NSK Linear Guides
Roller Guide RA Series

A roller guide series employing advanced analysis technology offers super-high load capacity and rigidity. The RA series includes a complete lineup to handle a wide range of applications.

For more information about NSK products, please contact:

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The fruits of comprehensive technology of NSK
RA series roller guides handle a diversity of applications

The RA series of roller guides is the product of a combination of NSK’s extensive experience in roller bearings and linear guide technologies. The result is an optimal design that takes full advantage of NSK’s unique expertise to realize super-high load capacity, rigidity and motion accuracy, plus smooth motion. Capable of handling a variety of applications, the RA series supports high machine performance.

**RA series features support high machine performance**

- **Super-long Life**
  - **Super-high load capacity**
    NSK has realized super-high load capacity, now the highest performance in the world, and achieved unprecedented operating life.
  - **Maintenance-free**
    Installing an NSK K1™ lubrication unit assures long-term, maintenance-free operation.
  - **Highly dust-proof**
    The high performance seals as standard equipment completely block the entry of foreign matter and maintain primary performance over the long term.

- **Contribution to High-precision Manufacturing**
  - **Super-high rigidity**
    Super-high rigidity provides high-precision manufacturing.
  - **Super-high motion accuracy**
    Coupled with NSK’s unique design approach, the vibration caused by roller passage has been substantially reduced. This will greatly contribute to improve machining quality.
  - **Smooth motion**
    The installation of a retaining piece achieves smooth motion, resulting in stable positioning accuracy.

- **Super-high rigidity**
  - Provides high-precision manufacturing.

- **Super-high motion accuracy**
  - Coupled with NSK’s unique design approach, the vibration caused by roller passage has been substantially reduced. This will greatly contribute to improve machining quality.

- **Smooth motion**
  - The installation of a retaining piece achieves smooth motion, resulting in stable positioning accuracy.

Five sizes (RA15, RA20, RA25, RA30 and RA65) have been added to the RA series. NSK also introduces a low-profile size (doesn’t apply to RA20 and RA65).

**Used in Many Fields**

- **Complete series**
  - Series includes a full lineup from small to large, including low-profile sizes.
  - You can choose the model according to the application.

- **Interchangeable mounting dimensions**
  - Outside dimensions and mounting dimensions conform to standard dimensions for the market, so RA series roller guides can be used without having to alter machine design. (See page 10 for mounting surface dimensions)

- **Low friction**
  - Uses rollers for rolling elements to hold down dynamic friction.

NSK executed a comprehensive, detailed performance simulation of roller guides by integrating its analysis technology and the tribology technology that the company had been developing over many years. Down to the dimensions and shapes of component details, we have attained an optimal design completely.
A variety of contributions to improve the performance of machine

NSK roller guide RA series exhibits the world’s highest load capacity and enhance the performance of machine through a variety of features, including super-high rigidity, super-high motion accuracy, and low friction variation.

### Super-high load capacity

By installing rollers that are the largest possible diameter and length within the existing standard cross-section dimension in a rational layout based on analysis technology, we have realized the world’s highest load capacity, far superior to conventional roller guides. Super-long life is achieved and impact load can be sufficiently handled.*

* Compared with products of the same size, as of September 1, 2003, researched by NSK.

### Features

#### Super-high motion accuracy

NSK has developed its own unique method of simulating rolling element passage vibration and method of designing optimal roller slide specifications for damping roller passage vibration. These developments have dramatically enhanced roller slide motion accuracy for the RA series.

#### Smooth motion

Installing a retaining piece between rollers and restraining the skew peculiar to roller bearings achieve smooth motion. The reduction of friction variation provides stable tracking in the complicated trajectory control.

#### Mounting dimensions compatibility

The outer and mounting dimensions of RA series are based on market standards. RA series can be replaced without altering equipment design. (See page 10 for mounting surface dimensions)
Low friction
Using rollers for rolling elements helps minimize dynamic friction.

Highly dust-proof and maintenance-free operation
Roller slides include high performance seals as standard equipment. The seal completely blocks the entry of foreign matter into the rolling surface and prevents loss of performance. In addition, rail covers are also available for severe operating conditions. (Rail covers reduce the amount of foreign matter to 1/10 that of conventional linear guide for machine tools.) The highly regarded NSK K1™ lubrication unit is also available to satisfy customer needs for long-term, maintenance-free operation.

Low noise
A retaining piece is provided between rollers to prevent collision of rollers to minimize noise.
2. Accuracy

Four accuracy grades are available: ultra super precision P3, super precision P4, high precision P5, and precision P6.

+ : Difference in roller slides on the reference side roller guide.

