

LM Guide NR and NRS — Ultra-Heavy-Load, High-Rigidity Type

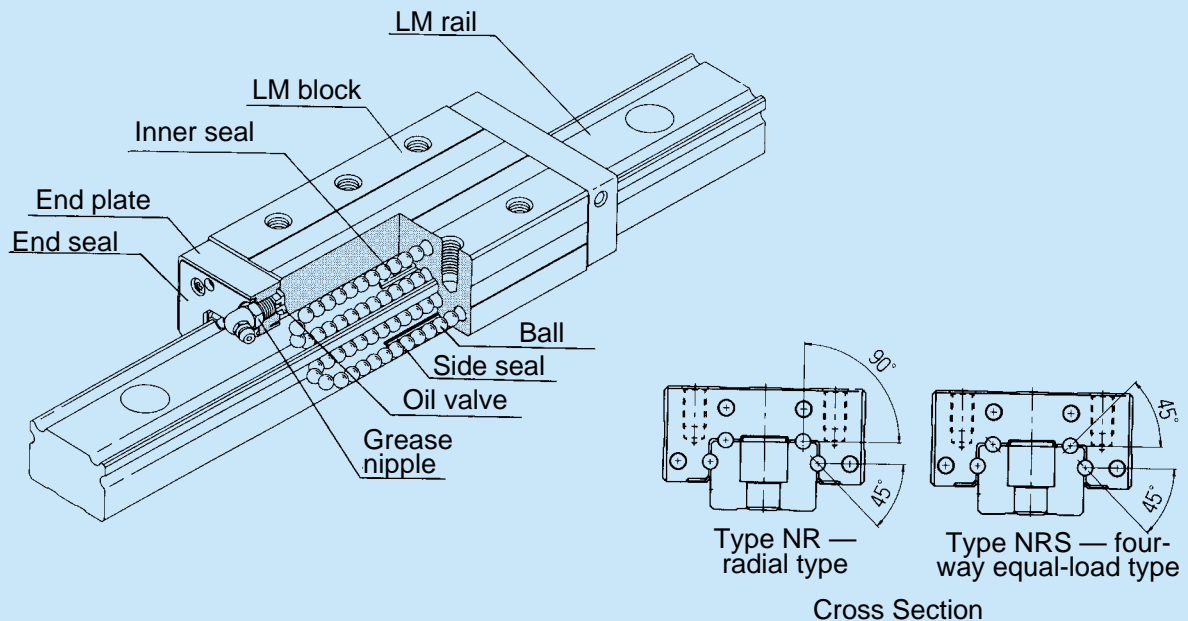


Fig. 1 Construction of Model NR•NRS

Construction and Features

Balls roll in four rows of a precisely-ground raceway on an LM rail and an LM block. The end plate attached to the LM block causes the trains of balls to circulate. The raceways are cut into deep grooves that have a radius closer to that of the balls than in the conventional design, using special equipment and an

Improved damping capacity

When cutting is not being performed, the LM block moves as smoothly and lively as normal. During cutting, the block receives a cutting load and the contact area between the balls and the raceway expands, producing appropriate roll-and-slide motion where both rolling and sliding occur. This increases frictional resistance, resulting in increased damping ability.

Since the absolute amount of sliding is slight, very little wear results and the service life is not affected.

Highly rational LM Guide

The excessive differential sliding seen with the Gothic-arch groove does not occur with the LM Guide. The motion during fast feeding is smooth, and the positioning accuracy remains high. During cutting,

extremely advanced cutting technique. This design provides high vibration and impact resistance, and the high damping capacity required for machine tools, making types NR and NRS capable of bearing ultra-heavy loads greater than those that can be borne by the roller type.

however, appropriate differential sliding occurs in proportion to the cutting load, resulting in increased rolling resistance and damping capacity, and improved cutting performance. Types NR and NRS are thus highly rational linear-motion guides.

High rigidity

If an LM block and rail are not sufficiently rigid, the system itself will lack rigidity in the reverse-radial and lateral directions. To increase the rigidity of LM blocks and rails, we have created the optimum design within the given dimensions, taking advantage of the FEM technique.

For radial-type NR and four-way equal-load-type NRS, we offer two different models with the same dimensions but different characteristics. Select the model best suited for your specifications.

Ultra-heavy load

The radius of the raceways is approximately the same as the ball radius. This makes it possible for the ball contact area to be made equal to or greater than the roller contact area, thus ensuring a load-bearing capacity superior to that of the roller type.

This raceway design is free from the various problems seen with the roller type, including locking due to

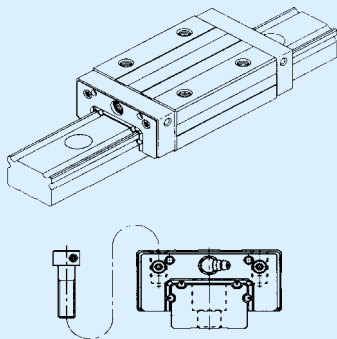
skewed rollers; the inability to ensure smooth motion as a result of the application of a preload to increase rigidity, giving rise to the extraordinary fluctuations in resistance that occur as rollers enter a loaded area; and deterioration of the load-bearing capacity due to uneven contact between rollers due to accuracy errors in the mounting surface. While maintaining the ease of use of other types of LM Guides, types NR and NRS are also capable of withstanding heavy loads.

Types and Features

For heavy loads

Types NR and NRS-R

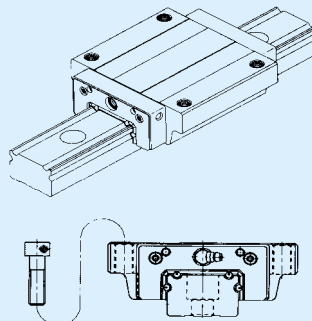
Compact type



The LM blocks of types NR and NRS-R have the smallest width of any models in this series, and are provided with tapped holes. Useful where space for the table is limited.

Types NR and NRS-A

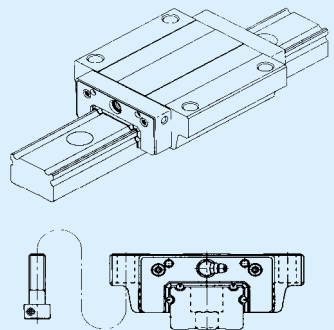
Tapped-hole flange type



The flange of the LM block is provided with tapped holes to allow simple assembly, making it suitable for use in build-up systems.

Types NR and NRS-B

Through-hole flange type

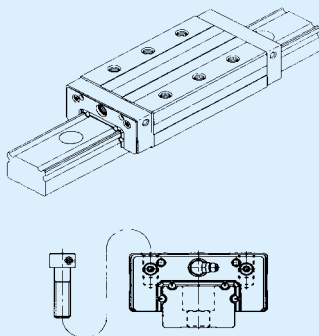


The flange of the LM block is provided with through holes, making it useful where the table cannot be drilled for mounting-bolt through holes.

For ultra-heavy loads

Types NR and NRS-LR

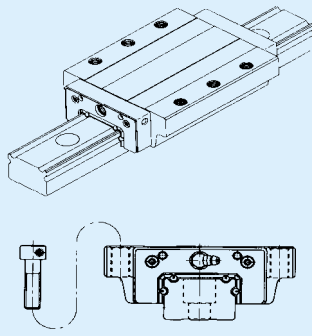
Compact type



While they have the same cross-sectional shapes as types NR and NRS-R, these ultra-heavy-load types are provided with extra load-bearing balls to increase their load rating.

Types NR and NRS-LA

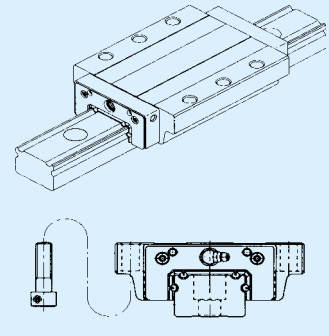
Tapped-hole flange type



While they have the same cross-sectional shapes as types NR and NRS-A, these ultra-heavy-load types are provided with extra load-bearing balls to increase their load rating.

Types NR and NRS-LB

Through-hole flange type

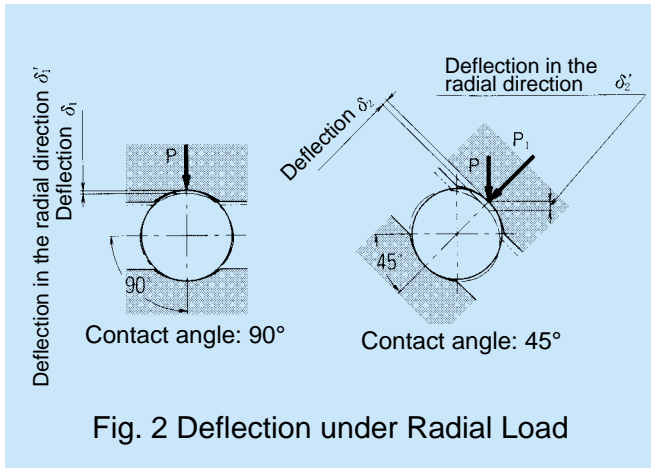


While they have the same cross-sectional shapes as types NR and NRS-B, these ultra-heavy-load types are provided with extra load-bearing balls to increase their load rating.

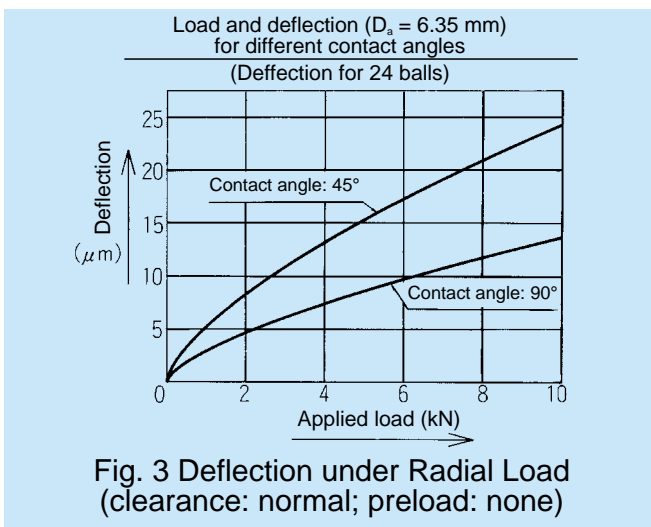
Characteristics of Types NR and NRS

Rigidity Up 200% Against Main Loads

The 90° contact design adopted in type NR results in a difference in rigidity from the 45° contact design. Under radial load P , deflection in the radial direction is 44% less with type NR than with 45° contact types.



The relationship between radial load and deflection is illustrated below. As shown, where rigidity in the radial direction is a requirement, type NR is advantageous over 45° contact types.

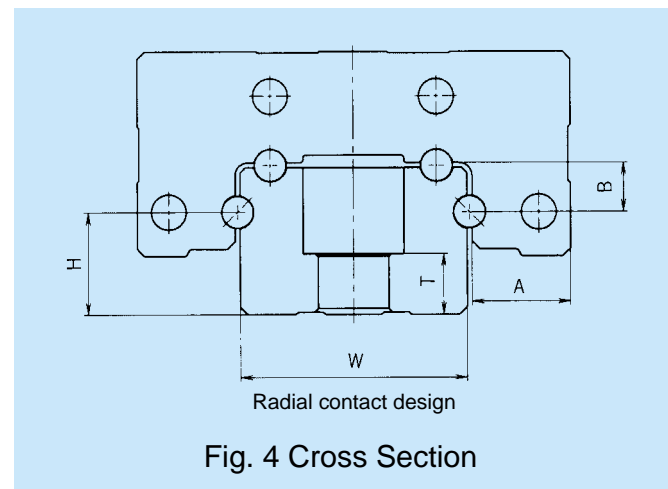


Rigidity Up 200% Against Lateral and Reverse-Radial Loads

Since the distance H from the LM rail bottom surface to the bottom groove balls (which are subjected to lateral loads) is short in LM Guide NR, the ratio of LM-rail width W to H is small. In addition the distance T from the LM-rail mounting-bolt seat to the rail bottom surface is short. Thus, under lateral loads, the LM rail undergoes only a limited amount of deflection, enabling the rail to maintain high rigidity against such loads.

