Precision Products
NSK’s ball screws—the fruit of the most advanced tribology (friction control technology)—are produced in greater numbers than those of any other maker based on the strength of the renowned production technology and quality control of NSK, widely recognized as the world’s leading brand.

Every NSK ball screw product benefits from industry-leading production technology and therefore reflects the world’s highest level of quality with unmatched adaptability for a wide variety of applications, including machine tools, injection molding machinery as well as semiconductor and liquid crystal production equipment.

The exceptional reliability of NSK’s ball screws has earned them a solid reputation in the global precision machinery industry.
NSK TOTAL SOLUTION

NSK is the only maker that comprehensively develops and provides a full range of precision products.

Ball screws, incorporating leading-edge technologies and recognized as No.1 in the world;
Linear guides, manufactured through a production technology that ensures high accuracy and premier quality;
Spindles, renowned for their high-speed rotation capability and acknowledged as the best in class; and
Bearings, reflecting the essence of NSK technological superiority and exhibiting unparalleled capabilities in extensive applications across the world.

NSK’s full range of precision products respond to sophisticated customer requirements and ensures the smooth operation of precision machinery as well as total optimization.
NSK Technology for Machine Tools

- NSK Roller Guides—RA Series
- Ball Screws for High-Speed Machine Tools—HMC Series
- High-Speed and Low-Noise Ball Screws—BSS Series
- High-Accuracy and High-Rigidity NSK Linear Guides—High-Accuracy Series
- Precision Bearings for Machine Tools—Robust Series
- Grease Replenishing System—Fine-Lub II
- High-Speed Integrated Motor Spindles—B1 Series
- Ball Screw Support Bearings—TAC Series

Japan has long been the world’s leader in the production of high-accuracy machine tools, and NSK’s ball screws, linear guides and precision bearings have significantly contributed to the development and evolution of high-accuracy machine tools made in Japan. NSK has enjoyed a substantial share of the global market for precision products, a testament to its high reliability, while satisfying customer requirements for exceptional accuracy, outstanding rigidity, and high speed.

1. Long operating life
   - High-load capacity
     The world’s premier high-load capacity, taking full advantage of NSK’s analysis technology, ensures long operating life.
   - Maintenance free
     Reliability of lubrication is improved through the use of NSK K1™ for long-term maintenance-free operation.
   - Highly dust-resistant specification
     A high performance seal, provided as standard, prevents the entry of foreign matter and maintains the original level of sound performance for extended periods of time.

2. High accuracy and high rigidity
   - High rigidity
     The optimum size of the roller used as a rolling element ensures high rigidity and supports more compact machinery.
   - High-motion accuracy
     Vibrations generated by roller passage are substantially reduced by NSK’s unique design method, thereby improving machining quality.

3. A wide range of applications
   - A complete lineup
     A full lineup, from small and large options to low-profile units. A variety of products are available to choose from, according to the customer’s specific application. (RA15, RA20, RA25, RA30, RA35, RA45, RA50 and RA60)
   - Mounting dimensions compatibility
     RA Series dimensions are based on global standards allowing replacement without altering equipment design.

The most advanced roller guides, the culmination of NSK’s advanced craftsmanship, especially in analysis technology and tribology. Featuring high-load capacity, high rigidity and a complete lineup, the RA Series is appropriate for a wide range of applications.

NSK developed RA Series roller guides, the world leader in super high rigidity and high-load capacity, to switch the sliding guides of machine tools to roller guides. Specifically designed retaining pieces and roller circulation components ensure outstanding motion accuracy.

A complete lineup, from small and large options to low-profile units. A variety of products are available to choose from, according to the customer’s specific application. (RA15, RA20, RA25, RA30, RA35, RA45, RA50 and RA60)

Mounting dimensions compatibility
RA Series dimensions are based on global standards allowing replacement without altering equipment design.

Example of bearing deformation analysis
Example of analysis of pressure distribution on the roller contact surface
Cross-sectional view
Satisfying the high speed, high rigidity and high-load capacity requirements of the machine tool industry. Low-vibration ball screws specifically developed for machining centers.

HMC Series are the best-selling ball screws, the standard for machining centers. The series satisfies the high-speed operation requirements of machining centers, which continually demand higher performance.