Table 1 Accuracy standards

<table>
<thead>
<tr>
<th>Accuracy standards</th>
<th>Ultra super precision P3</th>
<th>Super precision P4</th>
<th>High precision P5</th>
<th>Precision P6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting height: Dimensions in mounting height H</td>
<td>±0.008</td>
<td>±0.010</td>
<td>±0.020</td>
<td>±0.040</td>
</tr>
<tr>
<td>Mounting width: Dimensions in mounting width W1 or W2</td>
<td>±0.010</td>
<td>±0.015</td>
<td>±0.025</td>
<td>±0.050</td>
</tr>
<tr>
<td>Variation of mounting height dimension H</td>
<td>±0.003</td>
<td>±0.006</td>
<td>±0.007</td>
<td>±0.015</td>
</tr>
<tr>
<td>Variation of mounting width dimension W1 or W2</td>
<td>±0.003</td>
<td>±0.007</td>
<td>±0.010</td>
<td>±0.020</td>
</tr>
</tbody>
</table>

Table 2 Running parallelism

<table>
<thead>
<tr>
<th>Rail length (mm)</th>
<th>Ultra super precision P3</th>
<th>Super precision P4</th>
<th>High precision P5</th>
<th>Precision P6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over – 50 or less</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>50 – 80</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>80 – 125</td>
<td>2</td>
<td>2</td>
<td>3.5</td>
<td>5.5</td>
</tr>
<tr>
<td>125 – 200</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>200 – 315</td>
<td>2</td>
<td>2.5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>315 – 400</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>400 – 500</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>500 – 630</td>
<td>2</td>
<td>3.5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>630 – 800</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>800 – 1 000</td>
<td>2.5</td>
<td>4.5</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>1 000 – 1 250</td>
<td>3</td>
<td>5</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>1 250 – 1 600</td>
<td>4</td>
<td>6</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>1 600 – 2 000</td>
<td>4.5</td>
<td>7</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td>2 000 – 2 500</td>
<td>5</td>
<td>8</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>2 500 – 3 000</td>
<td>6</td>
<td>9.5</td>
<td>17</td>
<td>25</td>
</tr>
</tbody>
</table>

3. Preload and Rigidity

Preload is set for the RA series by slightly changing the size of the roller used. Applying preload enhances rigidity and minimizes elastic deformation.

With the characteristics of the roller guide, there is minimal variation in rigidity according to amount of preload. Because the RA series offers stable, high rigidity, only medium preload type Z3 (preload: 10% of C, where C is the basic dynamic load rating) is set. Typical measurements for preload and rigidity are as follows.

Table 3 Preload and rigidity

<table>
<thead>
<tr>
<th>Model No.</th>
<th>High load capacity type BL, BLN, GM</th>
<th>Ultra high load capacity type AL, AN, EM</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA15</td>
<td>1 030</td>
<td>1 300</td>
</tr>
<tr>
<td>RA20</td>
<td>1 920</td>
<td>2 400</td>
</tr>
<tr>
<td>RA25</td>
<td>2 920</td>
<td>3 540</td>
</tr>
<tr>
<td>RA30</td>
<td>3 890</td>
<td>4 760</td>
</tr>
<tr>
<td>RA35</td>
<td>5 330</td>
<td>6 740</td>
</tr>
<tr>
<td>RA45</td>
<td>9 280</td>
<td>11 600</td>
</tr>
<tr>
<td>RA55</td>
<td>12 900</td>
<td>16 800</td>
</tr>
<tr>
<td>RA65</td>
<td>21 000</td>
<td>28 800</td>
</tr>
</tbody>
</table>

Fig. 4 Specifications of accuracy

Fig. 5 Direction of load

Fig. 6 Rigidity measurement data
4. Basic Load Rating and Rated Life

Basic dynamic load rating that expresses load capacity is established by ISO standards (ISO14728-1) for linear guides. With basic dynamic load rating, direction and size do not fluctuate so that rated fatigue life is 100 km. Load rating for NSK linear guides complies with ISO standards. With the RA series, dynamic load rating is the same in both the vertical and horizontal directions (4-way equal load specs.). Rated fatigue life $L$ is calculated by the following formula when load $F$ is applied to the roller slide in the horizontal or vertical direction only.

$$L = 100 \times \left( \frac{C}{F_0} \right)^{10} \text{ (km)}$$

This formula is different from that for linear guides with ball rolling elements.

$F_0$ is load factor. Refer to the respective value from the following table 4 as a guideline according to potential vibration and the impact of the machine in which the linear guide is used, and select the load factor.

$$F = R + 0.5S \quad (R>S)$$
$$F = S + 0.5R \quad (R\leq S)$$

5. Lubrication Specifications

With standard specifications, grease fittings are mounted on the side of the roller slide for the RA series, but can also be mounted on the side of the end cap with optional specifications. A lubrication hole can also be provided on the top of the end cap. Openings are not provided on the top or side with standard specifications in order to prevent dust. Contact NSK for more information.

6. Dust-proof

RA series is equipped with side, inner* and bottom seals to prevent foreign matter from entering the inside of the roller slide. Under normal applications, the RA series can be used without modification. For severe usage conditions, optional rail covers are available. Contact NSK for information on how to mount the cover. The linear guide can also be equipped with a lubrication unit (NSK K1™) that has already proven its effectiveness with other NSK linear guides.