Moreover, now that length B has been decreased and thickness A has been increased, the strength of the LM block can be increased against the reverse-radial and lateral loads that act to open the block. Thus, the 90° contact design improves rigidity against reverse-radial loads.

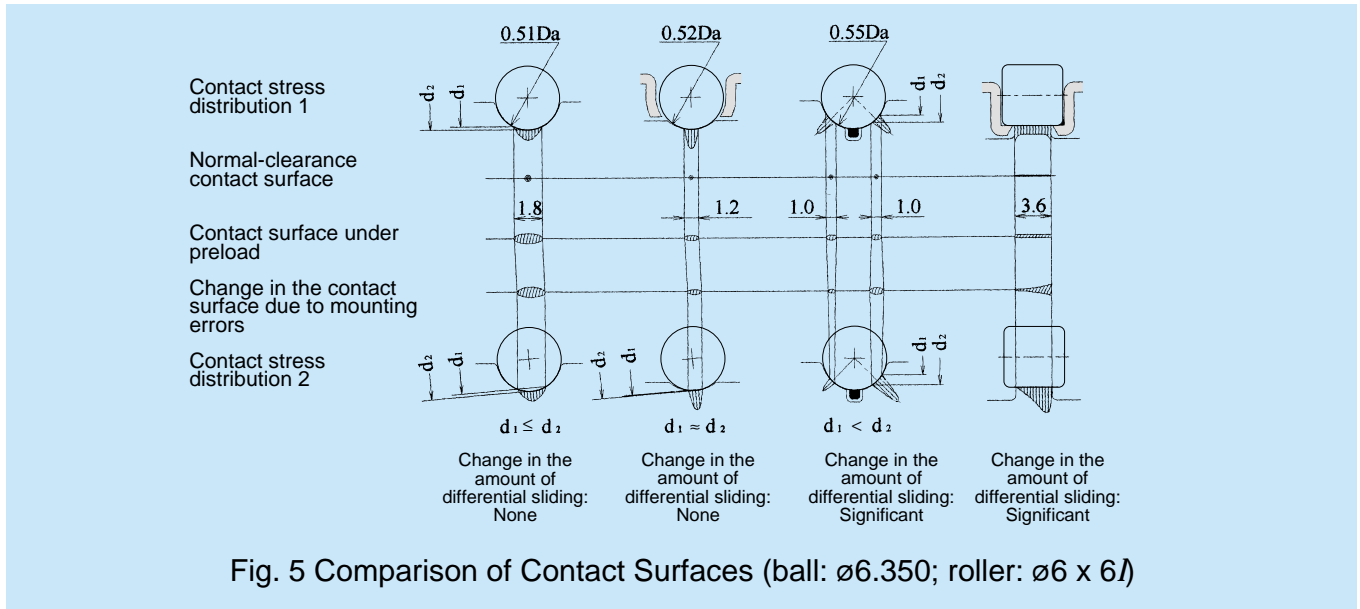
Compared with conventional equivalent models manufactured by THK, the balls are smaller and the number of effective balls is approximately 1.3 times greater, thereby increasing static rigidity.



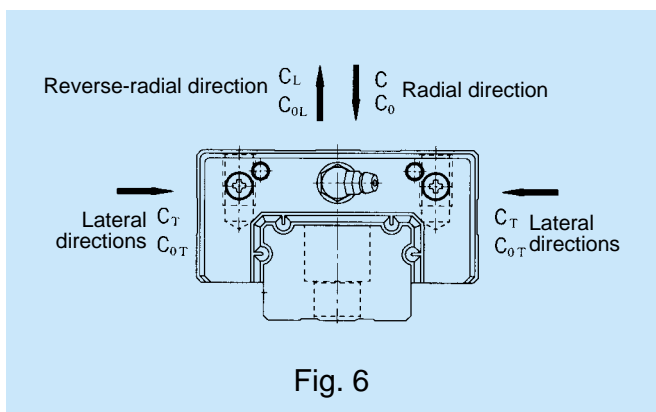
Comparison of Contact Surface and Internal Stress among Different Contact Designs

The dimensions of the contact area and the magnitude of the internal stress of a ball vary greatly depending on the shape of the contact surface. The actual contact surface, will not be as large as it appears, because the

retainer holds the roller, reducing its effective length. In addition, mounting errors may influence the stress distribution around the contact area, significantly affecting the amount of differential slip.



Load rating



Types NR and NRS can bear loads in all four directions: radial, reverse-radial, and the two lateral directions.

The basic load ratings of types NR and NRS are in the radial direction indicated in Fig. 6. The values are presented in the corresponding dimension tables. Values in the reverse-radial and lateral directions can be obtained from Table 1.

The basic load ratings of type NRS in four directions (radial, reverse-radial, and the two lateral directions) are equivalent to one another. The values are presented in the corresponding dimension table.

Table 1 Type NR Basic Load Ratings in Various Directions

| Direction | Basic dynamic-load rating | Basic static-load rating |
|--------------------------|---------------------------|-------------------------------------|
| Radial direction | C | C _O |
| Reverse-radial direction | C _L =0.78C | C _{OL} =0.71C _O |
| Lateral directions | C _T =0.48C | C _{OT} =0.45C _O |

Equivalent load

An equivalent load for type NR when reverse-radial and lateral loads are exerted on its LM block simultaneously can be obtained using the following equation:

$$P_E = X \cdot P_L + Y \cdot P_T$$

where

P_E : equivalent load (N)
 - In the reverse-radial direction
 - In the lateral directions

P_L : reverse-radial load (N)

P_T : lateral load (N)

X and Y : equivalent factor (see Table 2)

Table 2 Type NR Equivalent Factor

| P_E | X | Y |
|---|-----|---|
| Equivalent load in the reverse-radial direction | 1 | 2 |
| Equivalent load in the lateral directions | 0.5 | 1 |

An equivalent load for type NRS when reverse-radial and lateral loads are exerted on its LM block simultaneously can be obtained using the following equation:

$$P_E = P_R (P_L) + P_T$$

where

P_E : equivalent load (N)
 - In the radial direction
 - In the reverse-radial direction
 - In the lateral directions

P_R : radial load (N)

P_L : reverse-radial load (N)

P_T : lateral load (N)

Permissible moment

In types NR and NRS, a single LM block can bear moments in all directions. Table 3 and Table 4 present the permissible moments in directions M_A , M_B , and M_C for a single LM block and double LM blocks laid over one another (no data for direction M_C).

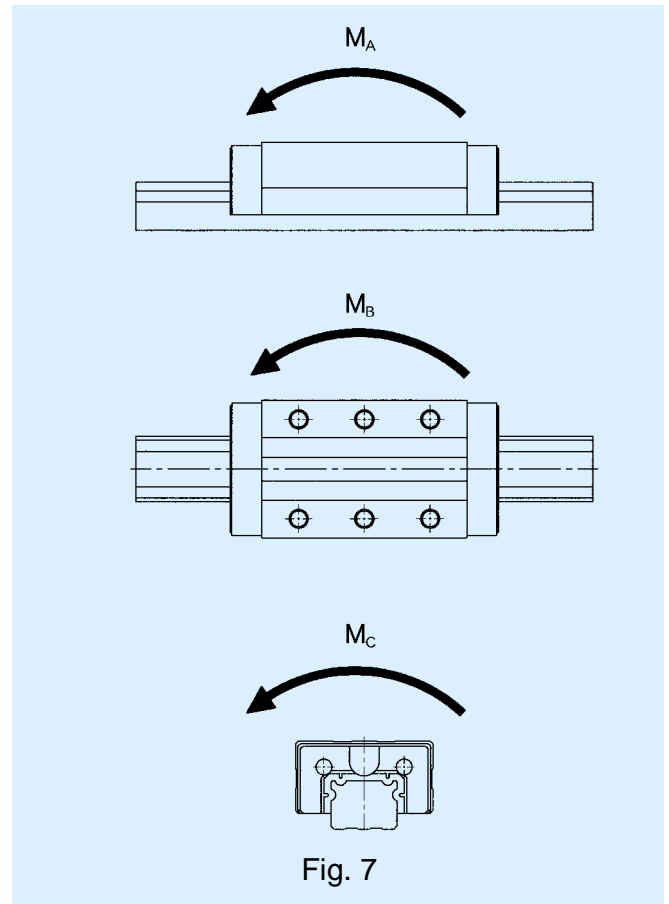


Fig. 7

Table 3 Type-NR Static Permissible Moment

Unit : kNm

| Direction Model No. | M_A | | M_B | | M_C |
|------------------------|--------------|--------------|--------------|--------------|--------------|
| | Single block | Double block | Single block | Double block | Single block |
| NR 25X | 0.49 | 2.9 | 0.31 | 1.8 | 0.58 |
| NR 25XL | 0.88 | 4.7 | 0.55 | 3.0 | 0.79 |
| NR 30 | 0.96 | 5.1 | 0.61 | 3.3 | 1.1 |
| NR 30L | 1.7 | 8.3 | 1.1 | 5.2 | 1.5 |
| NR 35 | 1.4 | 7.4 | 0.85 | 4.7 | 1.7 |
| NR 35L | 2.4 | 12.1 | 1.5 | 7.6 | 2.3 |
| NR 45 | 2.6 | 13.8 | 1.7 | 8.8 | 3.3 |
| NR 45L | 4.4 | 22.0 | 2.8 | 13.9 | 4.4 |
| NR 55 | 4.2 | 21.7 | 2.6 | 13.8 | 5.2 |
| NR 55L | 6.8 | 34.1 | 4.3 | 21.6 | 6.8 |
| NR 65 | 6.8 | 34.9 | 4.3 | 22.1 | 8.7 |
| NR 65L | 12.5 | 62.5 | 7.9 | 39.7 | 11.9 |
| NR 75 | 11.2 | 57.0 | 7.1 | 36.2 | 14.4 |
| NR 75L | 18.8 | 92.8 | 11.9 | 58.9 | 18.9 |
| NR 85 | 15.7 | 79.5 | 9.9 | 50.4 | 20.0 |
| NR 85L | 25.8 | 124 | 16.3 | 78.9 | 25.9 |
| NR100 | 24.9 | 132 | 15.8 | 83.6 | 32.5 |
| NR100L | 38.3 | 184 | 24.3 | 117 | 40.7 |

Table 4 Type-NRS Static Permissible Moment

Unit : kNm

| Direction Model No. | M_A | | M_B | | M_C |
|------------------------|--------------|--------------|--------------|--------------|--------------|
| | Single block | Double block | Single block | Double block | Single block |
| NRS 25X | 0.49 | 2.9 | 0.49 | 2.9 | 0.58 |
| NRS 25XL | 0.88 | 4.7 | 0.88 | 4.7 | 0.79 |
| NRS 30 | 0.96 | 5.1 | 0.96 | 5.1 | 1.1 |
| NRS 30L | 1.7 | 8.3 | 1.7 | 8.3 | 1.5 |
| NRS 35 | 1.4 | 7.4 | 1.4 | 7.4 | 1.7 |
| NRS 35L | 2.4 | 12.1 | 2.4 | 12.1 | 2.3 |
| NRS 45 | 2.6 | 13.8 | 2.6 | 13.8 | 3.3 |
| NRS 45L | 4.4 | 22.0 | 4.4 | 22.0 | 4.4 |
| NRS 55 | 4.2 | 21.7 | 4.2 | 21.7 | 5.2 |
| NRS 55L | 6.8 | 34.1 | 6.8 | 34.1 | 6.8 |
| NRS 65 | 6.8 | 34.9 | 6.8 | 34.9 | 8.7 |
| NRS 65L | 12.5 | 62.5 | 12.5 | 62.5 | 11.9 |
| NRS 75 | 11.2 | 57.0 | 11.2 | 57.0 | 14.4 |
| NRS 75L | 18.8 | 92.8 | 18.8 | 92.8 | 18.9 |
| NRS 85 | 15.7 | 79.5 | 15.7 | 79.5 | 20.0 |
| NRS 85L | 25.8 | 124 | 25.8 | 124 | 25.9 |
| NRS100 | 24.9 | 132 | 24.9 | 132 | 32.5 |
| NRS100L | 38.3 | 184 | 38.3 | 184 | 40.7 |

Accuracy Standards

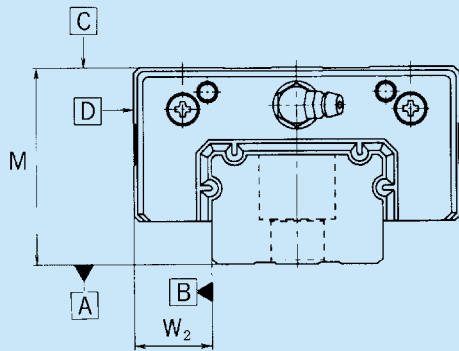


Fig. 8

The accuracy of types NR and NRS are divided into five grades, normal, high, precision, super-precision, and ultra-precision, in accordance with the model numbers shown in Table 5.