1. High speed
Strengthened ball circulation components and optimized ball groove profile facilitate operation at a high speed of 120 m/min, the world's fastest level for ball screws used in machine tools.

2. High rigidity and high-load capacity
Increased effective number of turns and optimized ball groove profile afford tripled rigidity and doubled load capacity compared with conventional models. Use of NSK K1™ significantly improves lubrication life.

3. Vertical axis type (option)
HMC Series can accommodate compact, high-load capacity units in which the effective number of turns is increased only in the main load direction.

4. Hollow shaft type (option)
HMC Series can accommodate a hollow shaft unit for the forced cooling of the shaft center to handle ball screw heat and thermal expansion.

New ball circulation method ensures low-noise performance by reducing noise level by 6 dB, corresponding to an approximately 50% reduction in audible noise.

1. Low noise
BSS Series ball screws can operate at super high speeds of 200 m/min, outstanding performance compared to other ball screws.

2. High speed
Ball nut outer diameter is 30% smaller than NSK's conventional models. Compact body allows low-profile table driving.

3. Compact design
Ball nut outer diameter is 30% smaller than NSK's conventional models. Compact body allows low-profile table driving.

Optimally designed ball circulation mechanism reduces vibration generated by the passage of steel balls to 1/3. Ball guides specifically designed for super high-speed machine tools or measuring equipment.

NSK’s High-Accuracy Series linear guides was developed to provide rolling guides with motion accuracy equal to or better than that achieved by hydrostatic guides and sliding guides currently in vogue for high-speed machine tools. High motion accuracy and rigidity are realized by providing an extra long bearing to improve machinery motion accuracy.

1. High-accuracy rail
Pitch of mounting holes is 1/2 that of conventional models to reduce rail deformation and NSK’s ingenuity is evident in mounting holes that prevent rail deformation.

2. High rigidity
Rigidity is further improved by increasing the number of steel balls while maintaining low friction.

3. Compact design
Downsizing of machine tools and equipment can be realized while maintaining high-load capacity. Further downsizing is made possible by combining with BSS Series ball screws.
With a newly developed grease-replenishing lubrication method, B1 Series is quiet, exerts less impact on the environment and offers 20,000 hours of maintenance-free performance.

1. Low noise, less environmental burden, maintenance-free operation
Combination of a highly heat-resistant precision bearing—the epitome of NSK’s expertise—with a FANUC motor provides a wide range of cutting performance.

2. High rigidity
Tool specification complies with BT and HSK. The unclamp mechanism is durable enough to withstand 2 million rotations. Through-coolant capability (7 Mpa) is available as an option.

3. All-in-one unit
Super high-speed angular contact ball bearings (BNR Series) offer high-speed rotation while maintaining low heat generation.
Super high-speed single-row cylindrical roller bearings (RX Series) achieve a speed of 3 million \( \text{d} \text{m} \text{n} \).

A variety of products is available, including units that satisfy the high accuracy and high-speed rotation required by machining centers, and products which provide the high rigidity required by lathes. (Angular contact ball bearings, cylindrical roller bearings, angular contact ball bearings with seals)

More accurate ring roundness and the most advanced engineered polymer technology used for cages make rotation smoother.
Combination of small-diameter balls and specifically designed grooves boost speed by 20% over standard angular contact ball bearings. In addition, a light-weight ceramic rolling element for effective high-speed rotation provides a 1.5 times increase in speed.

The Robust Series represents the epitome of NSK’s art, especially in material, assessment and analysis technologies and consistently supports high-performance machine tools.

1. Complete lineup with a wide range of products
A variety of products is available, including units that satisfy the high accuracy and high-speed rotation required by machining centers, and products which provide the high rigidity required by lathes. (Angular contact ball bearings, cylindrical roller bearings, angular contact ball bearings with seals)

2. High accuracy
More accurate ring roundness and the most advanced engineered polymer technology used for cages make rotation smoother.

3. High speed
Combination of small-diameter balls and specifically designed grooves boost speed by 20% over standard angular contact ball bearings. In addition, a light-weight ceramic rolling element for effective high-speed rotation provides a 1.5 times increase in speed.

