to 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

Applications

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

Ball deterioration

Sample No. 1 (without NSK K1™)  Sample No. 2 (with NSK K1™)

Rail raceway deterioration

Sample No. 1 (without NSK K1™)  Sample No. 2 (with NSK K1™)

Comparison of lubricant consumption

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

0.3 cm³ × 16 hr/day × 340 days/year × 5 years × 4 slides = 32,640 cm³

© NSK K1™ with grease  Oil lubrication

Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com
High-Load Life Test Using Cutting Coolant which is Contaminated with Cast Iron Particles

3 samples of different lubricant conditions

**Test conditions:**
- **Sample:** LY45BN (Preload 24)
- **Load:** 9,800 N per one ball slide
- **Preload:** 4,400 N
- **Feed:** Average 24 m/min
- **Stoke:** 400 mm
- **Contamination:** Coolant dilution 30:1
  - FCD45 particles 115 MESH (125 µm or less) added at 5% (by weight)
- **Pattern:** 2 days in coolant (ball grooves of rail are immersed), 5 days no coolant

**Friction force change**

![Friction force change graph]

**Test results**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Lubricating condition (*1)</th>
<th>Broken end cap</th>
<th>Flaking</th>
<th>Lost Preload</th>
<th>Result Distance (km)</th>
<th>Running year (*2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.1</td>
<td>Grease only</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>End cap broke prematurely due to inadequate means of lubrication and particles. 600 km, 0.8 years.</td>
<td></td>
</tr>
<tr>
<td>No.2</td>
<td>NSK K1™ (4 pcs.) + Grease</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Running uninterrupted over 3,600 km, 5 years.</td>
<td></td>
</tr>
<tr>
<td>No.3</td>
<td>Oil only</td>
<td>No</td>
<td>Slight</td>
<td>Yes</td>
<td>Shortened life because of particle and inadequate means of lubrication. 3,000 km, 4.1 years.</td>
<td></td>
</tr>
</tbody>
</table>

(*1): No replenishment of grease to sample No.1 and No.2 during test.

(*2): Running year is calculated by 720 km/year (average 3 m/min × 16 hr/day × 250 days/year).

**Comparison of lubricant consumption**

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

![Comparison of lubricant consumption graph]

**Merit**

- Reduced expense for lubricants (see graph to 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

**Applications**

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

---

Introduction of Performance by Use: Machine Tools

![Introduction of Performance by Use: Machine Tools image]
**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. Reapplied removed wood chips to rails 3 times/day.
- **[High volume of chips]:** \(A = 145 \text{ mm (width)} \times 700 \text{ mm (length)}\)
- **[Medium volume of chips]:** \(A = 170 \text{ mm (width)} \times 700 \text{ mm (length)}\)

**Test results (high volume of chips)**

<table>
<thead>
<tr>
<th>NSK K1™</th>
<th>Standard double seal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Damaged at 2,500 km</td>
</tr>
<tr>
<td></td>
<td>Damaged at 1,000 km</td>
</tr>
</tbody>
</table>

**Test results (medium volume of chips)**

<table>
<thead>
<tr>
<th>NSK K1™</th>
<th>Standard double seal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Damaged at 5,900 km</td>
</tr>
<tr>
<td></td>
<td>Damaged at 2,800 km</td>
</tr>
</tbody>
</table>

**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
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

**Comparison of particle emission characteristics**

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

<table>
<thead>
<tr>
<th>Speed</th>
<th>Stroke</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>High speed</td>
<td>200 m/min</td>
<td>1,800 mm</td>
</tr>
<tr>
<td>Medium speed</td>
<td>60 m/min</td>
<td>750 mm</td>
</tr>
</tbody>
</table>

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: Z1

**Change of dynamic friction force**

(100% at the beginning)

Applications

› LCD substrates polishing machines  
› LCD glass substrates transporting machines  
› LCD glass substrates testing equipment  
› 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
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:** LH30AN, preload Z1 (only with NSK K1™)
- **Load:** 4,700 N per one ball slide
- **Stroke:** 400 mm
- **Speed:** Average 38.4 m/min
- **Lubrication:** Grease full pack
  - Consistency: 280, Viscosity: 580 cst
- **Water exposure:** Run in water 1 day per week.