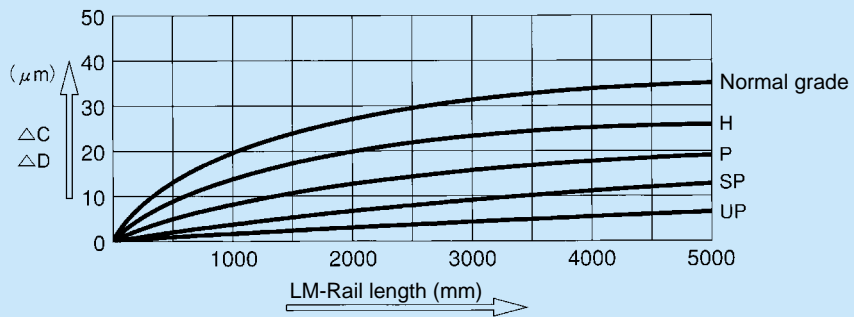


Fig. 9 Relationship Between LM-Rail Length and Running Parallelism

Table 5 Accuracy Standard

Unit : mm

| Model No. | Accuracy standard | Normal | High | Precision | Super-precision | Ultra-precision |
|--|---|-------------------|-------|------------|-----------------|-----------------|
| | Item | No symbol | H | P | SP | UP |
| NR/NRS25X NR/NRS 30 NR/NRS 35 | Tolerance for height M | ±0.1 | ±0.04 | 0 -0.04 | 0 -0.02 | 0 -0.01 |
| | Tolerance for the height M difference among LM blocks | 0.02 | 0.015 | 0.007 | 0.005 | 0.003 |
| | Tolerance for rail-to-block lateral distance W_2 | ±0.1 | ±0.04 | 0 -0.04 | 0 -0.02 | 0 -0.01 |
| | Tolerance for rail-to-block lateral distance W_2 difference among LM blocks | 0.03 | 0.015 | 0.007 | 0.005 | 0.003 |
| | Running parallelism of LM-block surface C with respect to surface A | C (as per Fig. 9) | | | | |
| | Running parallelism of LM-block surface D with respect to surface B | D (as per Fig. 9) | | | | |
| NR/NRS 45 NR/NRS 55 | Tolerance for height M | ±0.1 | ±0.05 | 0 -0.05 | 0 -0.03 | 0 -0.02 |
| | Tolerance for the height M difference among LM blocks | 0.03 | 0.015 | 0.007 | 0.005 | 0.003 |
| | Tolerance for rail-to-block lateral distance W_2 | ±0.1 | ±0.05 | 0 -0.05 | 0 -0.03 | 0 -0.02 |
| | Tolerance for rail-to-block lateral distance W_2 difference among LM blocks | 0.03 | 0.02 | 0.01 | 0.007 | 0.005 |
| | Running parallelism of LM-block surface C with respect to surface A | C (as per Fig. 9) | | | | |
| | Running parallelism of LM-block surface D with respect to surface B | D (as per Fig. 9) | | | | |
| NR/NRS 65 NR/NRS 75 NR/NRS 85 NR/NRS100 | Tolerance for height M | ±0.1 | ±0.07 | 0 -0.07 | 0 -0.05 | 0 -0.03 |
| | Tolerance for the height M difference among LM blocks | 0.03 | 0.02 | 0.01 | 0.007 | 0.005 |
| | Tolerance for rail-to-block lateral distance W_2 | ±0.1 | ±0.07 | 0 -0.07 | 0 -0.05 | 0 -0.03 |
| | Tolerance for rail-to-block lateral distance W_2 difference among LM blocks | 0.03 | 0.025 | 0.015 | 0.010 | 0.007 |
| | Running parallelism of LM-block surface C with respect to surface A | C (as per Fig. 9) | | | | |
| | Running parallelism of LM-block surface D with respect to surface B | D (as per Fig. 9) | | | | |

Radial clearance

Table 6 presents the radial clearances of types NR and NRS.

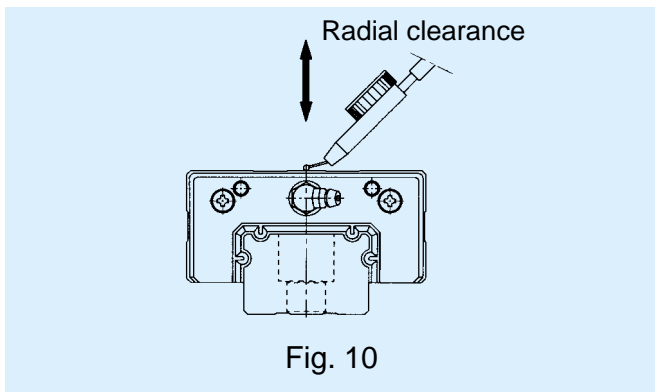
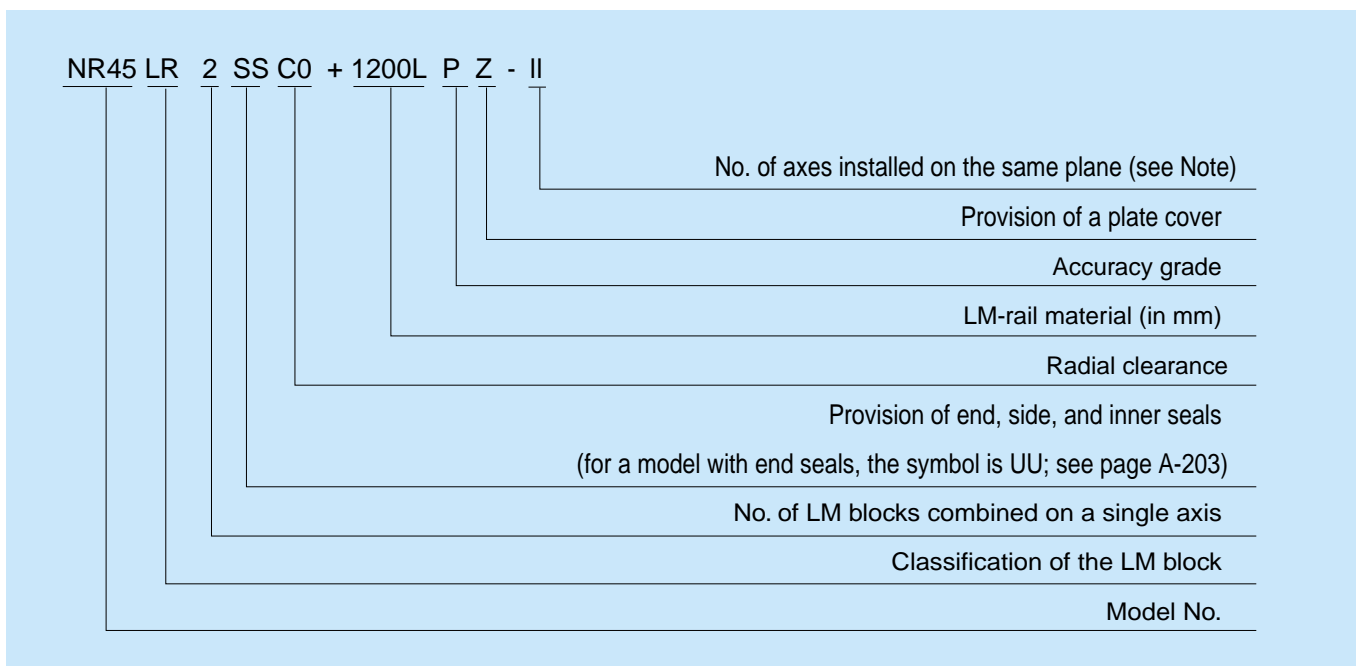


Table 6 Type NR/NRS Radial Clearances

| Clearance symbol Model No. | Normal | Under a light preload | Medium preload |
|-------------------------------|-----------|-----------------------|----------------|
| | No symbol | C1 | C0 |
| NR/NRS 25X | - 3 ~ +2 | - 6 ~ -3 | -9 ~ - 6 |
| NR/NRS 30 | - 4 ~ +2 | - 8 ~ -4 | - 12 ~ - 8 |
| NR/NRS 35 | - 4 ~ +2 | - 8 ~ -4 | - 12 ~ - 8 |
| NR/NRS 45 | - 5 ~ +3 | -10 ~ -5 | - 15 ~ -10 |
| NR/NRS 55 | - 6 ~ +3 | -11 ~ -6 | - 16 ~ - 11 |
| NR/NRS 65 | - 8 ~ +3 | -14 ~ -8 | - 20 ~ - 14 |
| NR/NRS 75 | -10 ~ +4 | -17 ~ -10 | - 24 ~ - 17 |
| NR/NRS 85 | -13 ~ +4 | -20 ~ -13 | - 27 ~ - 20 |
| NR/NRS100 | -14 ~ +4 | -24 ~ -14 | - 34 ~ - 24 |

Unit : μm

Model-number coding



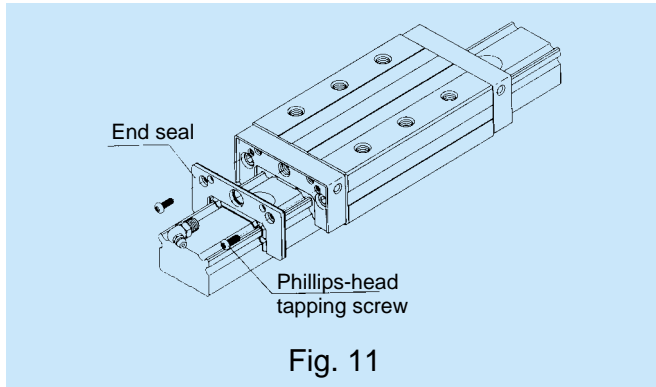
Note: This coding is based on the assumption of one set of code for a one-axis unit.
(A configuration of two axes installed in parallel is given at least two sets of code.)

Contamination Protection

Types NR and NRS are provided with end and side seals as standard contamination-protection accessories.