4. Material technology
Super high-speed bearings use highly seizure-resistant SH-X materials independently developed by NSK. The combination of SH-X materials and lubrication technology has resulted in the Spin Shot Series of angular contact ball bearings and the RX Series of cylindrical roller bearings. RX Series achieve a speed of 3 million \( \text{d} \text{m} \text{n} \). (#40 spindle: 30 000 \( \text{m} \text{n} \))

Energy-efficient, quiet performance achieved with grease lubrication. The world’s highest-level, high-performance integrated motor spindle.

1. Low noise, less environmental burden, maintenance-free operation
With a newly developed grease-replenishing lubrication method, B1 Series is quiet, exerts less impact on the environment and offers 20,000 hours of maintenance-free performance.

2. High rigidity
Combination of a highly heat-resistant precision bearing—the epitome of NSK’s expertise—with a FANUC motor provides a wide range of cutting performance.

3. All-in-one unit
Tool specification complies with BT and HSK. The unclamp mechanism is durable enough to withstand 2 million rotations. Through-coolant capability (7 Mpa) is available as an option.

Fine-Lub II
Enhanced eco-friendly performance; grease lubrication ensures energy-efficient, quiet and environmentally sound operation.

1. Provides small quantities of grease
Spindle is automatically replenished with grease at high-speed rotation, a function that was previously thought impossible. System increases the longevity of a grease-lubricated, high-speed spindle.
Feeding grease in at small quantities of 0.01 cc per shot every six hours enables steady operation at 20,000 \( \text{m} \text{n} \) with no increase in heat generation during replenishment.

2. Maintenance free
Energy-efficient, quiet replenishing system delivers 20,000 continuous hours of maintenance-free performance at 20,000 \( \text{m} \text{n} \).

High-speed integrated motor spindles

Energy-efficient, quiet performance achieved with grease lubrication. The world’s highest-level, high-performance integrated motor spindle.

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NSK Technology
for Injection Molding Machines

- Ball Screws for High Speed and Heavy Load—HTF-SRC Series
- Ball Screws for Heavy Load—HTF Series
- Ball Screws for Mold Clamping System in Injection Molding Machinery—HTF-Large Lead Series
- Ball Screw Support Bearings for Heavy Load—TAC 03 Series
- NSK Roller Guides—RA Series

Injection molding machinery driven by the electric servo is progressing to produce highly accurate plastic products and machinery components that must withstand hostile environments and operate with exceptional reliability.

From this point of view, NSK’s high-load capacity components should be considered essential for every drive mechanism. They are well suited not only for injection molding machines, but also press machines, die casting machines and other high-load applications.

Ball Screws for High Speed and High Load

NSK Technology for Injection Molding Machines

HTF-SRC Series

Ball screws for heavy load applications, evolved from the best-selling HTF Series of high-load ball screws.

Innovative ball recirculation method has been developed in the quest to meet the recent demands for high-speed rotation and noise reduction required by injection molding machinery.

1. Specifically designed for high load
High-load capacity is achieved by inheriting all the features of the HTF Series, which were developed to handle severe load conditions.

2. High-speed rotation
Feed speed is more than 2 times faster than conventional models as a result of optimizing ball recirculation paths.

3. Quiet
Noise level is reduced to a maximum of half of conventional models by adopting a newly developed ball recirculation method (SRC).

4. A wide variety
A wide variety of shaft diameters (50 to 120 mm) and leads (16 to 25 mm) are available.

5. Various shaft-end forms
Various types of shaft-end forms are available to ensure the perfect transmission of high torque from a drive motor.

Combination of shaft diameter and lead, and maximum feed speed

<table>
<thead>
<tr>
<th>Shaft</th>
<th>Lead</th>
<th>16 mm (dn 150 000)</th>
<th>20 mm (dn 140 000)</th>
<th>25 mm (dn 140 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#50</td>
<td>880 mm/s</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>#60</td>
<td>880 mm/s</td>
<td>740 mm/s</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>#80</td>
<td>550 mm/s</td>
<td>590 mm/s</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: d: outer diameter of screw shaft (mm), n: number of rotations (min⁻¹)
Ball Screws for Heavy Load

High-load capacity is achieved through high load-specific design. Smaller nuts are used for adapting to heavy load driving machinery, such as injection molding machines.