Table 5 Optional parts for dust-proofing

<table>
<thead>
<tr>
<th>Name</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSK K1™</td>
<td>Porous part containing oil enhances lubrication function.</td>
</tr>
<tr>
<td>Double seal</td>
<td>Sealing effect is enhanced by using pairs of side seals.</td>
</tr>
<tr>
<td>Protector</td>
<td>Removes large dust particles and protects side seals from hot and hard dust particles.</td>
</tr>
<tr>
<td>Rail cover**</td>
<td>Covers top of rail to prevent foreign matter from getting into the rail mounting holes.</td>
</tr>
<tr>
<td>Bolt hole cap</td>
<td>Prevents foreign matter such as cutting dust from collecting in the rail mounting holes.</td>
</tr>
</tbody>
</table>

Table 3 Load factor $F_w$

<table>
<thead>
<tr>
<th>Impact and/or vibration</th>
<th>Load factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>No impact and vibration from the outside</td>
<td>1.0 – 1.5</td>
</tr>
<tr>
<td>With impact and/or vibration from the outside</td>
<td>1.5 – 2.0</td>
</tr>
<tr>
<td>With heavy impact and/or vibration from the outside</td>
<td>2.0 – 3.0</td>
</tr>
</tbody>
</table>

Fig. 7 Two directional load

Fig. 8 Optional lubrication hole positions

500

Fig. 9 Rail cover**

7. Installation

(1) Mounting tolerance

Mounting tolerance results in harmful effects such as shortened operating life, deterioration in motion accuracy, and friction variation. NSK particularly focuses on operating life, and sets an operating life value of more than 20 000 km calculated under the following conditions as mounting tolerance:

- The load per roller slide is 10% of basic dynamic load rating $C$.
- The rigidity of machine is infinite.

The tolerance in Fig. 10 is shown in the Table 6 as typical tolerance.

Table 4 Mounting tolerance of RA series

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Parallelism tolerance of two roller guides $e_1$</th>
<th>Height tolerance of two roller guides $e_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA15</td>
<td>5</td>
<td>150 µm / 500 mm</td>
</tr>
<tr>
<td>RA20</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>RA25</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>RA30</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>RA35</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>RA45</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>RA55</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>RA65</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 10 Mounting tolerance

Table 7 Shoulder height and corner radius of attachment

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Shoulder Height</th>
<th>Chamfer (maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^*$</td>
<td>$R^+$</td>
<td>$r_e$</td>
</tr>
<tr>
<td>RA15</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>RA20</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>RA25</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>RA30</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>RA35</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>RA45</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>RA55</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>RA65</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

Fig. 11 Datum face of roller guide and shoulder

Handling Precautions

1. If oil lubrication is used, the oil may not pervade the rolling surface according to the roller slide mounting conditions such as upside down mounting and wall mounting. In these situations, consult with NSK.

2. Operating temperature limits should normally be less than 80 °C.

3. If using NSK K1™, service temperature should not exceed 50 °C (or 80 °C instantaneously). Make sure the unit does not come in contact with organic solvents with that can be used for degreasing. Do not place the unit in a location exposed to white kerosene or rust prevention oil containing white kerosene.
Example of specification number: RA 35 1000 AN C  2 -  P4  3 - II

Rails for butting connections. Contact NSK for more information.

If the rail length exceeds the above limitation, you may be able to cope with the problem by

● 100 km
● 50 km = 1.23

If the above basic dynamic load rating (100 km rating) is converted into 50 km rating, use the following formula:

RA20BN
RA65BN

60 mm bolt pitch will be provided if not specified.

The basic load rating complies with ISO standards (ISO14728-1, ISO14728-2).
If the above basic dynamic load rating (100 km rating) is converted into 50 km rating, use the following formula:

\[ C_{0\text{max}} = C_0 \times \frac{N}{100} \]

If the rail length exceeds the above limitation, you may be able to cope with the problem by rails for butting connections. Contact NSK for more information.

Please note that the appropriate design number will be inserted into the reference number and the tag end code (– *) will be omitted.
Flange type (for both tapped and bolt mounting holes)
RA-EM (High load type)
RA-GM (Super-high load type)

Example of specification number:

RA 35 1000 EM C 2 - ** P4 S - II

Series code
Size No.
Rail length (mm)
Roller slide shape code: EM, GM
Material and surface treatment code: C: Special carbon steel (NSK standard)

RA-EM
RA35EM
RA55EM
RA75EM
RA95EM
RA115EM
RA135EM
RA155EM
RA175EM
RA195EM
RA30EM
RA45EM
RA60EM
RA75EM
RA90EM
RA105EM
RA120EM
RA135EM
RA150EM
RA165EM
RA180EM
RA200EM

RA-GM
RA20GM
RA35GM
RA55GM
RA75GM
RA95GM
RA115GM
RA135GM
RA155GM
RA175GM
RA195GM
RA25GM
RA35GM
RA45GM
RA65GM
RA85GM
RA105GM
RA125GM
RA145GM
RA165GM
RA185GM
RA205GM

Number of roller slides per rail

rail length

nail

bolts

If the rail length exceeds the above limitation, you may be able to cope with the problem by rails for butting connections. Contact NSK for more information.

MRO