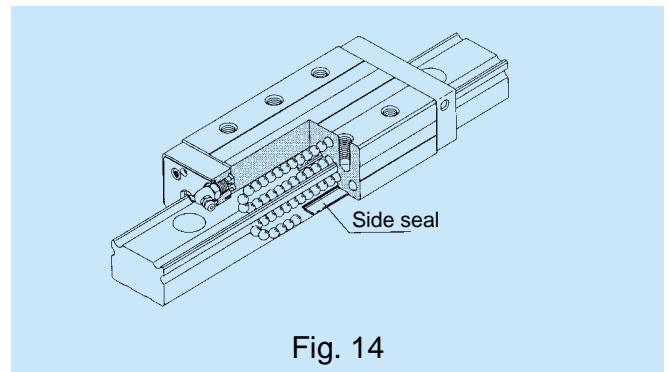
End seal

Standard accessory



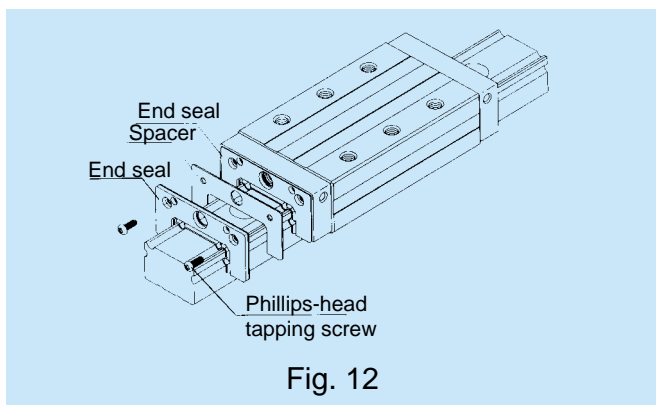
Side seal

Prevents contaminants from entering an LM block from below.



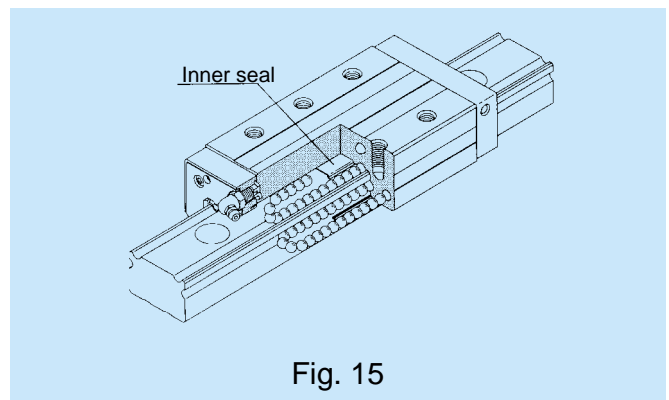
Double seal

Use two end seals to enhance the contamination-protection capacity.



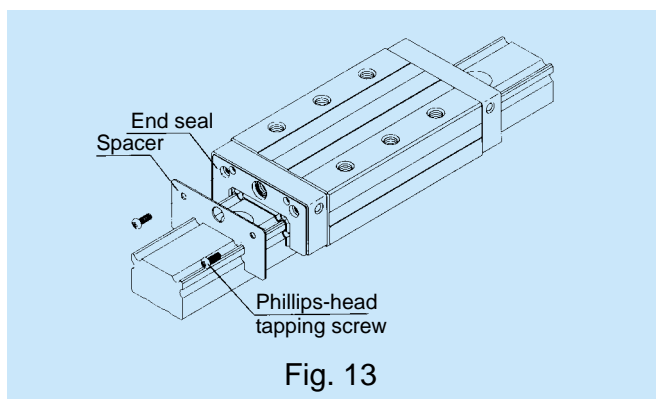
Inner seal

Installed in a LM block.



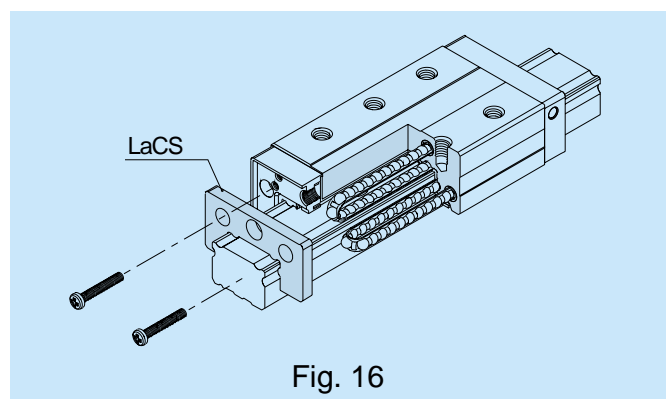
Scraper

Removes spatters and similar large foreign matter.



LaCS (laminated contact scraper)

Unlike metal scrapers, the LaCS surface-contacts the LM rail and is capable of removing foreign objects. The LaCS is provided as an option that is highly contamination-protective against minute foreign objects that have been difficult to remove with conventional metal scrapers.



Contamination-protection-accessory symbol

Where a contamination-protection accessory is required, specify the corresponding symbol shown below.

Attaching a contamination-protection accessory to an LM block changes the block overall length depending on the block type (see Table 7).

| Contamination-protection accessory | Symbol |
|---|--------|
| End seal (on both end faces) | UU |
| End seal + side seal + inner seal | SS |
| End seal + side seal + inner seal + scraper | ZZ |
| Double seal + side seal + inner seal | DD |
| Double seal + side seal + inner seal + scraper | KK |
| End seals + side seal + inner seal + metal scraper + LaCS | ZZHH |
| Double seal + side seal + inner seal + metal scraper + LaCS | KKHH |

Table 7 Type NR/NRS: LM Block Overall Length with a contamination-protection Accessory Attached

Unit : mm

| Model No. | No symbol | UU | SS | DD | ZZ | KK | ZZHH | KKHH |
|------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| NR/NRS 25XA/XR NR/NRS 25XLA/XLR | ○ 81.8 ○ 100.8 | ○ 83 ○ 102 | ○ 83 ○ 102 | ○ 90.4 ○ 109.4 | ○ 89.2 ○ 108.2 | ○ 96.8 ○ 115.8 | ○ 106.5 ○ 125.5 | ○ 114.5 ○ 133.5 |
| NR/NRS 30A/R NR/NRS 30LA/LR | ○ 97.1 ○ 119.6 | ○ 98 ○ 120.5 | ○ 98 ○ 120.5 | ○ 107 ○ 129.5 | ○ 104.4 ○ 126.9 | ○ 113.4 ○ 135.9 | ○ 124.5 ○ 147 | ○ 133.5 ○ 156 |
| NR/NRS 35A/R NR/NRS 35LA/LR | ○ 108.5 ○ 134 | ○ 109.5 ○ 135 | ○ 109.5 ○ 135 | ○ 119.7 ○ 145.2 | ○ 117.1 ○ 142.6 | ○ 127.3 ○ 152.8 | ○ 138.5 ○ 164 | ○ 148.5 ○ 174 |
| NR/NRS 45A/R NR/NRS 45LLA/LR | ○ 138 ○ 170 | ○ 139 ○ 171 | ○ 139 ○ 171 | ○ 149.2 ○ 181.2 | ○ 147.4 ○ 179.4 | ○ 157.6 ○ 189.6 | ○ 172 ○ 204 | ○ 182.5 ○ 214.5 |
| NR/NRS 55A/R NR/NRS 55LA/LR | ○ 160.6 ○ 198.1 | ○ 163 ○ 200.5 | ○ 163 ○ 200.5 | ○ 173 ○ 210.5 | ○ 171.4 ○ 208.9 | ○ 181.6 ○ 219.1 | ○ 198.5 ○ 236 | ○ 208.5 ○ 246 |
| NR/NRS 65A/R NR/NRS 65LA/LR | ○ 183.4 ○ 243.4 | ○ 186 ○ 246 | ○ 186 ○ 246 | ○ 196.6 ○ 256.6 | ○ 194.2 ○ 254.2 | ○ 204.8 ○ 264.8 | ○ 225 ○ 285 | ○ 235.5 ○ 295.5 |
| NR/NRS 75A/R NR/NRS 75LA/LR | ○ 214.6 ○ 270.6 | ○ 218 ○ 274 | ○ 218 ○ 274 | ○ 229 ○ 285 | ○ 226.6 ○ 282.6 | ○ 237.6 ○ 293.6 | × — | × — |
| NR/NRS 85A/R NR/NRS 85LA/LR | ○ 247.4 ○ 303.4 | ○ 248.5 ○ 304.5 | ○ 248.5 ○ 304.5 | ○ 264.4 ○ 320.4 | ○ 260.2 ○ 316.2 | ○ 273.8 ○ 329.8 | × — | × — |
| NR/NRS 100A/R NR/NRS 100LA/LR | ○ 287.4 ○ 327.4 | ○ 294 ○ 334 | ○ 294 ○ 334 | ○ 311.2 ○ 351.2 | ○ 304.4 ○ 344.4 | ○ 321.6 ○ 361.6 | × — | × — |

Note: ○ = Applicable

× = Not Applicable

Seal resistance value

For the maximum value of seal resistance of seals types NR and NRS...UU per LM block in which grease is applied see Table 8.

Table 8 Maximum Resistance Value of Seals to Types NR/NRS

Unit : N

| Model No. | Seal resistance value |
|------------|-----------------------|
| NR/NRS 25X | 15 |
| NR/NRS 30 | 17 |
| NR/NRS 35 | 23 |
| NR/NRS 45 | 24 |
| NR/NRS 55 | 29 |
| NR/NRS 65 | 42 |
| NR/NRS 75 | 42 |
| NR/NRS 85 | 42 |
| NR/NRS 100 | 51 |

Steel tape type SP (patent pending)

A special steel tape is available for types NR and NRS. With machine tools, contamination protection measures are essential. This steel tape, consisting of ultra-thin-sheet stainless steel (SUS304), covers the rail-mounting holes and thereby reinforces the sealability of the seal in use. This prevents the entry of coolant and chips from above the rails, which could not be prevented by the conventional means. (An end piece of type EP is used to install the steel tape.)

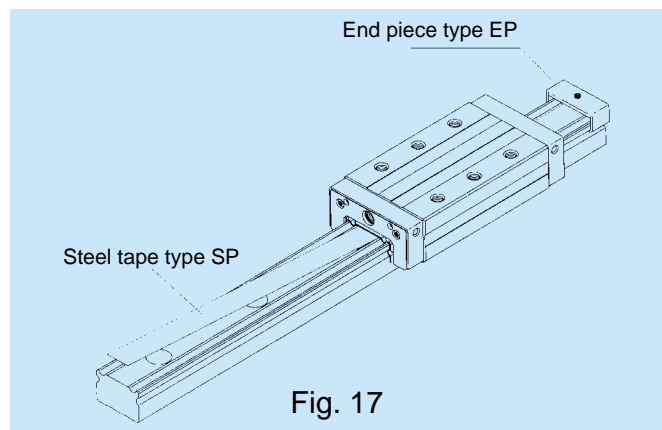
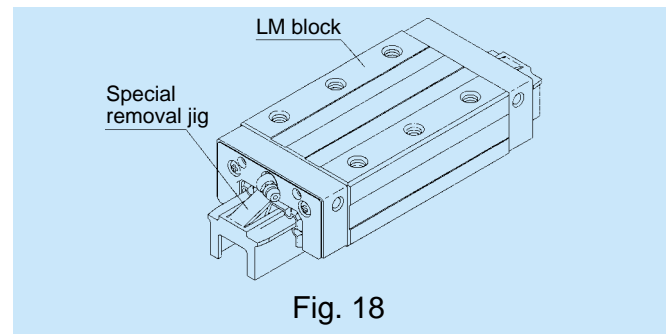


Fig. 17

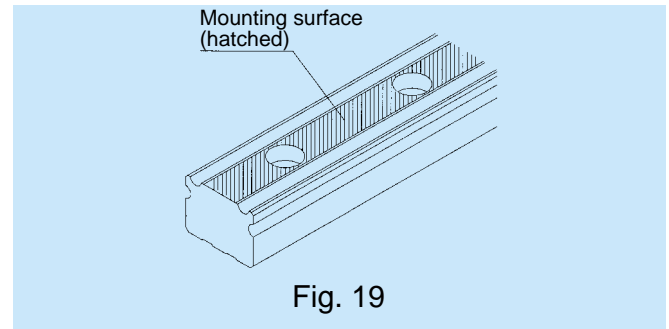
Mounting procedures

Fasten using adhesive tape and the end pieces.