Development of a ball screw for heavy load started in the first half of the 1980s, when injection molding machinery was motor driven. The HTF Series, which was released in 1996, has established its position as the industry standard for heavy load ball screws.

1. Design dedicated to extremely heavy load
   Ball diameter has been increased to the maximum. Rated load was extensively improved over the standard series by optimizing the configuration of recirculation paths and the use of ball grooves specially designed for heavy load.

2. Wide variety
   A wide variety of shaft diameters (45 to 200 mm) and leads (10 to 25 mm) are available.

3. Various shaft-end forms
   Various types of shaft-end forms are available to ensure the perfect transmission of high torque from a drive motor.

Ball Screws for Mold Clamping System in Injection Molding Machinery

Added to the HTF Series as a large-lead series—Employs new recirculation method that was proven in the BSS Series to allow even higher speeds for ball screws under heavy loads.

Developed to meet the demand for a larger lead than the HTF Series. High feed speeds over 100 m/min are possible.

1. High load-specific design
   Rated load is improved by employing the same innovative ball groove design for high-load capacity used in the HTF Series.

2. Quiet and compact design
   Noise level is reduced by up to half by employing the same new recirculation method used in the BSS Series. Outer diameter of nuts has been made smaller for compact design, and a protruding portion was removed.

3. Wide variety
   A wide variety of shaft diameters (50 to 80 mm) and leads (40 to 50 mm) are available. Six to eight effective turns are also available.

Ball Screw Support Bearings for Heavy Load

A series of high-load capacity, angular contact thrust ball bearings that support ball screws for heavy load under optimum conditions.

TAC 03 Series bearings offer high load-bearing capacity to support ball screws for heavy load. Use larger diameter steel balls than the TAC Series for machine tools, thereby reducing the number of combined rows.

1. Downsizing due to high-load capacity
   High-load capacity facilitates compact design.

2. Improved reliability
   Operating lifetime is 5 times longer than standard TAC Series.

3. Ease-of-use
   Dramatically improved ease-of-use compared with tapered roller bearings or thrust self-aligning roller bearings. Required rigidity can be obtained by changing the number of rows thanks to its universal combination capability, which contributes to achieving longer operation life.

4. Reduction in torque through optimal ball bearing design
   Torque is substantially reduced through optimal ball bearing design.

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NSK Roller Guides

RA Series

RA Series incorporates NSK’s leading-edge technology for high load-bearing capacity, high rigidity and environmentally friendly operation.

Capable of meeting the demand for roller guides used in mold-clamping system with no gap to prevent damage to the mold. RA Series roller guides offer the high load-bearing capacity required by injection molding machinery.

1. High load-bearing capacity
   World’s premier level high load-bearing capacity and long operating lifetime are achieved by the full application of analytic technology.

2. High rigidity
   Optimum size rollers are used as rolling elements for high rigidity, which facilitates compact equipment design.

3. Highly dust-resistant
   Standard highly dust-resistant seal prevents the entry of foreign matter and ensures original sound performance is maintained for a long time.
NSK Technology
for Semiconductor or Liquid Crystal Production Equipment (Special Environments)

- Monocarriers — MCM Series / MCH Series
- NSK Linear Guides — Miniature — PU Series / PE Series
- Thin-Film Lubrication for Vacuum Environments — Ball Screws and NSK Linear Guides with E-DFO for Vacuum Environments
- Surface Treatment for Special Environments — Ball Screws and NSK Linear Guides for Special Environments
- NSK Clean Grease — LG2 / LGU

Meeting cleanliness and anti-corrosion requirements in special environments for semiconductor and liquid crystal production equipment, in addition to offering short-term delivery through standard inventory. NSK’s precision products contribute to the advance of precision machinery and respond to next-generation needs.
NSK Linear Guides—Miniature

Excellent ease-of-use, light weight and compact design
NSK miniature linear guides ensure smooth movement.

Lighter-weight operating section is highly sought after to keep pace with the trend toward downsizing semiconductor manufacturing equipment. Use of resin materials for the bearing achieves light weight and softens the sound of operation.

1. Motion performance
   Newly designed ball recirculation component facilitates smooth circulation of steel balls. A special cage is positioned for trouble-free removal of bearings.