Good Operability (Stable Dynamic Friction Force)

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
- Food processing machines
- Food conveyor

---

Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com
Worldwide Sales Offices

NSK Ltd., Headquarters, Tokyo, Japan
www.nsk.com
Asia Business Strategic Division-Headquarters
tel: 81-03-3779-7145
Industrial Machinery Bearings Division-Headquarters
tel: 81-03-3779-7277
Automotive Division-Headquarters
www.nsk-americas.com
Needle Roller Bearings Strategic Division-Headquarters
tel: 81-03-3779-2563
Precision Machinery & Parts Division-Headquarters
tel: 81-03-3779-7219

Korea:
NSK Korea Co., Ltd.
www.kr.nsk.com
Seoul
82-02-3287-0300
tel: 82-055-287-6001
Changwon Plant

Malaysia:
NSK Bearings (Malaysia) Sdn. Bhd.
Kuala Lumpur
tel: 60-03-7722-3372
Kuala Lumpur
60-03-961-6288
Malaysia Plant

New Zealand:
NSK New Zealand Ltd.
Auckland
tel: 64-09-276-4992

Philippines:
NSK Representative Office
Makati City
tel: 63-02-893-9543

Singapore:
NSK International (Singapore) Pte Ltd.
Singapore
tel: 65-6496-8000
Singapore
65-6496-8000

Taiwan:
Taiwan NSK Precision Co., Ltd.
Taipei
tel: 886-02-2509-1305

Thailand:
NSK Bearings (Thailand) Co., Ltd.
Bangkok
66-02-6412-150
Siam NSK Steering Systems Co., Ltd.
Chachoengsao
66-038-522-343-350
NSK Asia Pacific Technology Center (Thailand) Co., Ltd.
Chonburi
66-038-454631-454633

Vietnam:
NSK Representative Office
Hanoi
tel: 84-04-935-1269

Europe
NSK Europe Ltd. (European Headquarers)
Maidenhead, U.K.
www.eu.nsk.com
44-01628-509800

France:
NSK France S.A.S.
Paris
33-01-30-57-39-39

Germany:
NSK Deutschland GmbH
Duesseldorf
tel: 49-02102-481-0
NSK Steering Systems Europe Ltd.
Stuttgart
49-0-711-79082-277
Newweg Fertigung GmbH
Munderingen
49-0-7193-540

Italy:
NSK Italia S.p.A.
Milano
39-02-995-19-1
Industria Lusinetti S.p.A.
Turin Plant
39-0119824811

NSK Ltd. has a basic policy not to export any products or technology designated as controlled items by export-related laws. When exporting the products in this brochure, the laws of the exporting country must be observed. Specifications are subject to change without notice and without any obligation on the part of the manufacturer. Every care has been taken to ensure the accuracy of the data contained in this brochure, but no liability can be accepted for any loss or damage suffered through errors or omissions. We will gratefully acknowledge any additions or corrections.

Netherlands:
NSK European Distribution Centre B.V.
Telburg
tel: 31-03-4676474

Poland:
NSK Polska Sp. z o.o.
Warsaw Branch
tel: 48-022-645-1525
NSK Iska S.A.
Kiele
48-041-366-6111
NSK European Technology Center, Poland Office
Kielce
48-041-366-5812

Spain:
NSK Spain S.A.
Barcelona
tel: 34-93-289-27-63

Turkey:
NSK Rulmanlar Orta Dogu Tic. Ltd Sii
90-0216-442-7106

United Kingdom:
NSK Bearings Europe Ltd.
Peterlee Plant
tel: 44-0191-586-6111
NSK European Technology Centre
Newark
tel: 44-01636-605323
NSK UK Ltd.
Newark
tel: 44-01636-605323
NSK Steering Systems Europe Ltd.
Comptery
tel: 44-027-3370100

North and South America

NSK Americas, Inc. (American Headquarters)
Ann Arbor
tel: 1-734-913-7500

Argentina:
NSK Argentina SRL
Buenos Aires
tel: 54-011-476-6556

Brazil:
NSK Brasil Ltda.
Sao Paulo
tel: 55-011-3269-3500

Canada:
NSK Canada Inc.
Toronto
tel: 1-905-890-0740

Mexico:
NSK Rodamientos Mexicanos, S.A. de C.V.
Mexico City
tel: 52-5-18282900

United States of America:
NSK Corporation
Ann Arbor
tel: 1-734-913-7509
NSK Americas, Inc.
Ann Arbor
tel: 1-734-913-7500
NSK Precision America, Inc.
Franklin
tel: 1-800-255-4773
NSK Steering Systems America, Inc.
Bennington, Vermont
1-802-442-5448
NSK Latin America, Inc.
Miami
tel: 1-305-477-0605

NSK Ltd. has a basic policy not to export any products or technology designated as controlled items by export-related laws. When exporting the products in this brochure, the laws of the exporting country must be observed. Specifications are subject to change without notice and without any obligation on the part of the manufacturer. Every care has been taken to ensure the accuracy of the data contained in this brochure, but no liability can be accepted for any loss or damage suffered through errors or omissions. We will gratefully acknowledge any additions or corrections.

K1/A8/1M14. Printed in the USA © NSK 2014. The contents of this publication are the copyright of the publishers.

Courtesy of Steven Engineering, Inc. - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com