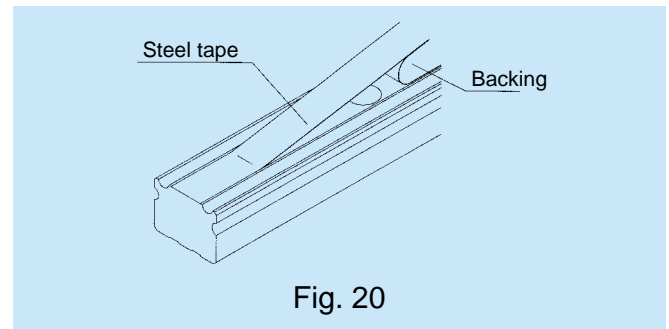
1. Using a special removal jig (page A-163), remove the LM block from the LM rail.



2. Completely remove grease and oil from the LM-rail top surface, to which the steel tape is adhered. Clean the surface well. Use a highly volatile agent (e.g., industrial alcohol) to remove grease and oil.

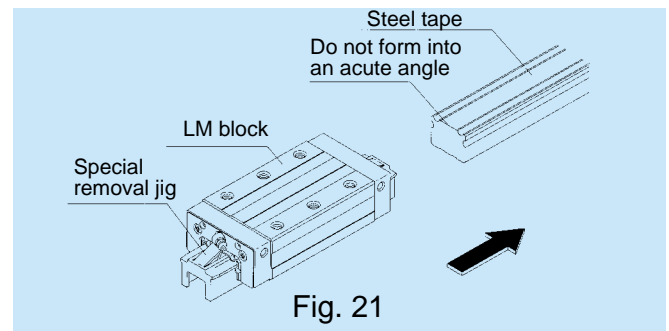


3. While gradually peeling off the steel-tape backing, adhere it to the surface while keeping it taut and straight.

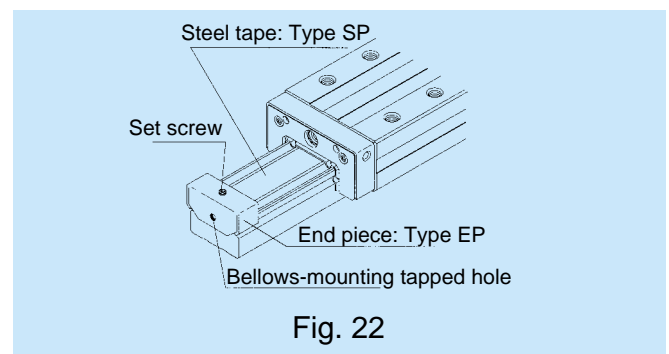


4. Rub the tape against the rail surface until it attains close contact. Although the bonding strength is increased as time elapses, the tape can be peeled from the rail by pulling it upward.

5. Insert an LM block into the LM rail.



6. Attach end pieces to both ends of the LM rail, and securely attach the steel tape to the rail. Fasten the set screws on the top side only. A tapped hole is provided on each end piece for the attachment of a bellows.

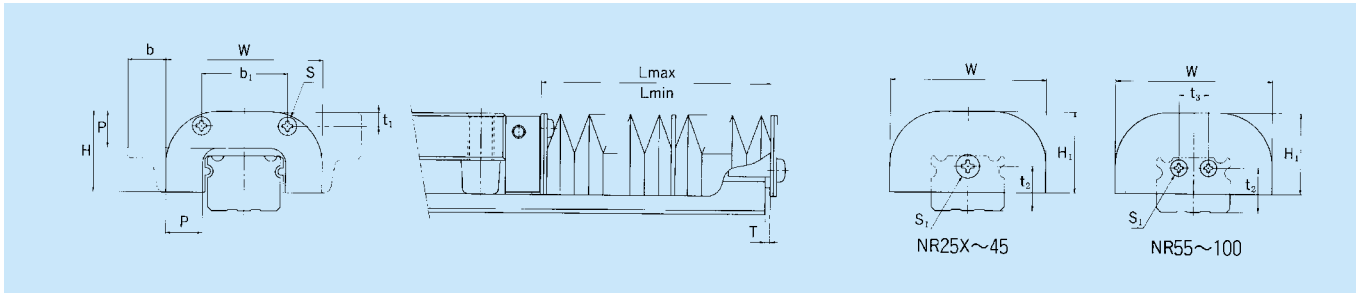


Notes: 1. The set screws at both ends are provided to lightly hold folded-over steel-tape ends in place. Stop tightening a set screw when you feel it reach the rail surface. Be sure not to overtighten it.
2. The steel tape is made of thin sheet steel. Mishandling of the tape may result in an injury such as a cut on the hand. Therefore, when handling a steel tape, wear rubber gloves or the like to ensure safety.

Simple bellows

Simple bellows are available for types NR and NRS. They should be installed where a coolant is likely to enter. As shown in Fig. 23, installing a telescopic

cover over the bellows ensures a greater contamination-protection effect.



Unit : mm

| Model No. | Boundary dimensions | | | | | | | | LM block side Mounting bolt | LM rail side Mounting bolt | b A,LA B,LB | T | A ($\frac{k_{max}}{min}$) | Applicable LM-Guide model |
|-----------|---------------------|------|----------------|----|----------------|----------------|----------------|----------------|-----------------------------------|----------------------------------|-------------------|-----|--------------------------------|---------------------------------|
| | W | H | H ₁ | P | b ₁ | t ₁ | t ₂ | t ₃ | | | | | | |
| JN 25 | 48 | 25.5 | 25.5 | 10 | 26.6 | 4.6 | 13 | - | M3 × 0.5 × 5/ | M4 × 0.7 × 4/ | 11 | 1.5 | 7 | NR/NRS 25X |
| JN 30 | 60 | 31 | 31 | 14 | 34 | 5.5 | 17 | - | M4 × 0.7 × 8/ | M4 × 0.7 × 4/ | 15 | 1.5 | 9 | NR/NRS 30 |
| JN 35 | 70 | 35 | 35 | 15 | 36 | 6 | 20.5 | - | M4 × 0.7 × 8/ | M5 × 0.8 × 4/ | 15 | 2 | 10 | NR/NRS 35 |
| JN 45 | 86 | 40.5 | 40.5 | 17 | 47 | 6.5 | 24 | - | M5 × 0.8 × 10/ | M5 × 0.8 × 4/ | 17 | 2 | 10 | NR/NRS 45 |
| JN 55 | 100 | 49 | 49 | 20 | 54 | 10 | 29.5 | 18 | M5 × 0.8 × 10/ | M5 × 0.8 × 4/ | 20 | 2 | 13 | NR/NRS 55 |
| JN 65 | 126 | 57.5 | 57.5 | 20 | 64 | 13.5 | 36.2 | 20 | M6 × 12/ | M6 × 5/ | 22 | 3.2 | 13 | NR/NRS 65 |
| JN 75 | 145 | 64 | 64 | 30 | 80 | 10.5 | 34.2 | 26 | M6 × 12/ | M6 × 5/ | 25 | 3.2 | 20 | NR/NRS 75 |
| JN 85 | 156 | 70.5 | 70.5 | 30 | 110 | 15.5 | 39.5 | 28 | M6 × 12/ | M6 × 5/ | 39.5 | 3.2 | 20 | NR/NRS 85 |
| JN 100 | 200 | 82 | 82 | 30 | 140 | 15 | 40 | 34 | M8 × 16/ | M6 × 5/ | 30 | 3.2 | 20 | NR/NRS100 |

Model-number coding

JN25 - 60/420

Bellows dimensions $\left(\frac{\text{length when compressed}}{\text{length when expanded}} \right)$

Model No. (bellows for types NR-NRS 25X in this example)

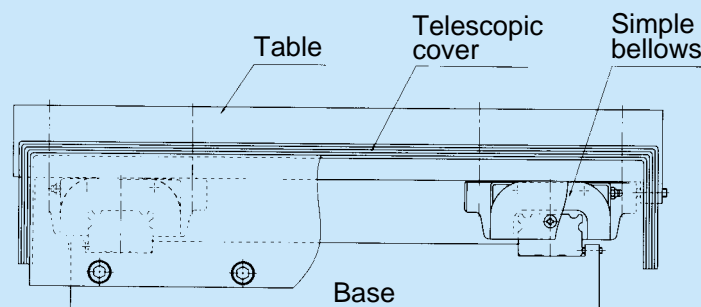


Fig. 23 Sample Installation of a Simple Bellows

Precautions on Use

Mounting-Surface Height and Corner Profile

Normally, mounting surfaces for LM blocks and rails have lateral reference sections to aid in positioning and assembly of the rails and blocks with a high degree of accuracy.

For the reference-section shoulder height, see Table 9.

Provide enough space for the corner profile of a mounting surface so that the corner does not interfere with chamfers made on the LM blocks and rails, or provide the corner with a radius smaller than corner radius r specified in Table 9.

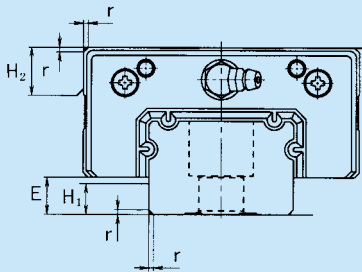


Fig. 24

Table 9 Mounting-Surface Shoulder Height and Corner Radius

Unit : mm

| Model No. | Corner radius r (max.) | LM-rail shoulder height H_1 | LM-block shoulder max. height H_2 | E |
|-----------|--------------------------|-------------------------------|-------------------------------------|------|
| NR/NRS25X | 0.5 | 5 | 5 | 5.5 |
| NR/NRS30 | 1.0 | 5 | 5 | 7 |
| NR/NRS35 | 1.0 | 6 | 6 | 9 |
| NR/NRS45 | 1.0 | 8 | 8 | 11.5 |
| NR/NRS55 | 1.5 | 10 | 10 | 14 |
| NR/NRS65 | 1.5 | 10 | 10 | 15 |
| NR/NRS75 | 1.5 | 12 | 12 | 15 |
| NR/NRS85 | 1.5 | 14 | 14 | 17 |
| NR/NRS100 | 2.0 | 16 | 16 | 20 |

Special removal jig

In types NR and NRS, when the LM block is removed from the LM rail, the balls may fall off and cause an accident. Therefore, to remove the LM block from the LM rail, always use the special removal jig.

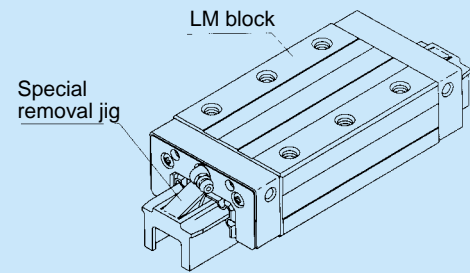


Fig. 25

End piece type EP

In types NR and NRS, when an LM block is removed from an LM rail, the balls may fall off and cause an accident. Therefore, these types are delivered with end pieces installed, in order to prevent the LM blocks from detaching.

If the LM Guide is used without the end pieces, be sure the LM block is not allowed to overrun.

The end piece can be used to fasten a steel tape in place and is applicable to LM rails types SSR, SR, and HSR.