2. Light weight
   Bearing is about 20% lighter than conventional models as a portion of its body is made with resin material.

3. Highly corrosion resistant
   Incorporates highly corrosion-resistant martensite stainless steel as a standard feature to provide outstanding resistance to corrosion.

4. Low dust emission
   Entire structure including bearing section is designed to prevent dust emission.

5. Short-term delivery
   Interchangeable types for freely matching rails and bearings are also available.

Thin-Film Lubrication for Vacuum Environments

Further advanced DFO thin-film lubrication technology ensures significantly longer life and lower outgassing in vacuum environments.

Fluorine grease used for vacuum lubrication has the disadvantages of a short lifetime and produces significant friction resistance in proportion to the level of outgassing and rotational speed. DFO thin-film lubrication technology was developed to solve these technical problems, and E-DFO was developed to extend longevity.

1. Long life
   Operating lifetime up to twenty times longer than conventional types, thereby lengthening maintenance service intervals.

2. Low outgassing
   Outgassing is suppressed under vacuum environments.

3. Low friction
   Friction is significantly reduced compared with conventional models. Motor load reduced and equipment efficiency is enhanced.

NSK Clean Grease

With excellent low dust emission and low torque, LG2 proves its worth in clean rooms—LGU can be used in a wide range of temperatures and offers superior durability.

In the past, grease could not be utilized in clean rooms, and fluorine grease was used in vacuum environments requiring superior low-dust performance. NSK Clean Grease was developed for improved rust resistance and lower friction than fluorine grease.

1. Low dust emission
   NSK Clean Grease is superior to fluorine grease in reliably ensuring low dust emission for long periods of time.

2. Torque characteristics
   NSK Clean Grease features stable torque characteristics which reduce load on the motor at high speeds.

3. Long operating lifetime
   Operating lifetime is more than 10 times longer than fluorine grease, thereby extending maintenance service intervals.

4. Ease-of-use
   NSK Clean Grease in a bellows-type tube (80g) can be attached to an NSK grease pump in a single motion.

<table>
<thead>
<tr>
<th>LG2</th>
<th>LGU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust emission (0.5 μm or more), piece/cf</td>
<td>Dust emission (0.5 μm or more), piece/cf</td>
</tr>
<tr>
<td>Operating temperatures</td>
<td>Operating temperatures</td>
</tr>
<tr>
<td>–20 to 70˚C</td>
<td>–30 to 120˚C</td>
</tr>
<tr>
<td>Puffing agent</td>
<td>Puffing agent</td>
</tr>
<tr>
<td>Lithium soap</td>
<td>Thurea</td>
</tr>
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2005 Japan Tribology Academic Society Technology Award

NSK Technology for Semiconductor or Liquid Crystal Production Equipment (Special Environments)
Ball screws and NSK linear guides include many standard inventory products that are ready for short-term delivery. Lubrication unit for maintenance-free operation and highly dust-resistant seals suitable for contaminated environments are also available to respond to the needs of machinery users.
**Lubrication Units (Installed in Ball Screws, NSK Linear Guides and Monocarriers)**

**NSK K1™**

NSK K1™ ensures long-term, maintenance-free operation and the long lifetime of components working under tough lubrication environments. Clean lubrication method exerts less impact on the environment.

Grease lubrication requires frequent and periodic replenishment. NSK led the way to solve this problem by developing NSK K1™. Oil is fed from the resin-constructed NSK K1™ for more than 100,000 hours.

**1. Long-term, maintenance-free operation**

NSK K1™ eliminates the need for adding a lubricant for 5 years or 10,000 km. Long-term, maintenance-free operation saves lubricant costs.

**2. Long operating lifetime**

NSK K1™ substantially extends the operating lifetime of components exposed to contaminated environments or other tough lubrication environments.

**3. High safety**

NSK K1™ for food processing or medical equipment is also available. Specifications comply with FDA standards for food processing and medical equipment, ensuring high safety.

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**For Light Load and Small Equipment**

**Support Units**

Ball screw support unit is available as a standard product. Support unit for clean operation is also available to provide excellent low dust emission, low torque and rust resistance.