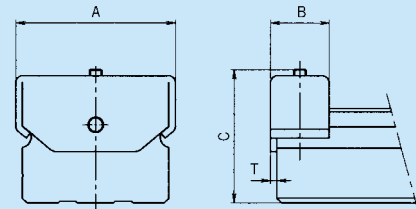


Fig. 26 End Piece Type EP for Types NR and NRS

Table 10 Dimensions of NR and NRS End Piece Type EP

Unit : mm

| Model . No. | A | B | C | T |
|-------------|-------|----|------|-----|
| NR/NRS 25X | 26 | 14 | 25 | 1.5 |
| NR/NRS 30 | 31 | 14 | 31 | 1.5 |
| NR/NRS 35 | 38 | 16 | 32.5 | 2 |
| NR/NRS 45 | 49 | 18 | 41 | 2 |
| NR/NRS 55 | 57 | 20 | 46.5 | 2 |
| NR/NRS 65 | 69.4 | 22 | 59 | 3.2 |
| NR/NRS 75 | 81.7 | 28 | 56 | 3.2 |
| NR/NRS 85 | 91.4 | 22 | 68 | 3.2 |
| NR/NRS 100X | 106.4 | 25 | 73 | 3.2 |

Lubrication adaptor

For types NR and NRS, lubrication adaptors specifically for oil lubrication are available.

Even in wall-hung, inverted, and other installations in which oil lubrication is difficult, the adaptor provides lubricant feed to all four rows of a raceway at a given rate.

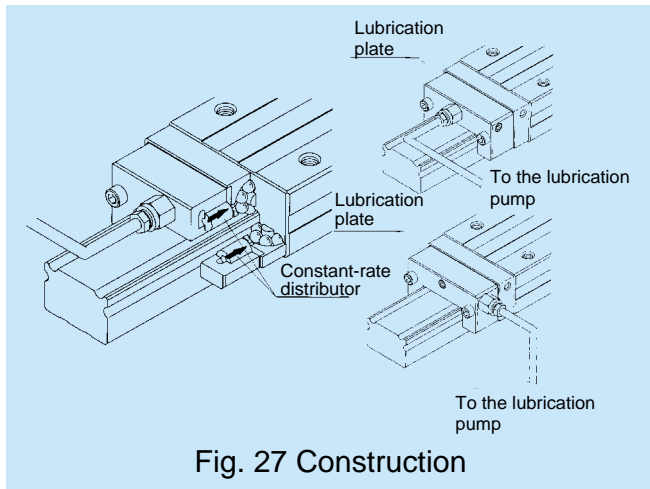


Fig. 27 Construction

Features

As a result of the incorporation of a constant-rate distributor, the lubrication adaptor specifically for types NR and NRS can reliably feed a given amount of lubricant to all raceways.

It is economical to feed the optimum amount of lubricant at all times, thus eliminating waste.

For piping, simply connect an intermittent lubrication pump (the type used for general machine tools and the like) to the feed holes (M8) provided on the adaptor front and side panels.

Specifications

| | |
|---------------------------------------|------------------------------|
| Viscosity range of the lubricant used | 32 to 64 cSt recommended |
| Discharge rate | 0.03 x 4 or 0.06 x 4 cc/shot |
| Connected pipe diameter | Ø4 or Ø6 |
| Material | Aluminum alloy |

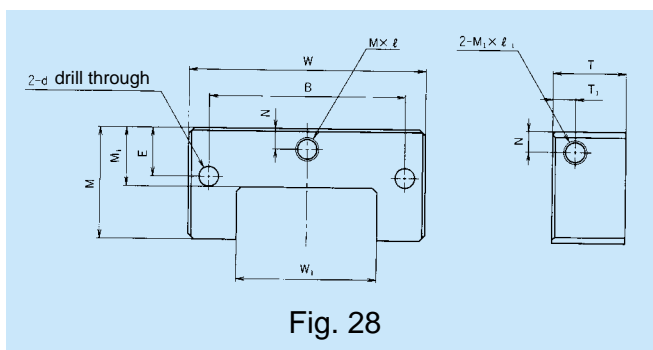


Fig. 28

Table 11 Dimensions of the Lubrication Adaptor

Unit : mm

| Model No. | Width W | Height M | T | W ₁ | M ₁ | B | E | N | T ₁ | d | M × l | M ₁ × l ₁ | cc/shot |
|-----------|------------|-------------|----|----------------|----------------|-----|------|------|----------------|-----|--------|---------------------------------|----------|
| A30N | 56 | 29 | 25 | 29 | 14.5 | 46 | 14 | 5.3 | 5.3 | 3.5 | M8 × 8 | M8 × 8 | 0.03 × 4 |
| A35N | 66 | 33 | 25 | 35 | 17 | 54 | 16.5 | 6 | 5.3 | 4.5 | M8 × 8 | M8 × 8 | |
| A45N | 81 | 38 | 25 | 48 | 20 | 67 | 16.5 | 7 | 7.8 | 6.6 | M8 × 8 | M8 × 8 | |
| A55N | 94 | 45.5 | 25 | 56 | 22 | 76 | 20.5 | 7 | 7.8 | 6.6 | M8 × 8 | M8 × 8 | 0.06 × 4 |
| A65N | 119 | 55.5 | 25 | 67 | 26.3 | 92 | 25.5 | 11.5 | 7.8 | 9 | M8 × 8 | M8 × 8 | |
| A85N | 147 | 68.5 | 25 | 92 | 34 | 114 | 32 | 15.5 | 7.8 | 9 | M8 × 8 | M8 × 8 | |

LM-Rail Standard and Maximum Lengths

Table 12 presents the standard and maximum lengths of LM rails for types NR and NRS. If your maximum length is not within the range of this table, we offer special LM rails intended for connected use.

For dimension G when a special length is specified, we recommend those listed in Table 10. A large

dimension G tends to reduce stability at the rail ends, which may degrade accuracy.

For connected use, we offer LM rails that ensure the elimination of level differences at joints. Therefore, when placing an order, please specify the overall length of the LM rails you require.

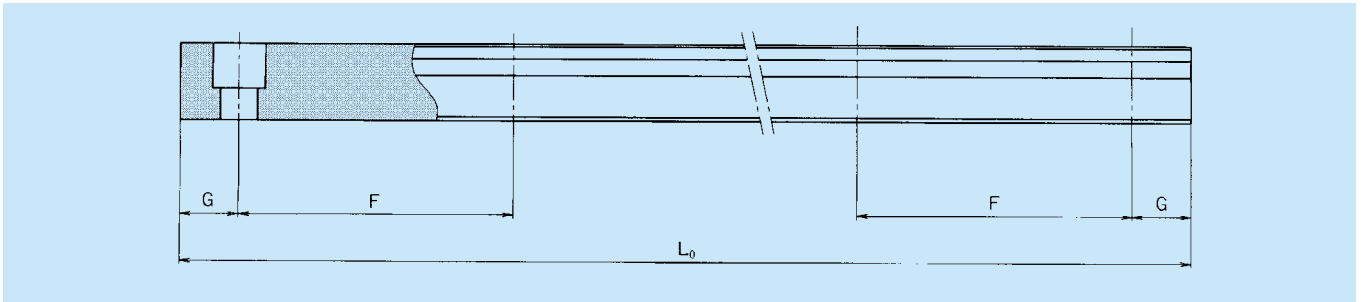


Table 12 Type NR and type NRS LM-Rail Standard and Maximum Lengths

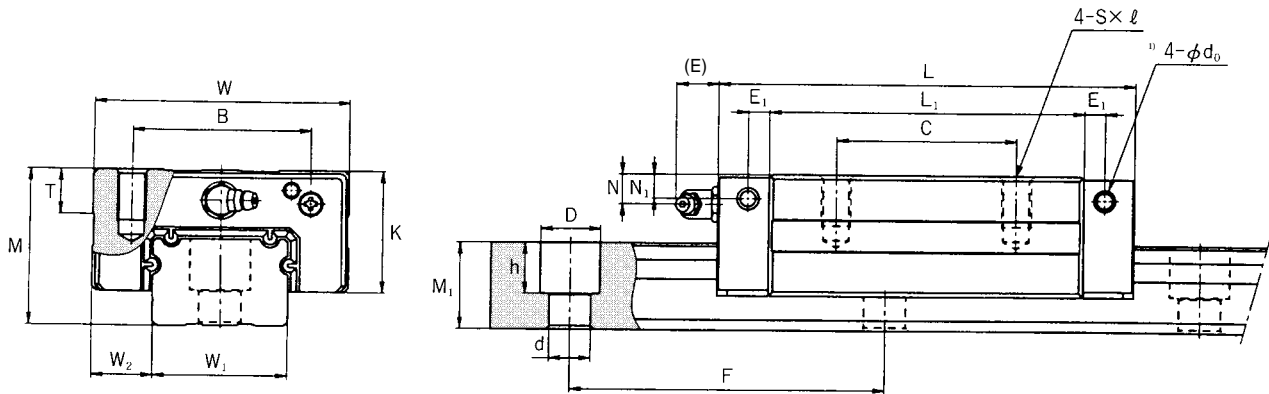
Unit : mm

| Model No. | NR/NRS25X | NR/NRS30 | NR/NRS35 | NR/NRS45 | NR/NRS55 | NR/NRS65 | NR/NRS75 | NR/NRS85 | NR/NRS100 |
|-------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| | 230 | 280 | 280 | 570 | 780 | 1270 | 1280 | 1530 | 1340 |
| | 270 | 360 | 360 | 675 | 900 | 1570 | 1580 | 1890 | 1760 |
| | 350 | 440 | 440 | 780 | 1020 | 2020 | 2030 | 2250 | 2180 |
| | 390 | 520 | 520 | 885 | 1140 | 2620 | 2630 | 2610 | 2600 |
| | 470 | 600 | 600 | 990 | 1260 | | | | |
| | 510 | 680 | 680 | 1095 | 1380 | | | | |
| | 590 | 760 | 760 | 1200 | 1500 | | | | |
| | 630 | 840 | 840 | 1305 | 1620 | | | | |
| | 710 | 920 | 920 | 1410 | 1740 | | | | |
| | 750 | 1000 | 1000 | 1515 | 1860 | | | | |
| | 830 | 1080 | 1080 | 1620 | 1980 | | | | |
| | 950 | 1160 | 1160 | 1725 | 2100 | | | | |
| | 990 | 1240 | 1240 | 1830 | 2220 | | | | |
| | 1070 | 1320 | 1320 | 1935 | 2340 | | | | |
| | 1110 | 1400 | 1400 | 2040 | 2460 | | | | |
| | 1190 | 1480 | 1480 | 2145 | 2580 | | | | |
| | 1230 | 1560 | 1560 | 2250 | 2700 | | | | |
| | 1310 | 1640 | 1640 | 2355 | 2820 | | | | |
| | 1350 | 1720 | 1720 | 2460 | 2940 | | | | |
| | 1430 | 1800 | 1800 | 2565 | 3060 | | | | |
| | 1470 | 1880 | 1880 | 2670 | | | | | |
| | 1550 | 1960 | 1960 | 2775 | | | | | |
| | 1590 | 2040 | 2040 | 2880 | | | | | |
| | 1710 | 2200 | 2200 | 2985 | | | | | |
| | 1830 | 2360 | 2360 | 3090 | | | | | |
| | 1950 | 2520 | 2520 | | | | | | |
| | 2070 | 2680 | 2680 | | | | | | |
| | 2190 | 2840 | 2840 | | | | | | |
| | 2310 | 3000 | 3000 | | | | | | |
| | 2430 | | | | | | | | |
| | 2470 | | | | | | | | |
| Standard pitch F | 40 | 80 | 80 | 105 | 120 | 150 | 150 | 180 | 210 |
| G | 15 | 20 | 20 | 22.5 | 30 | 35 | 40 | 45 | 40 |
| Max. length | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |

- Notes :
- The maximum length varies by accuracy grade. For questions regarding the maximum length, please contact us.
 - If connected use is impossible but a rail longer than the maximum length specified in the table is required, please contact us.

NR•NRS-R Type (Heavy-load type)
 NR•NRS-LR Type (Ultra-heavy-load type)

Compact type

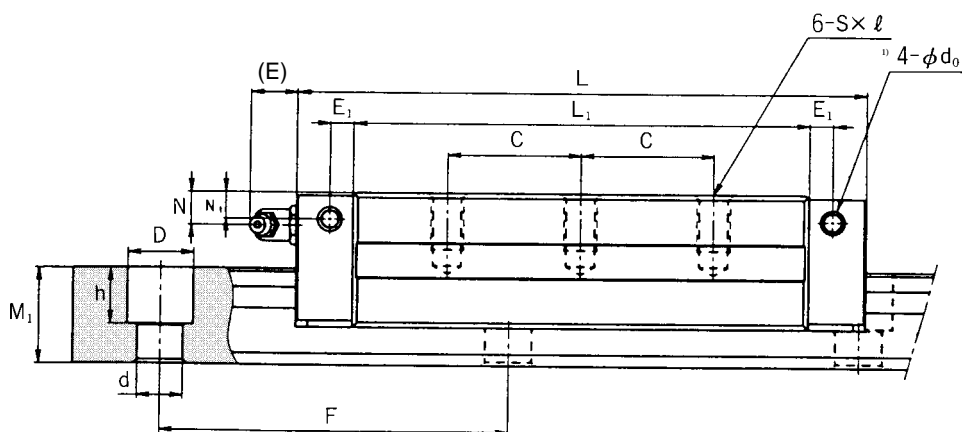


NR • NRS-R

| Model No. | External dimensions | | | LM-block dimensions | | | | | | |
|-----------------------------|---------------------|------------|----------------|---------------------|------------|----------|----------------|----|------|----|
| | Height M | Width W | Length L | B | C | S × I | L ₁ | T | K | N |
| NR/NRS 25XR NR/NRS 25XLR | 31 | 50 | 83 102 | 32 | 35 25 | M6 × 8 | 62.4 81.6 | 10 | 25.5 | 7 |
| NR/NRS 30R NR/NRS 30LR | 38 | 60 | 98 120.5 | 40 | 40 30 | M8 × 10 | 70.9 93.4 | 10 | 31 | 7 |
| NR/NRS 35R NR/NRS 35LR | 44 | 70 | 109.5 135 | 50 | 50 36 | M8 × 12 | 77.9 103.4 | 12 | 35 | 8 |
| NR/NRS 45R NR/NRS 45LR | 52 | 86 | 139 171 | 60 | 60 40 | M10 × 17 | 105 137 | 15 | 40.5 | 10 |
| NR/NRS 55R NR/NRS 55LR | 63 | 100 | 163 200.5 | 65 | 75 47.5 | M12 × 18 | 123.6 160.8 | 18 | 49 | 11 |
| NR/NRS 65R NR/NRS 65LR | 75 | 126 | 186 246 | 76 | 70 55 | M16 × 20 | 143.6 203.6 | 22 | 60 | 16 |
| NR/NRS 75R NR/NRS 75LR | 83 | 145 | 218 274 | 95 | 80 65 | M18 × 25 | 170.2 226.2 | 26 | 68 | 18 |
| NR/NRS 85R NR/NRS 85LR | 90 | 156 | 248.5 304.5 | 100 | 80 70 | M18 × 25 | 194.9 251 | 28 | 73 | 20 |
| NR/NRS 100R NR/NRS 100LR | 105 | 200 | 294 334 | 130 | 150 100 | M18 × 27 | 223.4 263.4 | 35 | 85 | 23 |

Notes:

- For permissible static moments M_A , M_B , and M_C , see page A-255.
- For standard LM-rail lengths, see page A-235.
- For model-number coding, see page A-228.



NR · NRS-LR

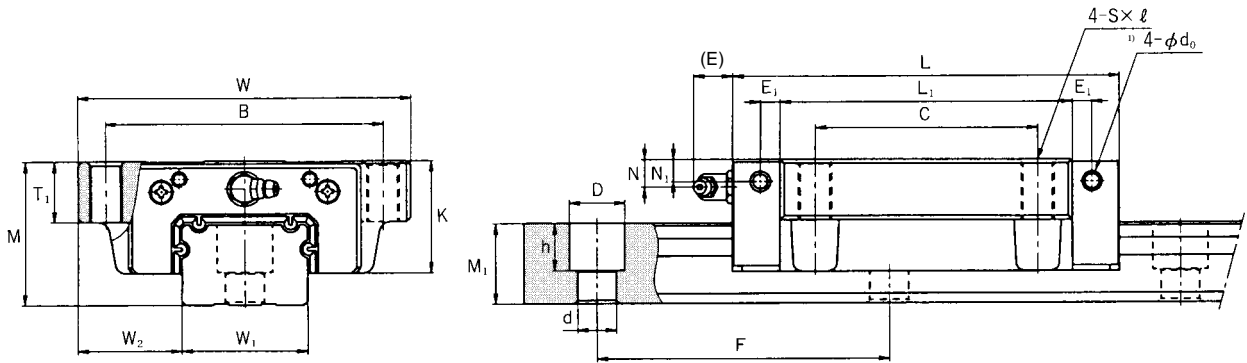
Unit : mm

| N ₁ | E | E ₁ | d ₀ | Grease nipple | LM-rail dimensions | | | | | Basic load rating | | | | Mass | |
|----------------|------|----------------|----------------|---------------|---------------------------------------|----------------|--------------------------|------------|---------------|--------------------|---------------------------------|---------------------|----------------------------------|----------------|-----------------|
| | | | | | Width W ₁ 0 -0.05 | W ₂ | Height M ₁ | Pitch F | d × D × h | NR Type C kN | NR Type C ₀ kN | NRS Type C kN | NRS Type C ₀ kN | LM block kg | LM rail kg/m |
| 7 | 10 | 4 | 3.9 | B-M6F | 25 | 12.5 | 17 | 40 | 6 × 9.5 × 8.5 | 33.0 44.0 | 84.6 113 | 25.9 34.5 | 59.8 79.7 | 0.43 0.55 | 3.1 |
| 7 | 9.5 | 5 | 3.9 | B-M6F | 28 | 16 | 21 | 80 | 7 × 11 × 9 | 48.7 64.9 | 122 162 | 38.2 51.0 | 86.1 115 | 0.74 1.0 | 4.3 |
| 8 | 9 | 6 | 5.2 | B-M6F | 34 | 18 | 24.5 | 80 | 9 × 14 × 12 | 63.1 85.7 | 155 210 | 49.5 67.2 | 109 148 | 1.1 1.4 | 6.2 |
| 8 | 14 | 7 | 5.2 | B-PT1/8 | 45 | 20.5 | 29 | 105 | 14 × 20 × 17 | 96.0 126 | 231 303 | 75.3 98.8 | 163 214 | 2.0 2.8 | 9.8 |
| 10 | 13.5 | 8 | 5.2 | B-PT1/8 | 53 | 23.5 | 36.5 | 120 | 16 × 23 × 20 | 131 170 | 310 402 | 103 133 | 220 284 | 3.3 4.3 | 14.5 |
| 15 | 13.5 | 9 | 8.2 | B-PT1/8 | 63 | 31.5 | 43 | 150 | 18 × 26 × 22 | 189 260 | 436 600 | 148 204 | 309 425 | 6.0 8.7 | 20.3 |
| 17 | 13 | 9 | 8.2 | B-PT1/8 | 75 | 35 | 44 | 150 | 22 × 32 × 26 | 271 355 | 610 800 | 212 278 | 431 566 | 8.7 11.6 | 24.6 |
| 20 | 13 | 10 | 8.2 | B-PT1/8 | 85 | 35.5 | 48 | 180 | 24 × 35 × 28 | 336 435 | 751 972 | 264 342 | 531 687 | 12.3 15.8 | 30.5 |
| 23 | 10 | 12 | 8.2 | B-PT1/4 | 100 | 50 | 57 | 210 | 26 × 39 × 32 | 479 599 | 1040 1300 | 376 470 | 737 920 | 21.8 26.1 | 42.6 |

Notes: ¹⁾Pilot holes for side nipples are not drilled through so as to prevent the entry of foreign matter.
If a side nipple hole is required, contact us.

NR•NRS-A Type (Heavy-load type)
 NR•NRS-LA Type (Ultra-heavy-load type)

Tapped-hole flange type

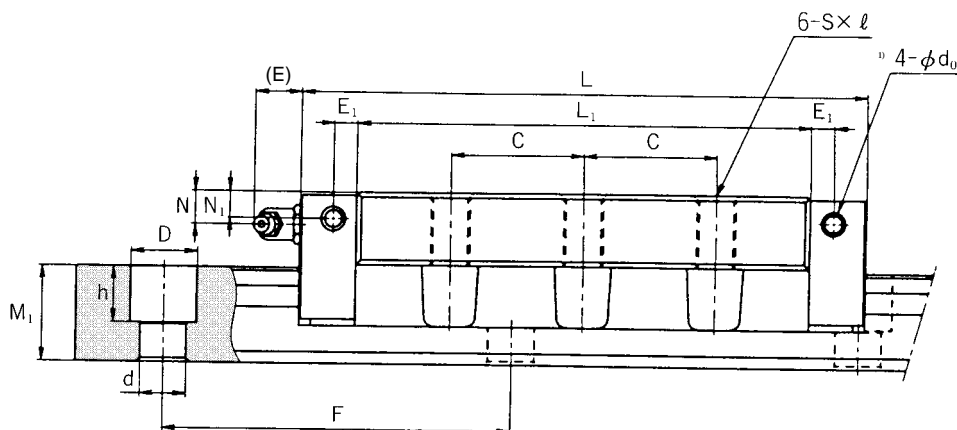


NR • NRS-A

| Model No. | External dimensions | | | LM-block dimensions | | | | | | | |
|-----------------------------|---------------------|------------|----------------|---------------------|------------|----------|----------------|----------------|------|----|--|
| | Height M | Width W | Length L | B | C | S × I | L ₁ | T ₁ | K | N | |
| NR/NRS 25XA NR/NRS 25XLA | 31 | 72 | 83 102 | 59 | 45 22.5 | M8 × 16 | 62.4 81.6 | 16 | 25.5 | 7 | |
| NR/NRS 30A NR/NRS 30LA | 38 | 90 | 98 120.5 | 72 | 52 26 | M10 × 18 | 70.9 93.4 | 18 | 31 | 7 | |
| NR/NRS 35A NR/NRS 35LA | 44 | 100 | 109.5 135 | 82 | 62 31 | M10 × 20 | 77.9 103.4 | 20 | 35 | 8 | |
| NR/NRS 45A NR/NRS 45LA | 52 | 120 | 139 171 | 100 | 80 40 | M12 × 22 | 105 137 | 22 | 40.5 | 10 | |
| NR/NRS 55A NR/NRS 55LA | 63 | 140 | 163 200.5 | 116 | 95 47.5 | M14 × 24 | 123.6 160.8 | 24 | 49 | 11 | |
| NR/NRS 65A NR/NRS 65LA | 75 | 170 | 186 246 | 142 | 110 55 | M16 × 28 | 143.6 203.6 | 28 | 60 | 16 | |
| NR/NRS 75A NR/NRS 75LA | 83 | 195 | 218 274 | 165 | 130 65 | M18 × 30 | 170.2 226.2 | 30 | 68 | 18 | |
| NR/NRS 85A NR/NRS 85LA | 90 | 215 | 248.5 304.5 | 185 | 140 70 | M20 × 34 | 194.9 251 | 34 | 73 | 20 | |
| NR/NRS 100A NR/NRS 100LA | 105 | 260 | 294 334 | 220 | 150 100 | M20 × 38 | 223.4 263.4 | 38 | 85 | 23 | |

Notes:

- For permissible static moments M_A , M_B , and M_C , see page A-225.
- For standard LM-rail lengths, see page A-235.
- For model-number coding, see page A-228.