Support unit for ball screw is designed independently and required components are incorporated into a single unit. Today, support units are used worldwide as standard products. Support units with special features for clean operation, such as low dust emission, are also available.

1. **Quick delivery**

   All support units are standard stock items.

2. **Wide variety**

   A wide variety of internal diameters of support bearing diameters (4 to 25 mm) are available. Support units can be conveniently used with NSK’s ball screws as standard stock.

3. **Low dust emission**

   Reduces dust emission to 1/10 that of general support units.

4. **High rust resistance**

   High rust resistance is achieved by applying low-temperature chromium plating and using stainless steel parts.

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**NSK Standard Linear Guides**

**LH Series / LS Series**

LH and LS Series afford outstanding impact-load resistance, self-aligning capability and high accuracy. These linear guides are designed for superior safety and ease-of-use.

Using internationally standard dimensions, this series is NSK’s standard linear guide product.

1. **Easy installation**

   Acceptable margin of error in mounting increases because of self-aligning capability.

2. **Impact-load resistance**

   Non-contact areas also bear part of the impact load when high load acts on a linear guide from above.

3. **Wide variety of types and sizes**

   A wide variety of types and sizes are available to respond to a wide range of applications. Long stainless products are included in the standard LS Series products (the maximum length: 3,500 mm). Products specifically designed for high-temperature or high-speed conditions are also available.
Innovative servo algorithm shortens positioning time by up to 1/5 compared with conventional motors.

1. Shorter positioning time
   Innovative servo algorithm shortens positioning time by up to 1/5 compared with conventional motors.

2. Compact motor
   Optimal magnetic-field design delivers twice the force density of conventional motors.

3. Highly accurate position sensor
   PS Series incorporates an absolute position sensor with positioning accuracy of 90 seconds.

4. Compact drive unit
   Combined with a special module, drive unit body is 60% smaller than conventional units.

NSK Low-Noise Linear Guides

NSK S1 Series feature quiet, non-obtrusive sound and low dust emission, for smooth operation.

Based on the LHLS Series, this series incorporates retaining pieces to improve the quality of motion and suppress noise. It also reduces friction variation at fixed-speed driving.

1. Quiet and non-obtrusive sound
   Placement of retaining pieces and newly designed ball recirculation paths reduce noise by 5 dB compared with conventional models.

2. Smooth motion
   Improves dynamic friction characteristics and allows smooth, stable motion even at low-speed driving.

3. Low dust emission
   Superior to conventional models in low dust emission.

4. Wide variety
   A wide variety of types (SH Series: #15 to #55; SS Series: #15 to #35) and interchangeable types of rails and ball slides are available.

New Type of Rolling Element Linear Motion Bearing

Translide features high dust-resistance and long-term, maintenance-free operation. Maximum ball diameter facilitates the transport of heavy load.

1. High dust-resistance and long operating lifetime
   NSK K1™ and highly dust-resistant seals are featured as standard to ensure the long operating lifetime and high dust-resistance required for transfer systems.

2. High-load capacity
   Ball diameter has been increased to the maximum size to enable the transport of heavy loads.

3. Interchangeability
   Interchangeable types of rails and slides are available for freely combining components.

Highly Dust-Resistant Ball Screws and NSK Linear Guides V1 Series

NSK’s most advanced high-performance seals deliver more than 4 times longer service life under contaminated environments than conventional models.

These high-performance seals were developed to cope with contaminated or adverse environments in which, for example, a woodworking machine or graphite processing machine produces dust that can shorten equipment operating life. Highly dust-resistant seal features a special lip structure that dramatically enhances sealing performance.

1. High dust-resistance
   (1) Ball screws
      Specially profiled screw shaft grooves and high-performance seals prevent the entry of fine contaminants, reducing particle penetration rate by up to 1/5 compared with conventional standard models.
   (2) NSK linear guides
      End seals with a multi-stage lip structure reduce particle penetration by up to 1/10 compared with conventional standard models.

2. Long life
   Thanks to their high dust-resistance, ball screws and NSK linear guides provide longer operating lifetimes even under contaminated environments.

3. Option
   (1) Ball screw: protector (against high-temperatures and foreign matter)
   (2) NSK linear guides: protector (against high-temperatures and foreign matter); a type with tapped mounting holes on the backside of a rail is also available.