NR · NRS-LA

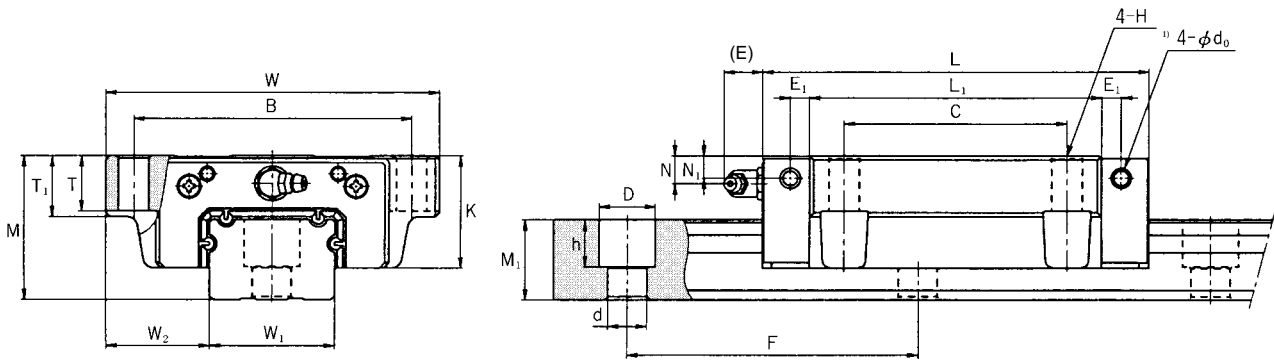
Unit : mm

| N ₁ | E | E ₁ | d ₀ | Grease nipple | LM rail dimensions | | | | | Basic load rating | | | | Mass | |
|----------------|------|----------------|----------------|---------------|---------------------------------------|----------------|--------------------------|------------|---------------|--------------------|---------------------------------|---------------------|----------------------------------|----------------|-----------------|
| | | | | | Width W ₁ 0 -0.05 | W ₂ | Height M ₁ | Pitch F | d × D × h | NR Type C kN | NR Type C ₀ kN | NRS Type C kN | NRS Type C ₀ kN | LM block kg | LM rail kg/m |
| 7 | 10 | 4 | 3.9 | B-M6F | 25 | 23.5 | 17 | 40 | 6 × 9.5 × 8.5 | 33.0 44.0 | 84.6 113 | 25.9 34.5 | 59.8 79.7 | 0.58 0.77 | 3.1 |
| 7 | 9.5 | 5 | 3.9 | B-M6F | 28 | 31 | 21 | 80 | 7 × 11 × 9 | 48.7 64.9 | 122 162 | 38.2 51.0 | 86.1 115 | 1.1 1.4 | 4.3 |
| 8 | 9 | 6 | 5.2 | B-M6F | 34 | 33 | 24.5 | 80 | 9 × 14 × 12 | 63.1 85.7 | 155 210 | 49.5 67.2 | 109 148 | 1.5 1.9 | 6.2 |
| 8 | 14 | 7 | 5.2 | B-PT1/8 | 45 | 37.5 | 29 | 105 | 14 × 20 × 17 | 96.0 126 | 231 303 | 75.3 98.8 | 163 214 | 2.7 3.5 | 9.8 |
| 10 | 13.5 | 8 | 5.2 | B-PT1/8 | 53 | 43.5 | 36.5 | 120 | 16 × 23 × 20 | 131 170 | 310 402 | 103 133 | 220 284 | 4.4 5.7 | 14.5 |
| 15 | 13.5 | 9 | 8.2 | B-PT1/8 | 63 | 53.5 | 43 | 150 | 18 × 26 × 22 | 189 260 | 436 600 | 148 204 | 309 425 | 7.6 10.9 | 20.3 |
| 17 | 13 | 9 | 8.2 | B-PT1/8 | 75 | 60 | 44 | 150 | 22 × 32 × 26 | 271 355 | 610 800 | 212 278 | 431 566 | 11.3 15.0 | 24.6 |
| 20 | 13 | 10 | 8.2 | B-PT1/8 | 85 | 65 | 48 | 180 | 24 × 35 × 28 | 336 435 | 751 972 | 264 342 | 531 687 | 16.2 20.7 | 30.5 |
| 23 | 10 | 12 | 8.2 | B-PT1/4 | 100 | 80 | 57 | 210 | 26 × 39 × 32 | 479 599 | 1040 1300 | 376 470 | 737 920 | 26.7 31.2 | 42.6 |

Notes: ¹⁾Pilot holes for side nipples are not drilled through so as to prevent the entry of foreign matter.
If a side nipple hole is required, contact us.

NR•NRS-B Type (Heavy-load type)
 NR•NRS-LB Type (Ultra-heavy-load type)

Through-hole flange type

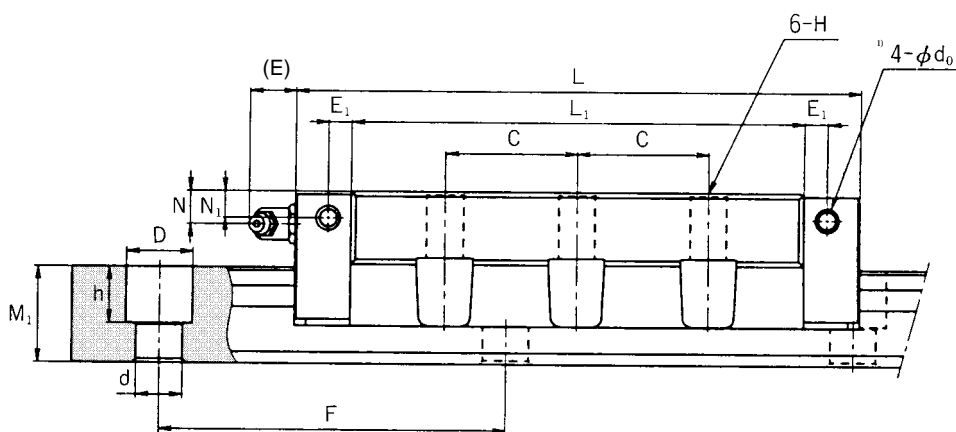


NR • NRS-B

| Model No. | External dimensions | | | LM-block dimensions | | | | | | | | |
|-----------------------------|---------------------|------------|----------------|---------------------|------------|----|----------------|----|----------------|------|----|--|
| | Height M | Width W | Length L | B | C | H | L ₁ | T | T ₁ | K | N | |
| NR/NRS 25XB NR/NRS 25XLB | 31 | 72 | 83 102 | 59 | 45 22.5 | 7 | 62.4 81.6 | 12 | 16 | 25.5 | 7 | |
| NR/NRS 30B NR/NRS 30LB | 38 | 90 | 98 120.5 | 72 | 52 26 | 9 | 70.9 93.4 | 14 | 18 | 31 | 7 | |
| NR/NRS 35B NR/NRS 35LB | 44 | 100 | 109.5 135 | 82 | 62 31 | 9 | 77.9 103.4 | 16 | 20 | 35 | 8 | |
| NR/NRS 45B NR/NRS 45LB | 52 | 120 | 139 171 | 100 | 80 40 | 11 | 105 137 | 20 | 22 | 40.5 | 10 | |
| NR/NRS 55B NR/NRS 55LB | 63 | 140 | 163 200.5 | 116 | 95 47.5 | 14 | 123.6 160.8 | 22 | 24 | 49 | 11 | |
| NR/NRS 65B NR/NRS 65LB | 75 | 170 | 186 246 | 142 | 110 55 | 16 | 143.6 203.6 | 25 | 28 | 60 | 16 | |
| NR/NRS 75B NR/NRS 75LB | 83 | 195 | 218 274 | 165 | 130 65 | 18 | 170.2 226.2 | 26 | 30 | 68 | 18 | |
| NR/NRS 85B NR/NRS 85LB | 90 | 215 | 248.5 304.5 | 185 | 140 70 | 18 | 194.9 251 | 28 | 34 | 73 | 20 | |
| NR/NRS 100B NR/NRS 100LB | 105 | 260 | 294 334 | 220 | 150 100 | 20 | 223.4 263.4 | 32 | 38 | 85 | 23 | |

Notes:

- For permissible static moments M_A , M_B , and M_C , see page A-225.
- For standard LM-rail lengths, see page A-235.
- For model-number coding, see page A-228.



NR · NRS-LB

Unit : mm

| N ₁ | E | E ₁ | d ₀ | Grease nipple | LM-rail dimensions | | | | | Basic load rating | | | | Mass | |
|----------------|------|----------------|----------------|---------------|---------------------------------------|----------------|--------------------------|------------|---------------|--------------------|---------------------------------|---------------------|----------------------------------|----------------|-----------------|
| | | | | | Width W ₁ 0 -0.05 | W ₂ | Height M ₁ | Pitch F | d × D × h | NR Type C kN | NR Type C ₀ kN | NRS Type C kN | NRS Type C ₀ kN | LM block kg | LM rail kg/m |
| 7 | 10 | 4 | 3.9 | B-M6F | 25 | 23.5 | 17 | 40 | 6 × 9.5 × 8.5 | 33.0 44.0 | 84.6 113 | 25.9 34.5 | 59.8 79.7 | 0.58 0.77 | 3.1 |
| 7 | 9.5 | 5 | 3.9 | B-M6F | 28 | 31 | 21 | 80 | 7 × 11 × 9 | 48.7 64.9 | 122 162 | 38.2 51.0 | 86.1 115 | 1.1 1.4 | 4.3 |
| 8 | 9 | 6 | 5.2 | B-M6F | 34 | 33 | 24.5 | 80 | 9 × 14 × 12 | 63.1 85.7 | 155 210 | 49.5 67.2 | 109 148 | 1.5 1.9 | 6.2 |
| 8 | 14 | 7 | 5.2 | B-PT1/8 | 45 | 37.5 | 29 | 105 | 14 × 20 × 17 | 96.0 126 | 231 303 | 75.3 98.8 | 163 214 | 2.7 3.5 | 9.8 |
| 10 | 13.5 | 8 | 5.2 | B-PT1/8 | 53 | 43.5 | 36.5 | 120 | 16 × 23 × 20 | 131 170 | 310 402 | 103 133 | 220 284 | 4.4 5.7 | 14.5 |
| 15 | 13.5 | 9 | 8.2 | B-PT1/8 | 63 | 53.5 | 43 | 150 | 18 × 26 × 22 | 189 260 | 436 600 | 148 204 | 309 425 | 7.6 10.9 | 20.3 |
| 17 | 13 | 9 | 8.2 | B-PT1/8 | 75 | 60 | 44 | 150 | 22 × 32 × 26 | 271 355 | 610 800 | 212 278 | 431 566 | 11.3 15.0 | 24.6 |
| 20 | 13 | 10 | 8.2 | B-PT1/8 | 85 | 65 | 48 | 180 | 24 × 35 × 28 | 336 435 | 751 972 | 264 342 | 531 687 | 16.2 20.7 | 30.5 |
| 23 | 10 | 12 | 8.2 | B-PT1/4 | 100 | 80 | 57 | 210 | 26 × 39 × 32 | 479 599 | 1040 1300 | 376 470 | 737 920 | 26.7 31.2 | 42.6 |

Notes: ¹⁾Pilot holes for side nipples are not drilled through so as to prevent the entry of foreign matter.
If a side nipple hole is required, contact us.